A Connecticut Model for Mathematics Curriculum

"Mathematical discoveries have come both from the attempt to describe the natural world and from the desire to arrive at a form of inescapable truth from careful reasoning. In the last century mathematics has been successfully applied to many aspects of the human world: voting trends in politics, the dating of ancient artifacts, the analysis of automobile traffic patterns, and long-term strategies for the sustainable harvest of deciduous forests, to mention a few. Today, mathematics as a mode of thought and expression is more valuable than ever before. Learning to think in mathematical terms is an essential part of becoming a liberally educated person."

— Dr. Robert Lewis, Fordham University

"All students must be mathematically literate to make informed decisions about the world around them and ensure success in postsecondary study and in work. An individual who is mathematically literate:

- *has a deep understanding of big ideas within the number, algebra, geometry, probability, and statistics standards;*
- *is able to compute, reason and communicate mathematically when solving problems;*
- *uses a variety of strategies, tools and technology to solve mathematics problems; and*
- *understands the application of mathematics to daily life."*

— Connecticut State Board of Education Mathematics Position Statement, 2006

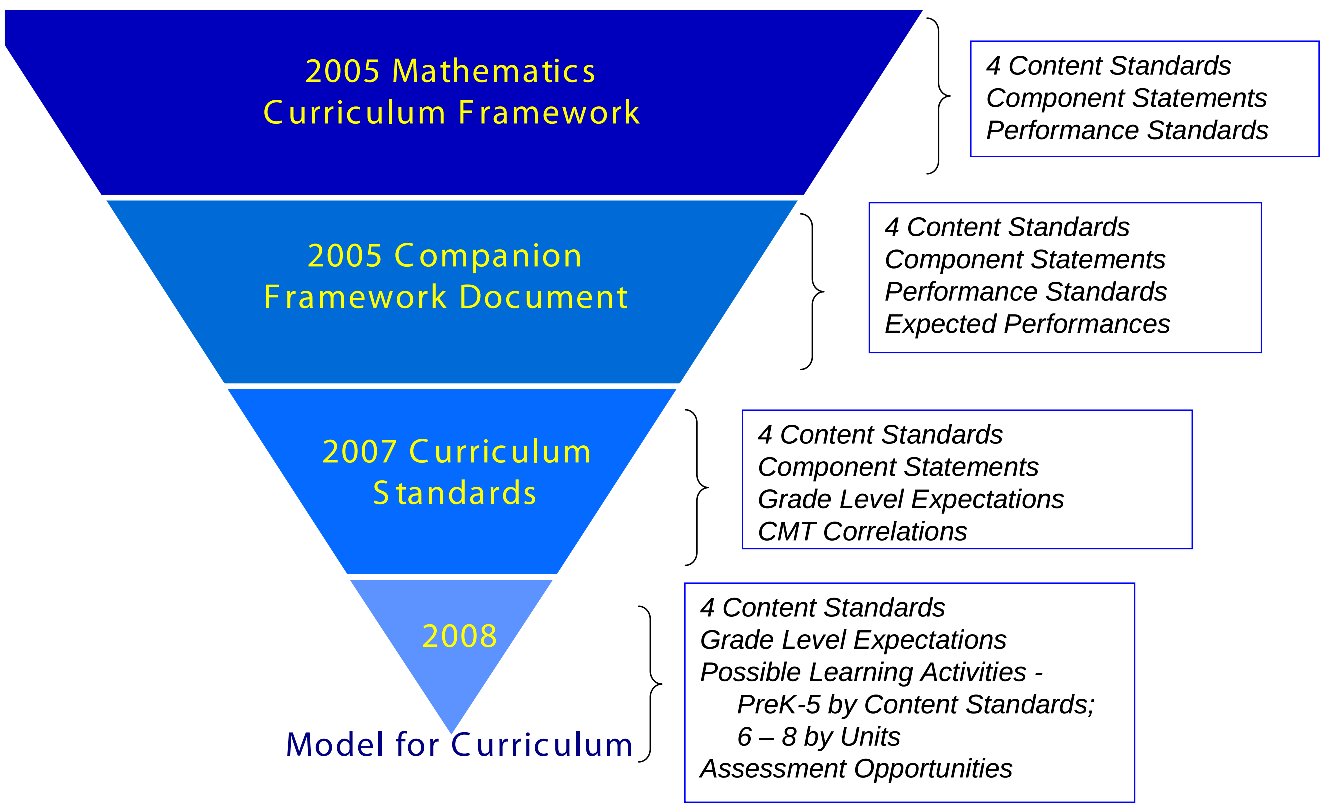
Mathematically literate children need to be actively engaged in challenging learning experiences that make mathematical sense of the world around them. Dynamic interaction between learners, both children and educators, and the exploration of authentic subject matter develops requisite skills and concepts that facilitate understanding, reasoning and thinking.

A comprehensive curriculum is a major vehicle through which a school district sustains teachers and students and advances mathematical literacy. Districts must align curriculum with state and national standards for mathematics content and skills. District curriculum should reflect the overarching professional communities' expectations for instructional approaches, content knowledge and ongoing assessment.

This model for mathematics curriculum is intended to be an example of instruction that is based on valid research and aligned with standards. The document incorporates a variety of strategies, tools and approaches to engage students in learning meaningful mathematics.

The Prekindergarten–Grade 5 Model for Mathematics Curriculum was designed to be the next step in making the 2007 Mathematics Curriculum Standards clearly understandable and accessible for classroom teachers in Connecticut schools and districts. The evolution of the document is outlined in the diagram below.

CSDE Mathematics Curriculum Standards Evolution



PREKINDERGARTEN THROUGH GRADE 5
MODEL FOR CURRICULUM COMPONENTS

Information included for each standard at a grade level:

The Learner at This Level: These are statements specific to the characteristics or development of children at this level. The primary source for statements in this section is *Yardsticks: Children in the Classroom Ages 4-14- A Resource for Parents and Teachers*, by Chip Wood. Information in Yardsticks is organized by age while the model for mathematics curriculum is organized by grade level. The Learner at This Level statements can be referenced using the following crosswalk:

YARDSTICKS (AGE)	MODEL FOR CURRICULUM (GRADE LEVEL)
4	Prekindergarten
5	Kindergarten
6	1
7	2
8	3
9	4
10	5

Central Understanding: At each grade level, a central understanding was developed for each of the standards based on National Council of Teachers of Mathematics (NCTM) Focal Points and other research. These understandings form the foundation upon which the possible learning activities and lessons were built.

CENTRAL UNDERSTANDINGS				
	Algebraic Reasoning	**Numerical and Proportional Reasoning**	**Geometry and Measurement**	**Working with Data**
Prekindergarten	Patterns are found in our environment.	Our environment can be described in a quantitative way using number concepts.	The attributes of objects in the environment can be measured.	Objects in the environment can be organized based on attributes and spatial relationships.
Kindergarten	Patterns can be described, generalized and extended based upon physical attributes or positions.	The relative numerical value of collections can be determined through comparison.	Objects can be described by attributes, properties, measurements, and location.	Objects can be classified and organized based on attributes.
Grade 1	The same pattern can be represented in many different forms.	Relationships between and among numbers can be described in a systematic way.	Attributes can be determined through composing and decomposing shapes and solids.	Information about attributes can be organized to see relationships.
Grade 2	Relationships shown through number patterns extend the understanding of number properties and operations.	In the base-10 numeration system, number relationships can be described and represented in a variety of ways to support conceptual understanding and computation.	Attributes can be compared by applying measurement to an object, situation or event.	The same information can be organized in different ways.

CENTRAL UNDERSTANDINGS				
Grade 3	Relationships can be generalized and represented through rules.	Relationships between numbers and operations are discovered and learned in contextual situations.	Objects and geometric shapes and figures can be described and categorized based upon measurement and classification of specific attributes.	Decisions are made based upon relationships determined from data sets.
Grade 4	Equivalence is a relationship between members of one set and members of another set.	Number relationships and properties of operations provide generalizations for efficient problem solving.	Geometric shapes and solids can be described through estimated and actual measurement. Generalizations can be used foe efficient problem solving.	Predictions can be made by analyzing information gathered from organized data.
Grade 5	Numerical relationships can be represented using symbols.	Numerical relationships are not changed when rational numbers are represented in different ways.	Geometric relationships can be represented spatially and generalized through formulas.	Organized data can be used to summarize what is typical for a specific situation and condition.

Mathematics Background for Teachers: Background statements supply contextual information and research findings for educators. These statements provide overarching information that support student learning at this level. (See the Reference page and Resource sections for specific references and citations).

GRADE-LEVEL MATHEMATICS CURRICULUM STANDARDS CONNECTIONS

Correlated GLEs: This document includes the Mathematics Curriculum Standards, comprised of grade-level expectations with correlations to the Connecticut Mastery Test and an additional column for districts to correlate their curriculum and instructional materials to grade level expectations.

Sequenced GLEs: Grade-level expectations indicate what every learner should know and be able to do by the end of that grade or level. The GLEs are organized by standard and developmentally sequenced by three seasons, fall, winter and spring. Grade-level expectations that are related to concepts and skills assessed on the Connecticut Mastery Test are generally sequenced prior to the scheduled administration of that test. It is important to note that learning not be limited by a suggested sequence of instruction. In order for learners to become mathematically literate, instruction must be fluid so that connections can be made throughout a school year.

Correlated Goals 2000 CRT: Items from the Goals 2000 criterion referenced test have been coded by grade level expectation so that they can be used as pre-and post-assessment of the learner's understanding of the targeted skill or concept.

Possible Learning Activities: Organized by standards and grade level expectations, numerous suggested activities are included to support student understanding of that expectation. Parenthetical cross references to other related grade-level expectations (See also GLE X.X.X) are included where applicable.

SAMPLE INTEGRATED LESSON

These lessons correspond to expected performances from the Mathematics Curriculum Standards. Citations from current Connecticut State Department of Education frameworks for other disciplines are included to illustrate connections between mathematics in this standard and other content areas. A sample lesson template follows.

Context: Sets the stage for this specific lesson. The teacher can scaffold and make connections based upon student experiences.

Objective: What the children should know and be able to do from their participation in the lesson.

Grade-Level Expectations: The GLEs that apply to this lesson are referenced.

Time: The projected amount of time needed to complete the lesson. One instructional period equals about 60 minutes.

Materials: A list of the materials that will be necessary for the implementation of the lesson.

Procedure: Step-by-step instructions on how to implement the lesson. Questioning strategies and suggestions are included to develop learning through guided discovery.

- **Possible Assessment Opportunities**
    - Includes suggestions for interventions and challenges.

The following chart contains citations from the 2006 frameworks of the indicated disciplines that have been integrated into the possible learning activities and integrated lesson.

Interdisciplinary Framework Connections				
Science	**English/Language Arts**	**Social Studies**	**Visual and Performing Arts**	**Physical Education**

Frameworks for each discipline are available here: http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&Q=320954&sdenav_gid=1757.

Vocabulary: A list of applicable vocabulary that is important for development and communication of the mathematics content of the central understanding for this standard.

Resources:

Electronic Resources: A list of electronic resources that support the content learning.

Teacher References: Research, references, and supplementary material to develop background knowledge or lesson structures.

Children's Literature: List of trade books that support the concepts and skills.

Notes: Space for notetaking and reflection

SAMPLE INTEGRATED LESSON TEMPLATE

Context:

Grade Level Expectations:

Time:

Materials:

Procedure:

- **Possible Assessment Opportunities:**

  Intervention:

  Challenge:

Interdisciplinary Framework Connections				
Science	**English/Language Arts**	**Social Studies**	**Visual and Performing Arts**	**Physical Education**

Vocabulary:

Resources:

Electronic Resources:

Teacher References:

Children's Literature:

Notes:

EMBEDDED PROCESS STANDARDS

Problem-solving, Reasoning and Proof, Communication, Connections, and Representation are the NCTM process standards. These process standards highlight ways of acquiring and using mathematics knowledge and help give meaning to mathematics.

Mathematical knowledge is built through problem solving. Problem-solving means to engage in a task for which a solution is not known in advance. Engaging in these tasks allows children to apply and adapt strategies, to solidify and extend knowledge, and to stimulate new learning. The possible learning activities are meant to provide opportunities for children to engage and explore in problem-solving strategies that are embedded across this model mathematics curriculum.

Reasoning and proof must be a consistent part of all mathematics. Reasoning helps mathematics make sense to children when they are investigating conjecture and evaluating mathematical arguments. Systematic reasoning is a habit of mind that is developed throughout the curriculum activities and lessons using questioning techniques.

Communicating is an important component in all aspects of life. Children need to use the language of mathematics to organize and analyze their thinking, as well as to justify their reasoning. Part of communicating in mathematics is the ability to see the perspective of others and learn to evaluate their thinking. This interaction provides the opportunity for children to weigh the strengths and limitations of different approaches and develop critical thinking skills.

Making sense of the world around us requires the ability to make connections between varieties of contexts. Children must be able to recognize the connections between and among mathematical ideas. The ability to recognize how ideas in different areas are related helps children develop the understanding that mathematics is not a set of isolated skills. The integrated lessons in this model mathematics curriculum use the insights gained by children in mathematics to solve problems in other contexts.

Children need to represent ideas in ways that make sense to them; however, they need to use representations that allow for accurate communication with others as well. In order to model, interpret and communicate mathematical ideas, representations are used to organize and record solutions to problems.

Engagement in mathematical content is accomplished when instruction is designed through the use of these process standards. Children will gain a better understanding of mathematics and have longer retention of mathematical knowledge as they solve problems, reason mathematically, prove mathematical relationships, participate in mathematical discourse, make mathematical connections, and model and represent mathematical ideas in a variety of ways.

"Teaching is not a matter of pouring knowledge from one mind into another as one pours water from one glass into another. It is more like one candle igniting another. Each candle burns with its own fuel. The true teacher awakens a love for truth and beauty of mathematics in the heart — not the mind."

— David R. Garcia, An Essay Well Worth Reading

Prekindergarten

CONTENTS

The Learner at This Level

The Prekindergarten Child:

- Learns best through play, exploration, acting out stories.
- Enjoys picture books with repetitive themes or phrases, parallel reading, and math within stories.
- Learns more using large muscles than small muscles, e.g., painting on an easel instead of writing with pencil on paper.

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS

- Observes patterns through meaningful exploration and play both at school and at home and begins to acknowledge that patterns are important.
- Distinguishes the elements in simple AB auditory and kinesthetic patterns that repeat.
- Uses one attribute of an object at a time, e.g., just color or just shape, to create patterns.
- Describes patterns using terms that describe position, e.g., next, in front of, under, etc.

NUMERICAL AND PROPORTIONAL REASONING

- Compares two sets of objects and identifies them as more than, less than or the same.
- Counts real world objects, sounds and movements to develop number sense from "hand to head."
- Learns number names through rote counting.
- Uses one-to-one correspondence to systematically match number names with objects by touching or pointing when counting.
- Solves practical problems using the meanings of numbers (e.g., "I have a snack for each person in my group.").
- Notices that the terms "first" and "last" describe the position of an object.
- Discovers cardinality: that the last number stated in a sequence answers the question, "How many?"
- Discovers that a whole object can have two equal parts called halves.

GEOMETRY AND MEASUREMENT

- Uses the senses to identify objects based on attributes such as color, size, position or texture.
- Builds understanding of attributes, properties, locations and positions of objects through the manipulation of materials such as clay, blocks and puzzles.
- Groups geometric shapes and solids by their similarities.
- Sorts and classifies objects through direct comparison of measurable attributes such as length and weight.
- Describes time through sequencing familiar events.
- Measures and compares the length, area or capacity of objects with nonstandard units using terms such as more, less or the same.

WORKING WITH DATA: PROBABILITY AND STATISTICS

- Organizes objects by observable attributes.
- Uses seemingly nonmathematical language such as “pointy,” “the same color as an apple,” and “looks like a house” to describe objects.
- Creates real graphs to answer questions. For example, how many different color cars do we have in the play area? Children line the cars up by color to create a “real” graph that provides the answers.

Mathematics Background for Teachers

MATHEMATICS BACKGROUND FOR PREKINDERGARTEN TEACHERS

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS

Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

Central Understanding: Patterns are found in our environment.

Background: Repetitive patterns contain recognizable core elements that are repeated. These patterns can be represented in more than one way. Patterns are found in many physical and geometric situations in a child's environment as well as in number. Identification of patterns is a basic building block for algebraic thinking. Children make predictions and generalizations in their informal pattern explorations. As these generalizations are investigated, they help build a foundation for both number and geometry.

NUMERICAL AND PROPORTIONAL REASONING

Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

Central Understanding: Our environment can be described in a quantitative way using number concepts.

Background: Number concepts are intimately tied to the world around us. Recognizing and applying number relationships in our environment is the foundation of making sense of the world in a mathematical way (van de Walle, p.115). Determining and comparing quantities enables children to form ideas about number and develop number sense. Counting is the determination of the total number of objects in a set and requires much more than the recitation of words in a correct sequence. Counting is a foundation for children's early work with number, patterns and sets.

MATHEMATICS BACKGROUND FOR PREKINDERGARTEN TEACHERS

GEOMETRY AND MEASUREMENT

Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies

Central Understanding: The attributes of objects in the environment can be measured.

Background: Children can identify and describe attributes of objects in their environment. Similarities and differences of objects can be explained based on color, orientation, texture and measurable attributes such as size, shape, weight or length. Opportunities for direct comparisons of measurable attributes help children solve problems such as categorizing objects that are the same as, longer than or heavier than another object. Spatial sense can be defined as an intuition about shapes and the relationships among shapes (van de Walle p.347). Children develop spatial sense when they have opportunities to observe, feel, build, describe and take apart two- and three-dimensional shapes and solids.

WORKING WITH DATA: PROBABILITY AND STATISTICS

Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

Central Understanding: Objects in the environment can be organized based on attributes and spatial relationships.

Background: The ability to observe, identify, qualify and quantify attributes develops the foundation for classification and data analysis. Comparisons of quantity, physical attributes, spatial relationships and use of objects provide structure for the analysis of various ways that things can be categorized.

Correlated Grade-Level Expectations

Click here to access correlated grade-level expectations for prekindergarten on the State Department of Education Web site.

Sequenced Grade-Level Expectations

PREKINDERGARTEN SEQUENCED GLES

Grade-Level Expectations	Fall	Winter	Spring
ALGEBRAIC REASONING			
1.1 Understand and describe patterns and functional relationships.			
1. Sort and classify familiar objects by a single attribute (size, shape, color, texture, orientation and position) and explain the reason.			
2. Recognize, copy, extend and create simple AB patterns using objects, movement or sounds.			
NUMERICAL AND PROPORTIONAL REASONING			
2.1 Understand that a variety of numerical representations can be used to describe quantitative relationships.			
1. Represent quantities of up to 20 objects in a set.			
2. Compare two sets of up to 20 objects, and identify which set is more, less or the same.			
3. Identify the ordinal position of objects: first and last.			
4. Explore a whole and half of an object			
2.2 Use numbers and their properties to compute flexibly and fluently and to reasonably estimate measures and quantities.			
5. Count by rote to at least 20.			
6. Count as one more object is added to a set of up to 20 objects.			
7. Act out and solve story problems using sets of up to 10 objects.			
GEOMETRY AND MEASUREMENT			
3.1 Use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.			
1. Identify and describe familiar shapes (triangles, squares, rectangles and circles) and solids (cubes, spheres, cylinders and prisms) in the environment and contextual situations.			
2. Compare and sort familiar shapes and solids in the environment and contextual situations.			
3. Construct shapes using a variety of materials.			

Grade-Level Expectations	Fall	Winter	Spring
3.2 Use spatial reasoning, location and geometric relationships to solve problems.			
4. Describe location, direction, and position of objects using terms such as under, over, inside, next to, near, in front of, first and last.			
5. Complete simple shape and jigsaw puzzles and explain the reasoning used to complete the puzzle.			
3.3 Develop and apply units, systems, formulas and appropriate tools to estimate and measure.			
6. Use patterns to determine events that reoccur.			
7. Sequence events and describe time periods using terms such as morning, afternoon, night, yesterday, today and tomorrow.			
8. Use nonstandard units or reference objects to compare length, area and capacity and to order, estimate and sort objects by size (length or area). Describe the comparisons using language such as more, longer, shorter or taller.			
9. Discuss strategies to estimate and compare length, area, temperature and weight.			
WORKING WITH DATA			
4.1 Collect, organize and display data using appropriate statistical and graphical methods.			
1. Create real graphs using familiar objects and pictures that represent information about the group of children.			
4.2 Analyze data sets to form hypotheses and make predictions			
2. Describe real graphs using comparative language such as more, less, most, least and the same.			
4.3 Understand and apply basic concepts of probability			
3. Use patterns to describe some events that repeat.			
4. Explain why events are likely or unlikely to happen, based on personal experiences.			

Correlated GOALS 2000
Criterion Referenced Test

PREKINDERGARTEN CORRELATED GOALS 2000 CRT

The Goals 2000 Mathematics Curriculum was written as a companion to the 1998 Mathematics Framework. The Goals 2000 resources cited in this 2008 Model for Mathematics Curriculum are aligned to the 2005 Mathematics Curriculum Framework, 2007 Curriculum Standards and the fourth generation Connecticut Mastery Test.

The Prekindergarten Criterion Referenced Test Part A from the Goals 2000 Mathematics Curriculum is aligned to the prekindergarten sequenced GLEs and can be used for pre- and post-assessment. The Prekindergarten Criterion Referenced Test Part B may also be used for pre- and post-assessment and integrated when appropriate. Student progress must be recorded by keeping a record of observations or a folder of student work samples. It is important to integrate items from Part B into the assessment process.

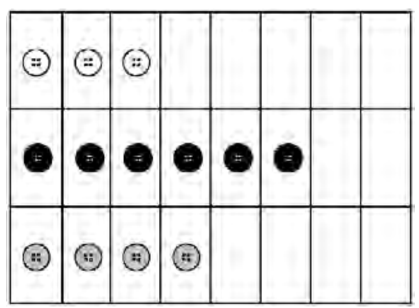
Please use the link below to access the electronic version of the complete document, which includes other activities, such as opportunities for open-ended and challenge experiences that must be examined for alignment prior to use.

http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=321084

Standard	State Framework	Performance Activity	Performance Task
Algebraic Reasoning	**PK 1.1.1**	**Single Attributes** In advance, prepare a set of about 20 objects that can only be sorted by color, such as Unifi cubes, Color Tiles or construction paper squares, so that only four different colors are available — red, yellow, green, and blue. Ask the student to sort them. Successful performance is the ability to organize the objects into four piles. If successful, you may ask the student to name the colors. [Fall, Winter]	**Multiple Sorts/Multiple Rules** Ask the student to sort a set of objects and describe the rule; then sort the same set of objects in a different way, and describe the second rule. [Fall]
Numerical and Proportional Reasoning	**PK 2.1.1**	**Counting Objects** Place three counting mats on a table and put five blocks on one mat, eight blocks on another mat, and 10 blocks on the third mat. Ask the student "How many blocks are on this mat?" as you indicate the first mat. Observe how the student performs the task (touch counts, counts without touching the blocks, or immediately states the number without counting). If the student correctly states, "There are five blocks," then repeat the question with the remaining mats. Successful performance is the ability to state the correct number of blocks on each mat, regardless of the strategy used. Record the highest number counted correctly on the record card. [Fall] Repeat the task as needed. [Winter] Repeat the task as needed. [Spring]	**Identifying Numerals** Ask the student to tell each number as you show a set of number cards.

Standard	State Framework	Performance Activity	Performance Task
Numerical and Proportional Reasoning	**PK 2.1.2**	**Comparing Sets** Give the student five red and six white Unifi cubes (loose, not attached). Ask the student to tell you how many of each color there are. Then ask the student to tell you which color set of cubes is more. If successful, remove one of the white cubes and ask the student to compare the two sets again (they are the same or equal). [Fall] Repeat the task. If the student correctly says that the white set has more, ask, "How many more?" [Winter] Repeat the task but rather than ask which set is more, ask which set is less. [Spring]	**Estimating and Comparing** Ask the student to estimate which of two sets is more; (ask why they made that choice); then have the student count each set and tell which is more. Ask the student to name the number which is one more than the larger set.
Numerical and Proportional Reasoning	**PK 2.2.5**	**Rote Counting** Ask the student to count out loud starting from one. If the student counts beyond 100, ask the student to stop. Record the highest correct number. Successful performance is the ability to count correctly to 30 by the end of the year. [Fall] Assess rote counting three times during the year and enter the highest number on the record card each time. [Winter] Assess rote counting for a third time and enter the highest number on the record card. [Spring]	**Recording Highest Number** Observe the student rote count and record the highest number.

Standard	State Framework	Performance Activity	Performance Task
Numerical and Proportional Reasoning	**PK 2.2.7**	**Combining Sets** In advance, use a marker to draw a Sets Board arrangement on a large sheet of paper or oaktag. Have available some counting objects, such as blocks of one color, bottle caps or teddy bear counters. Ask the student to put three blocks in one small ring and two blocks in the other. Ask, "How many blocks are there together?" Repeat with other combinations, such as 2 + 2, 3 + 1, 1 + 4. Observe the student's strategy — does the student count them all again, count on or simply state the sum? If the student recounts all objects in both sets, the student should be given more opportunities to complete similar tasks in the classroom. Do not check the record card for mastery. If the student counts on, or states the sum, the student is ready to move on in the curriculum. Record the task as mastered. [Spring]	**Acting Out Story Problems** Take out a *Workjob* material and tell a simple story to the student who uses the material to act out the story, such as "There were three fish in the aquarium. Two more swim in. How many fish are there in all?"
Geometry and Measurement	**PK 3.1.1**	**What shape am I?** Show the student each shape in turn and ask the student to name it. You may use wooden blocks from manipulative sets such as Attribute Blocks or Pattern Blocks. Teacher-made cardboard cutouts also may be used. Successful performance is the ability to name each shape. [Fall]	**Name the Shape** Child will point out and name shapes (circle, triangle, square, rectangle, diamond).
Geometry and Measurement	**PK 3.2.4**	**Vocabulary of Position** In advance, draw a rectangle on a sheet of oaktag. Place it in front of the student and give the student a Unifi cube. Ask the student to put the cube inside the rectangle. If successful, continue to ask the student to move the cube so it is outside, to the right, near the bottom, etc. [Winter]	**Geoboards: Shapes and Positions** Ask the student to build a square on the geoboard. Ask the student to place a Unifi cube inside the square; then place the cube, in turn, near the top, near the bottom, outside, to the left, and to the right of the square.

Standard	State Framework	Performance Activity	Performance Task
Geometry and Measurement	**PK 3.3.7**	**Before and After** Give the student a set of three or four picture cards and ask the student to arrange them in order and tell a story. [Winter]	**Time Relationships** Observe that students use the appropriate language to describe time relationships.
		Calendar Language During the daily classroom activities, observe that the student consistently uses the names of the days of the week, can tell which weekdays are school days and which days are not, and appropriately uses terms such as today, yesterday, and tomorrow. [Winter]	**Time Relationships** Observe that students use the appropriate language to describe time relationships.
Working with Data	**PK 4.2.2**	**Analyzing Pictographs** In advance, make a real graph by placing three colors of buttons (or construction paper pieces) into three rows; for example, a row of three white, a row of six black, and a row of four gray buttons. You may wish to glue the buttons onto 1-inch grid paper and save the graph for use with each student.  Ask the student to tell how many buttons are white, then black, then gray. Ask the student, “Which color has more buttons?” “Which has the least?” Ask the student to tell you something else about the graph. [Winter] Repeat the task in May, but use a simple pictograph. [Spring]	**Reading Graphs** Ask the student to describe the information in a real graph. Ask the student to tell you about the graph. If necessary, during the interview, ask the student, “Which is the most? The least? How many of each?”

Curriculum Standards Connections

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS. Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 1.1. UNDERSTAND AND DESCRIBE PATTERNS AND FUNCTIONAL RELATIONSHIPS.

Grade-Level Expectations

1. **Sort and classify familiar objects by a single attribute (size, shape, color, texture, orientation and position) and explain the reason. (See also GLE 3.1.2.)**

   - Give children opportunities to identify all objects in the room that have the same attribute, e.g., all red things or all smooth things.

   - Ask the children to respond to the choral question "Why is he/she putting that__there?" by saying "I am putting this here because it is___," while putting the identified objects in a specific place such as on a table or in a large yarn circle or hula-hoop.

2. **Recognize, copy and create simple AB patterns using objects, movement or sounds.**

   Provide opportunities for children to recognize, copy and create AB patterns using objects, movement and auditory patterns e.g., those in songs, poems and/or rhymes.

   - Have children use their own bodies to copy, and create AB patterns such as blinking, clapping and/or hopping.

   - Have children identify the core elements in a pattern that the class is making together, such as touching the head and then a knee or snapping and then stomping.

- Show children a group of objects arranged in a teacher-made AB pattern. Have the children describe the pattern and then copy the pattern using the same objects.

- When providing opportunities for children to create patterns of their own have children explain their thinking by asking questions such as:

    1. How did you make your pattern?
    2. Can you make your pattern a different way? (Using shapes, colors, size, position, numbers or letters.)
    3. Can you find a pattern that is similar to your pattern? How is it similar?

❖ **Possible Assessment Opportunities**

❖ Compare patterns using two given AB patterns (such as circle, square and white, blue) and have the children compare the patterns.

Intervention: Use sentence starters or guiding questions to help children identify the elements of a pattern. Repeat the process with another pattern. Then guide the children in the discussion of how the patterns are different and alike.

Challenge: Have the children explain how these patterns could be used to create two new, similar patterns using different materials.

❖ Children recognize, copy, extend and create repeating patterns of two or three elements (objects, songs, rhymes and body movements, e.g., clap, clap, stomp).

Intervention: Limit objects to those that a child can physically manipulate or recreate. Have the child follow the steps used in previously modeled patterns.

Challenge: Provide additional elements for existing patterns so children can create new patterns and extend them.

SAMPLE INTEGRATED LESSON — PATTERNS

Context: Sara and Joel were walking across the playground when they noticed how pretty the different colored leaves were. They decided to bring the leaves back to their classroom and use them to make patterns. Can you create patterns with leaves? How many different patterns can you make with leaves?

Grade-Level Expectations: 1.1.2

Time: One instructional period

Objective: Children will be able to copy a repeating AB pattern using leaves.

Materials: Collections of leaves, paper, glue

Procedure:

1. Collect leaves from the schoolyard and discuss their attributes (size, color, shape, texture, etc).
2. Discuss different ways to use the attributes of the leaves to make a repeating pattern.
3. Ask the children to create an AB pattern (red, brown; or large, small; or maple, oak, etc.) using their leaf collections.
4. In small groups, have each child describe the leaf pattern that another child has created and discuss how that pattern is like the one.
5. Have children record their patterns by gluing them on a paper and displaying the results. Each child should represent that pattern in another way.

- **Possible Assessment Opportunities**
  - Have each child use different elements (actions, words or symbols) to create and extend a pattern and describe the core elements of the pattern.

  Intervention: Provide multiple copies of cards or pictures that illustrate different elements that can be used to form an AB pattern (such as tree and flower or cat and dog).

  Challenge: Allow students to develop their own patterns using three or four different elements.

Note to teacher: This lesson may be adapted to use rocks, flowers or shells depending on seasonal availability.

Interdisciplinary Framework Connections			
Science	**English/Lang. Arts**	**Visual and Performing Arts**	**Physical Education**
A.INQ 3 Make predictions based on observed patterns (e.g., look for patterns in leaves, flowers, etc.)	**2.1a** Begin to recognize patterns in text (e.g., have children recite simple poems/rhymes)	• Perform easy rhythmic, melodic and choral patterns accurately (e.g., copy then create simple AB patterns) • Echo short rhythms and melodic patterns (e.g., sing songs) **Art** • Look for patterns in pictures	• Recognize and apply the concepts of body space, effort and relationships in developing movement sequences and game strategies (e.g., copy, extend and create body patterns/dance)

Vocabulary: pattern, patterns, next, before, after, over, under, size, shape, color, day, week, year, days of the week, sort, classify, extend

Resources:

Teacher References:

Teddy Bears Go to the Movies and *Teddy Bears Go Hiking*. Primarily Bears, AIMS

Algebra in the PreK-2 Curriculum? Teaching Children Mathematics – NCTM September 2005

Yardsticks: Children in the Classroom Ages 4-14, by Chip Wood

Electronic Resources:

A to Z Teacher Stuff: http://lessonplanz.com/Preschool/

Kinderplans: http://www.kinderplans.com/content.cfm?pageid=132

KinderArtLittles: http://www.kinderart.com/littles/dinosaur.shtml

SuperKids (Educational software Review): http://www.superkids.com/aweb/pages/reviews/multisub/preschoo/

Center for Distance and Online Learning: http://teams.lacoe.edu/teachers/index.asp

Teach Learn Communicate: http://www.alfy.com/teachers/teach/thematic_units/Patterns_Shapes/PS_1.asp

Properties Everywhere: http://illuminations.nctm.org/LessonDetail.aspx?ID=L20

Structured Observations – Goals 2000

Literature Connections:

A Pair of Socks, by Stuart J. Murphy

Pattern Fish, by Trudy Harris

Elmer, by David McKee

Over in the Meadow, by Ezra Jack Keats

Lots and Lots of Zebra Stripes, by Stephen R. Swinburne

I Went Walking, by Sue Williams

Rosie's Walk, by Pat Hutchins

Classroom materials: collections such as buttons, shells, crayons and colored cubes

Notes:

***NUMERICAL AND PROPORTIONAL REASONING*. Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.**

COMPONENT STATEMENT: 2.1. UNDERSTAND THAT A VARIETY OF NUMERICAL REPRESENTATIONS CAN BE USED TO DESCRIBE QUANTITATIVE RELATIONSHIPS.

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

1. Represent quantities of up to 20 objects in a set.

Provide daily opportunities to quantify objects in the environment and develop number concepts.

- Count real world objects from the children's environment.
- Have children use their bodies and movements such as clapping, hopping or nodding or moving to music to demonstrate quantities 2, 3… 20.

❖ **Possible Assessment Opportunities**

❖ Count the number of objects in a set of up to 20 objects. Ask questions such as:

1. How many objects do we have?
2. Can you show me how to count the same amount using a different objects?
3. Is this set of objects close to very little? Close to 5? Close to 10?

Intervention: Begin with a set of five or fewer objects.

Challenge: Start with two, three or more objects and count on to 30 or as far as the child can count.

2. **Compare two sets of up to 20 objects, and identify which set is more, less or the same.**

- Use objects such as cardboard circles or masking tape to make a line in the classroom, hallway or play area. Have children decide how many of them can fit on the line, standing shoulder to shoulder or lying head to toe. Have the children line up and count how many of them fit. Ask the children to explain whether more of them fit shoulder to shoulder or head to toe and why.

- Repeat the preceding activity using other objects such as sentence strips with Unifix cubes, teddy bear counters, or other objects in the classroom. Have the children count and make comparisons among the number of objects it takes to fit on the line.

❖ **Possible Assessment Opportunities**

❖ Given a set of up to 10 objects, create a new set that has more than, less than or the same number of objects. Ask questions such as:

1. Can you show me another way to make ____?

2. Is your group a lot more or a lot less? A little more or a little less?

3. How many more are in this group? How is this amount different from_____?

(For example, have four children line up joining hands, then have one more child join or leave the group. Explain why we now have more or less than the original set of children.)

Intervention: Begin with a set of two or three objects. Make sets of one more and one less.

Challenge: Make the original set between 20 and 30. Have the child make multiple sets that are more than and less than the original set.

3. **Identify the ordinal position of objects: first and last.**

- Count objects while moving the objects from one place to another and have the children identify which object is first or last.

4. **Explore a whole and half of an object.**

- During normal classroom activities, divide whole objects such as fruit, a cracker, a paper plate or a piece of drawing paper into two parts and ask the children if the parts are the same, equal (one-half) or unequal.

COMPONENT STATEMENT: 2.2. USE NUMBERS AND THEIR PROPERTIES TO COMPUTE FLEXIBLY AND FLUENTLY AND TO REASONABLY ESTIMATE MEASURES AND QUANTITIES

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

5. ***Count by rote to at least 20.***

Provide daily opportunities to quantify objects in the environment and develop number concepts.

- Sing nursery rhymes and songs, do finger plays and repeat poems using counting words.
- Read counting books.

6. ***Count as one more object is added to a set of up to 20 objects.***
7. ***Act out and solve story problems using sets of up to 10 objects.***

SAMPLE INTEGRATED LESSON — COUNTING FLOWER PETALS

Context: Tinesha was shopping with her mom in the grocery store. As they passed by the flowers, Tinesha's mom noticed the blossoms on one of the flowers. She called Tinesha's attention to it by saying, "Look at all those petals on that flower! There must be 20 of them!" " How do you know that, Mom?" asked Tinesha. "Oh! I can count them," she replied. When Tinesha went to school the next day, she noticed a flower on her teacher's desk. She wanted to know how many petals were on that flower. Can you help Tinesha figure out how many petals are on the flower?

Grade-Level Expectations: 2.1.1, 2.1.2, 2.2.5, 2.2.6, 2.2.7

Time: Multiple sessions including reading the book and matching flowers with Unifix cubes

Objectives: Children will determine how many objects are in a set. Children will create corresponding sets.

Materials: I Can Count the Petals of a Flower by John and Stacy Wahl; real, plastic or silk flowers with one to 10 petals per flower (try to get examples of each number)

Procedure:

1. Read the book, *I Can Count the Petals of a Flower*.
   - As the book is read, count the petals on each of the flowers saying, "Count with me, 1, 2, 3, …"
   - Develop discussions comparing the flowers using ideas such as "more than, less than" as well as exact counting.
2. Distribute Unifix cubes.
3. Show children the collection of flowers. Choose one flower and say, "I wonder how many petals are on this flower? We can find out using the cubes."
4. Have the children put one Unifix cube on the end of each finger as they count petals with the teacher. Have children count again as they take the cubes off their fingers, one at a time.

❖ **Possible Assessment Opportunities**

- ❖ Using real, plastic or silk flowers, count the petals on other flowers. Repeat two or three times using flowers with different amounts of petals on them. Ask questions such as:

1. How many petals will be on this flower if it had one more, … one less petal?

2. What number comes after____? Show a flower with that many petals.

3. What number comes before_____? Show a flower with that many petals.

Intervention: Use three or four objects such as blocks. Have the child lay the blocks down, one at a time, while counting each Next, ask the child to place a Unifix cube next to each block and count the cubes. The child should then place the Unifix cubes and on fingers, one at a time, while counting. Ask the child to justify their answer to the question: "Do your fingers match the blocks when you count?"

Challenge: Put some flowers in order from the least to the greatest number of petals on each flower.

Interdisciplinary Framework Connections			
Science	**English/Lang. Arts**	**Visual & Performing Arts**	**Physical Education**
A.3 Count objects in a group and use mathematical terms to describe quantitative relationships such as same as, more than, less than, equal, etc. **A.INQ 8** Use nonstandard measures to estimate and compare sizes of objects.	• Identify current knowledge and awareness on a selected topic before a reading activity. • Draw conclusions and use evidence to substantiate them by using texts heard, read and viewed. • Select and organize visual and auditory information to answer a specific question.	**Art** • Use different media, techniques and processes to communicate ideas, feelings, experiences and stories. **Music** • Sing a song from memory. • Use improvisation to discover and invent movement and to solve movement problems.	• Follow classroom rules, activity-specific rules, safety practices, procedures, etiquette and good sportsmanship in various physical activity settings. • Work cooperatively with peers of varying skill levels.

Vocabulary: more than, less than, same, equal, count, one more, one less, close to, closer to, near, very little, more, less, bigger, smaller, few, most, a lot more, a lot less

Resources:

Electronic Resources:

Let's Count to 5: http://illuminations.nctm.org/LessonDetail.aspx?id=U57

Building numbers to 10: http://illuminations.nctm.org/LessonDetail.aspx?id=U147

Understanding a Child's Development of Number Sense: http://illuminations.nctm.org/Reflections_preK-2.html (text and video)

Chickety, Chickety, Chop – Goals 2000

Number Assessment Interviews – Goals 2000

Teacher References:

Elementary and Middle School Mathematics, Teaching Developmentally, by J. Van de Walle, 5th Ed p. 116–121

The Young Child and Mathematics, by Juanita V Copley

Yardsticks: Children in the Classroom Ages 4-14, by Chip Wood

Children's Literature:

The Very Hungry Caterpillar, by Eric Carle

How Many Snails? by Paul Giganti

What Do Plants Need? An AIMS Booklet for K.

I Can Count the Petals of a Flower, by John and Stacy Wahl

Classroom Materials: snacks, toys, shoes, clothing, items from nature (shells, rocks, leaves, flowers), items from daily living (silverware, napkins, dishes, chairs, mats), books, markers, crayons, Unifix or interlocking cubes, blocks

Notes:

GEOMETRY AND MEASUREMENT. Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 3.1. USE PROPERTIES AND CHARACTERISTICS OF TWO- AND THREE-DIMENSIONAL SHAPES AND GEOMETRIC THEOREMS TO DESCRIBE RELATIONSHIPS, COMMUNICATE IDEAS AND SOLVE PROBLEMS.

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

1. **Identify and describe familiar shapes (triangles, squares, rectangles and circles) and solids (cubes, spheres, cylinders and prisms) in contextual situations.**

   - Have each child select one shape or solid from a collection of circles, squares, triangles, rectangles, cylinders, spheres, cubes and prisms and say or describe one or two interesting things about the shape or solid. Continue the process by having children select a second item and explain how the two are alike and/or different.
   - Challenge the children to see if observations about one shape will apply to all shapes with the same name. (For example: Circles from a set of attribute blocks may be different colors, sizes and thicknesses. Have children explain or describe the characteristics that make all of them circles.)

❖ **Possible Assessment Opportunities**

❖ Supply children with shapes and solids that have been presorted. Ask questions such as:

1. Can you think of a reason these items are sorted this way?
2. Could these items be sorted differently?
3. How would you sort them?

Intervention: Use sentence starters such as, “These shapes are alike because _________.”

Challenge: Provide multiple sets of presorted two- and three-dimensional objects so that children can re-sort them in different ways.

2. Compare and sort familiar shapes and solids in the environment and contextual situations

- Collect objects from home or outdoors and sort them into groups based on size, length, weight, shape, use, location or color (e.g., sort by bigger than a hand, longer than foot, taller than my desk, longer than my pencil, etc.).
- Give each pair of children a paper showing labeled pictures of a triangle, square, circle and rectangle. Work with the children to find examples of the same shapes in the room, around the building and outside (e.g., the clock is the shape of a circle, and the easel is the shape of a rectangle, etc.). After many examples have been found have the children come back together as a group and talk about the objects they found in the environment to match the shapes on their papers.

❖ **Possible Assessment Opportunities**

❖ Have children sort a group of common classroom materials (e.g., toys, blocks, etc.) by one attribute such as use, location, function, size or shape.

Intervention: Say: I am thinking of an object that is _____ and have the child find an object that matches the description.

Challenge: Have the child think of a different category for sorting objects to challenge the teacher and/or other students and then verify their responses.

3. Construct shapes using a variety of materials.

- Provide opportunities to put together, take apart, make and build shapes and solids out of materials such as clay, blocks or paper.

~ *COMPONENT STATEMENT: 3.2. USE SPATIAL REASONING, LOCATION AND GEOMETRIC RELATIONSHIPS TO SOLVE PROBLEMS.*

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

4. Describe location, direction, and position of objects using terms such as under, over, inside, next to, near, in front of, first and last.

- Stack different colored blocks in a vertical pile or side by side. Ask children to describe the position of the blocks using language such as, "The blue block is on top of or in front of the red block."
- Have children explain where objects are placed in the room by using terms such as near, next to, under and over.

Describe a child's place in line using terms such as first, last, in back of or next to.

5. Complete simple shape and jigsaw puzzles and explain the reasoning used to complete the puzzle.

- Provide children with opportunities to complete simple shape (e.g., animals, numbers or letters) and jigsaw puzzles.
- Have children put three-dimensional objects in place based on their shape (such as placing round pegs in round holes or using a Shape Sorter). Have the children share how they where a shape will fit.

~ *COMPONENT STATEMENT: 3.3. DEVELOP AND APPLY UNITS, SYSTEMS, FORMULAS AND APPROPRIATE TOOLS TO ESTIMATE AND MEASURE.*

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

6. Use patterns to determine events that reoccur. (See also GLE 1.1.2.)

- Identify patterns in the child's environment (e.g., patterns based on daily weather conditions, or relating seasonal weather patterns to activities or clothing).

- Children explore the patterns in our day, week and year (e.g., daily routines and schedules).
- Use pictures or photographs of daily classroom and home activities. Have children arrange the pictures according to the time of day they usually occur: morning, afternoon or evening.

7. **Sequence events and describe time periods using terms such as morning, afternoon, night, yesterday, today, and tomorrow.**

- Have children agree or disagree and explain their reasoning when given statements such as:
  - The sun will rise in the evening.
  - We will eat dinner in the morning.
  - We will go outside wearing only our swimsuit in the winter.

8. **Use nonstandard units or reference objects to compare length, area and capacity and to order, estimate and sort objects by size (length or area). Describe the comparisons using language such as more, longer, shorter or taller**

- Cut heavy paper or cardboard into strips that are 2 inches wide. Have each child place his or her foot at one end of the strip. Cut a strip to match the length of the child's foot. Choose one child's strip as a reference and ask the other children to state whether their strip is the same as, longer than or shorter than the strip that was chosen. To help children determine the relative length of their strip, have them place their strip next to the strip that was chosen. Once each child has decided whether his or her strip is the same as, longer, or shorter, have the children discuss their observations. Ask questions such as: How did you decide to describe your strip? How does your strip compare to another child's who described her foot the same way?
- Record each child's name and the date on his or her strips. These strips can be used to make a class graph. The same strips can be used later in the year to compare the changes, if any, in foot lengths.
- Give each child a rectangular piece of paper. Have the child think about how many scoops or handfuls of a designated object such as counters, beans, buttons or pasta it will take to cover the paper. Allow the children to check their thinking and repeat the activity until the paper is covered. Discuss why changes were or were not made in order to cover the paper.
- Put out a tub of rice and a variety of containers so that children can explore filling the containers and comparing the amount of rice each container holds. Discuss with the children what they observed about the different containers and their capacity.

9. ***Discuss strategies to estimate and compare length, area, temperature and weight.***

SAMPLE INTEGRATED LESSON — I'VE SEEN THAT SHAPE BEFORE! (ADAPTED FROM NCTM ILLUMINATIONS)

SHAPE SPOTTING — CLASSROOM AND BEYOND

Context: A wonderful teacher named Mrs. Ring was tidying up the shopping area in the room when she picked up a can of peas. She held up the can so that the children could see the bottom and asked if anyone had seen the shape before. Jose said he had seen it on the bottom of the ice cream container his mom bought yesterday. Janelle said she had glasses at home that look just like the can. Robert yelled out the silo in the farm corner of the classroom looked just like the can of peas, too! Let's investigate to see if we can spot some familiar shapes.

Grade-Level Expectations: 3.1.1, 3.1.2, 1.1.1

Time: Multiple instructional periods, including assessment

Objective: To recognize three-dimensional shapes in the real world.

Materials: Physical models of a cube, cylinder, sphere, and prism. Models can be familiar objects such as balls, boxes or blocks, Models are commercially available or models can be made from materials such as clay, craft foam or cardboard.

Procedure:

Solid Shapes in the Classroom

1. Organize and display a labeling system for the children such as yellow Post-its are for cylinders, blue Post-its are for cubes, etc., and give each a collection of the Post-it notes.
2. Model for the children by holding up an object such as a ball and ask the children to identify what shape it is by holding up the post-it that should go on this object. Have a child place the appropriate Post-it on the ball.
3. Ask students to look around the classroom to find examples of the 3-D shapes they have been studying (cubes, spheres, cylinders and prisms).
4. Have the children label each object with the corresponding Post-it note that identifies its geometric shape. Ask questions such as:
    a. Which of the shapes roll?

b. Why can't all shapes roll?

c. How are the cube and the rectangular prism alike? Different?

d. Can you point to the corners, sides and faces of each of the solid figures?

e. What shape are the faces of the solid? What solids have faces in that shape?

❖ Possible Assessment Opportunities

❖ Solid Shapes Outside the Classroom

5. Take the class on a walk around the school to identify solid figures, cubes, spheres, cylinders and prisms in the environment. Have children identify all objects found as being man-made or natural and provide a possible reason or explanation for the object's shape. Children can take photographs or draw pictures to record the location of each figure and later use these pictures or photographs to make a bulletin board display or a book for the class or school library.

During the walk and after ask questions such as:

a. What can you tell me about the shape? What else do you notice?

b. Is this figure exactly like the model in the classroom?

c. How is it alike? How is it different?

d. Does this object have any flat or smooth sides? Corners?

(Help students understand they can recognize shapes even when the objects they see are not exactly like the shapes they can imagine.)

Intervention: Provide students with a rectangular prism and have them identify only that one shape in the environment in two- or three- dimensional objects.

Challenge: Ask children to find or make shapes and solids that are a combination of or contain other shapes and solids (e.g., in various shapes in a tangram square; triangles, trapezoids and rhombuses in hexagon pattern blocks and cones in cylinders).

Interdisciplinary Framework Connections				
Science	**English/Lang. Arts**	**Social Studies**	**Visual & Performing Arts**	**Physical Education**
Properties of Matter **A.1** Use the senses and simple measuring tools, such as rulers and equal-arm balances, to observe common objects and sort them into groups based on size, weight, shape or color. **A.2** Sort objects made of materials such as wood, paper and metal into groups based on properties such as natural or man-made, attraction to magnets, and whether they float or sink in water. **A.7** Describe and record daily weather conditions. **A.8.** Relate seasonal weather patterns to appropriate choices of clothing and activities (e.g., discuss patterns in calendar and day) **A.INQ 9** Count, order and sort objects by their properties.	• Recognize when they do not understand and apply appropriate strategies such as asking questions. • Generate and respond to questions. • Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.). • Use oral language to communicate a message. • Select and organize visual and auditory information to answer a specific question.	**Humans and Environment Interaction** • Explain ways in which humans use and interact with the environment (e.g., why we make things in certain shapes.) • Create timelines that sequence events and people, using days, week, months (e.g., explore the pattern of our day; identify patterns in our community)	**Art** • Use different media techniques and processes to communicate ideas, feelings, experiences and stories. • Use elements of art and principles of design to communicate ideas. • Select and use subject matter symbols and ideas to communicate meaning. (e.g., use art materials to create sorting pictures, such as cutting out pictures and sorting them, creating pictures of shapes, etc).	**Responsible Behavior** • Follow class rules, activity-specific rules, safety practices, procedures, etiquette and good sportsmanship in various physical activity settings (e.g. following the rules for outside behavior).

Vocabulary: sort, alike, different, diagram, float, sink, shape, same, size, color, under, over, inside, next, near, in front of, first, last

Resources:

Electronic Resources:

Amazing Attributes: http://illuminations.nctm.org/LessonDetail.aspx?id=U186

Just Alike: http://illuminations.nctm.org/LessonDetail.aspx?ID=L47

I've Seen That Shape Before: http://illuminations.nctm.org/LessonDetail.aspx?id=L237

Measuring Length: http://illuminations.nctm.org/WebResourceReview.aspx?ID=30

Non-Standard Measuring: http://illuminations.nctm.org/WebResourceReview.aspx?ID=490

Making Comparisons – Goals 2000

Teacher References:

Spring Into Math and Science, by AIMS Education Foundation, 1987

Elementary and Middle School Mathematics, by John Van De Walle

Engaging Young Children in Mathematics, by Douglas H. Clements, 2004

Yardsticks: Children in the Classroom Ages 4-14, by Chip Wood

Children's Literature:

So Many Circles, So Many Squares, by Tana Hoban

A Cloak for the Dreamer by Aileen Freidman

The House by Monique Felix

Shapes, Shapes, Shapes by Tana Hoban

The Fine Round Cake by Arnica Esterl

Notes:

WORKING WITH DATA: PROBABILITY AND STATISTICS. Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 4.1. COLLECT, ORGANIZE AND DISPLAY DATA USING APPROPRIATE STATISTICAL AND GRAPHICAL METHODS.

Grade-Level Expectation

1. Create real graphs using familiar objects and pictures.

- Provide opportunities for children to graph responses to questions such as:

    1. What did you wear to school today? Generate a list from the children's responses. Choose the top two or three most common items such as hats, sweaters or sneakers. Mark off a space on the floor or play area for the graph. Have the children place each item in the appropriate space or line up in the appropriate space according to the item they are wearing, if placing the actual item on the graph is not appropriate. If children are on the graph, give each child in a category the same color block or piece of paper. Ask the children to mark the spot where they stood with their block or paper , and return to the group or circle area to talk about the graph they have made.

    2. How many people in the room have long hair? Short hair? Repeat the format above. Use pictures of long or short hair or actual photographs of the children.

    3. What is your favorite fruit? Limit to two or three choices such as red and green apples or oranges and bananas. Place the fruit in the appropriate place on a graph drawn on chart, newsprint or butcher paper.

COMPONENT STATEMENT: 4.2. ANALYZE DATA SETS TO FORM HYPOTHESES AND MAKE PREDICTIONS.

Grade-Level Expectation

2. Describe real graphs using comparative language such as more, less, most, least and the same.

- Using the graphs created in the previous grade-level expectation, ask the children to describe what they see using comparative language and explain or justify the use of the words they chose.

COMPONENT STATEMENT: 4.3. UNDERSTAND AND APPLY BASIC CONCEPTS OF PROBABILITY.

Grade-Level Expectations

3. Use patterns to describe some events that repeat.

- When discussing the schedule for that day, leave out a detail such as circle time or quiet time. If the children do not offer reminders of the omissions, ask children to think about how today's schedule is the same or different from other same days of the week (e.g., Tuesdays) or days in general and to justify their responses.

4. Explain why events are likely or unlikely to happen based on personal experiences.

- Challenge the children with statements such as: It is winter, I wonder if the leaves on trees will change color. It is summer and it will probably snow tomorrow.

SAMPLE INTEGRATED LESSON — SORTING AND CLASSIFYING USING FLOATING AND SINKING

Context: Your teacher has announced that a new water table will be delivered to your classroom. The teacher is worried because the water table must be placed near the work centers in the classroom. Only centers that have materials that will float can be placed close to the water table. What can be done to figure out which materials can float?

Grade-Level Expectations: 1.1.1, 2.1.1, 2.1.2, 4.1.1, 4.2.2

Time: One instructional period

Objective: The children will be able to compare objects that float or sink.

Materials: Large see-through container for water; objects for testing and sorting (e.g., crayon, paper clip, marble, rubber band, pencil, packing peanuts, wooden stick, cotton ball, small rock or other easily accessible objects); paper towels; two large yarn circles or two hula hoops to use as a graphic organizer for sorting items; paper; crayons; and pencils

Procedure:

1. Review the problem with the children.
2. Discuss the terms "floating" and "sinking." Assess background knowledge in these areas.
3. Ask children what kind of activity they would create to test for floating and sinking (scientific method).
4. Make two separate circles using the yarn or hula-hoops, one for floating and one for sinking.
5. Ask children to make predictions about whether an item will sink or float and record their predictions on chart paper.
6. Model the experiment and lay the objects in the appropriate circle on the organizer as each item is tested.
7. Compare the class predictions with the results and discuss any differences.
8. Compare the number of objects that sink and float to determine if there is a larger category.

❖ **Possible Assessment Opportunities**

❖ Place children in small groups. Provide each child with a different object.

- Let each child, in turn, test his/her item and place it on the organizer in the correct circle.
- Each child will record the results on paper.

Use questioning to guide the children to share, in sequence, how they sorted the objects. Orally share as a whole class what happened. Ask questions such as:

a. Which items floated? How many were there?

b. Which items sank? How many were there?

c. What was the same about the objects that floated? Sank?

d. Can you describe a difference between the items that floated and sank?

Intervention: Prompt children to orally share using verbal cues, such as "My ______ sank to the bottom of the container and Juleen's _________ floated on the top of the water because ____________________."

Challenge: Give children another set of objects to test and make comparisons with the previous sets of sinkers and floaters. Have the children develop rules for why things will sink or float.

Interdisciplinary Framework Connections				
Science	**English/Lang. Arts**	**Social Studies**	**Visual & Performing Arts**	**Physical Education**
Properties of Matter **A.1.** Use the senses and simple measuring tools, such as rulers and equal-arm balances, to observe common objects and sort them into groups based on size, weight, shape or color. **A.1.** Sort objects made of materials such as wood, paper and metal into groups based on properties such as flexibility, attraction to magnets, and whether they float or sink in water. **A.INQ 9** Count, order and sort objects by their properties.	• Recognize when they do not understand and apply appropriate strategies such as asking questions. • Generate and respond to questions. • Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.). • Use oral language to communicate a message. • Select and organize visual and auditory information to answer a specific question.	**Humans and Environment Interaction** • Explain ways in which humans use and interact with the environment (e.g.,, how we use sorting in everyday life, such as sorting trash and recyclables.)	**Art** • Use different media techniques and processes to communicate ideas, feelings, experiences and stories. • Use elements of art and principles of design to communicate ideas. • Select and use subject matter symbols and ideas to communicate meaning. (e.g.,, use art materials to create sorting pictures, such as cutting out pictures and sorting them, creating pictures of shapes, etc).	**Responsible Behavior** • Follow class rules, activity-specific rules, safety practices, procedures, etiquette and good sportsmanship in various physical activity settings (e.g., sorting different types of balls according to their use).

Vocabulary: sort, alike, different, diagram, float, graph, sink, shape, same, size, color, under, over, inside, next, near, in front of, first, last

Resources:

Electronic Resources:

Sinking & Floating: http://www.sciencenetlinks.com/lessons.cfm?BenchmarkID=4&DocID=164 .

What's My Rule for Sorting: http://illuminations.nctm.org/LessonDetail.aspx?ID=L494

Mr. Roger's Sorting & Classifying: http://pbskids.org/rogers/parentsteachers/theme/1461_p_act.html

Making Comparisons – Goals 2000

Digital Camera

Teacher References:

Spring Into Math and Science, by AIMS Education Foundation, 1987

Elementary and Middle School Mathematics, by John Van De Walle

Engaging Young Children in Mathematics, by Douglas H. Clements, 2004

Yardsticks: Children in the Classroom Ages 4-14, by Chip Wood

Children's Literature:

Sorting All Kinds of Socks, by Margarette Reid

Alligator Shoes, by Arthur Dorros

Is It Rough? by Tana Hoban

The Button Box, by Betsey Franco

Is It Red? by Tana Hoban

Color Zoo, by Lois Ehlert

Sort It Out, by Kari Jensen Gold

Notes:

Kindergarten

CONTENTS

The Learner at This Level

THE KINDERGARTEN CHILD:

- Learns best through play, direct experience and active exploration of concrete materials.
- Benefits most from routines and repetitive behavior and may be reluctant to try new activities.
- Thinks out loud and verbal answers may not equal cognitive understanding because they have more ideas than words.
- Needs a great deal of physical activity.

ALGEBRAIC REASONING

- Begins to realize patterns are everywhere through meaningful exploration at school and at home
- Identifies the core elements in a pattern.
- Focuses on repeating patterns, and can generate different types of repeating patterns (AB, AAB, ABB, etc).
- Describes the rules of simple patterns.
- Models situations of addition and subtraction and identifies quantities as equivalent or not equivalent.

NUMERICAL AND PROPORTIONAL REASONING

- Develops number sense by counting real world objects, sounds and physical movements and rote counts by reciting number names.
- Compares two sets of objects and identifies them as more than, less than or the same.
- Recognizes that the amount of objects in same-sized sets has the same number name (three-ness).
- Begins to recognize how many are in a small set without counting (subitizes).
- Counts a set of objects and learns that the last number stated in the sequence answers the question, "How many?" the rule of cardinality.
- Begins to use 10 as a benchmark.
- Determines whether parts of wholes are closer to very little, a half or a whole.
- Begins to describe the position of objects in a sequence by using ordinal numbers.
- Solves story problems by acting them out.

GEOMETRY AND MEASUREMENT

- Determines how things are alike and different by focusing on one attribute.
- Sorts objects and shapes by the presence or absence of a certain characteristic (round/not round).
- Uses nonstandard measurement as a way to systematically arrange or identify objects by size.
- Needs explorations of size, shape, length, and capacity.
- Explores patterns of minutes, days, hours, weeks, months and seasons.

WORKING WITH DATA AND PROBABILITY

- Begins to organize data into categories during informal sorting experiences, such as putting away classroom materials.
- Explains the criteria used to sort and group objects.
- Connects numbers with real quantities of familiar objects by using graphic organizers, such as real graphs and non-intersecting Venn diagrams.
- Represents collections with written symbols or drawings on graphic organizers.

Mathematics Background for Teachers

MATHEMATICS BACKGROUND FOR KINDERGARTEN TEACHERS

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS

Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

Central Understanding: Patterns can be described, generalized and extended based upon physical attributes or positions.

Background: The young child enters the formal school setting having observed patterns at home, in nature, at play and in stories. Understanding patterns, functions and algebra is a continual process of making connections between observations from the real-world environment and planned activities in a classroom. Meaningful experiences with patterns in contextual situations build a foundation from which children can begin to describe, generalize and extend patterns in geometry and number. Recognizing and working with patterns helps young children talk about relationships, predict what will happen and see the connections between mathematics concepts and their world (Copley, p. 83-84).

NUMERICAL AND PROPORTIONAL REASONING

Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

Central Understanding: The relative numerical value of collections can be determined through comparison.

Background: Recognition of quantity emerges very early in life. To provide a strong foundation for number knowledge and the development of quantitative reasoning, children must be involved in numerous, engaging experiences in counting and comparing collections (Clements, p. 17). Through these experiences, children build their capacity to understand the relationships between and among quantities and extend their number knowledge as they begin to assign numerical value to quantity.

MATHEMATICS BACKGROUND FOR KINDERGARTEN TEACHERS

GEOMETRY AND MEASUREMENT

Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

Central Understanding: Objects can be described by attributes, properties, measurements, and location.

Background: Children at this level (van Hiele – Level 0) recognize and begin to learn the attributes of two-dimensional shapes and three-dimensional solids. The understanding of geometric figures expands when children are provided with numerous and varied experiences to manipulate them move them in space and discuss their attributes and characteristics (Copley, p. 106). Children should also have numerous opportunities to compare two things with respect to length (longer, shorter), area (covers more, covers less), and weight (heavier, lighter) because comparing objects lays the foundation for measurement. Children need to construct measurement concepts for themselves over an extended period of time, by being actively involved in comparisons using non-standard units of measure and by discussing and recording their observations about those comparisons. Measurement provides an ideal bridge between geometry and number, when numerical values are assigned to measurements (Copley, p. 131). In discussion, children will communicate using their own descriptions, which should be reinforced with formal mathematics language.

WORKING WITH DATA: PROBABILITY AND STATISTICS

Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

Central Understanding: Objects can be classified and organized based on attributes

Background: The skill of classification rests on the ability to observe and identify characteristics and make comparisons. Classification, the first step in the organization of data (Van de Walle, p. 386), is the act of systematically arranging objects by their attributes. Children's descriptive language and names for objects and attributes reflect their observations and are acceptable ways of classification. Children refine their classification skills when they encounter challenges to the categories they have established. Young children need experiences with categorizing familiar things in different ways in order to learn to make sense of real-world data. Activities that involve sorting, grouping and categorizing must build on children's previous experiences and be explicitly designed to develop flexible thinking about the characteristics of data.

Correlated Grade-Level Expectations

Click here to access correlated grade-level expectations for kindergarten on the State Department of Education Web site.

Sequenced Grade-Level Expectations

KINDERGARTEN SEQUENCED GLES

Grade-Level Expectations	Fall	Winter	Spring
ALGEBRAIC REASONING			
1.1 Understand and describe patterns and functional relationships.			
1. Sort and classify objects by a variety of attributes (size, shape, color, texture, orientation, position and use), and explain the reason for each sort.			
2. Describe and make comparisons of qualitative and quantitative changes of a given pattern using terms such as warmer, softer, more, 1 more, less, 1 less, bigger, smaller, longer, and shorter.			
3. Recognize, reproduce, extend and create repeating patterns using movement, sounds, color, shapes, numbers and textures.			
4. Identify and extend visual, auditory and physical patterns in order to make predictions.			
NUMERICAL AND PROPORTIONAL REASONING			
2.1 Understand that a variety of numerical representations can be used to describe quantitative relationships.			
1. Represent quantities of up to 30 objects in a set.			
2. Compare sets of up to 30 objects and use the terms more, less or the same to compare the two sets and identify a set with one more or one less than a given set.			
3. Order sets of up to 30 objects from least to greatest.			
4. Identify the ordinal position of objects: first, second, third, fourth, fifth and last.			
5. Use a variety of models and familiar objects to compare two parts of a whole and describe the parts as being closer to a whole or closer to very little.			
6. Use a variety of models and familiar objects to: • Identify one whole and one half of an object. • Recognize a half and put two helves of an object together to make a whole. • Form a whole from two smaller sets that have equal amounts.			

Grade-Level Expectations	Fall	Winter	Spring
2.2 Use numbers and their properties to compute flexibly and fluently and to reasonably estimate measures and quantities.			
7. Count by rote to at least 30.			
8. Count and group up to 30 objects by tens.			
9. Identify the numerals 1-30 and match each numeral to an appropriate set of objects.			
10. Act out and solve addition and subtraction story problems that reflect real-world experiences and contextual problems using sets of up to 10 objects and describe the strategy or reasoning used to solve a problem. (Example: Put 2 crayons together with 4 crayons; then count to determine the number of crayons needed for all students at a table).			
11. Write the number sentences which correspond to story problems using addition, subtraction and equal symbols 12. (+, -, =) correctly.			
13. Estimate the amount of objects in a set using 10 as a benchmark, and then count to determine if the amount is more or less than 10.			
14. Identify and name pennies and dimes.			
15. Count pennies and trade pennies for objects.			
GEOMETRY AND MEASUREMENT			
3.1 Use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.			
1. Identify and describe familiar shapes (triangles, squares, rectangles and circles) and solids (cubes, spheres, cylinders, cones and prisms) in the environment.			
2. Compare and sort familiar shapes and solids in the environment and contextual situations.			
3. Construct small sets of shapes and solids using a variety of materials.			
3.2 Use spatial reasoning, location and geometric relationships to solve problems.			
4. Describe the location, direction, and position of objects or parts of objects, using terms such as under/over, inside/outside, next to/near, top/bottom, in front of, first and last.			

Grade-Level Expectations	Fall	Winter	Spring
5. Complete simple shape and jigsaw puzzles and explain the reasoning used to complete the puzzle and solve the problem.			
3.3 Develop and apply units, systems, formulas and appropriate tools to estimate and measure.			
6. Recognize events that reoccur (at specific times of the day or week).			
7. Locate yesterday, today, and tomorrow on a calendar to sequence events and use terms like before and after to compare events.			
8. Use non-standard units, physical referents (like a finger)or everyday object such as links, Unifix cubes, or blocks to compare ,estimate and order measures of length, area, capacity, weight, and temperature and describe the reasoning and strategies used.			
9. Describe and order small sets of familiar objects by size, length or area using comparative language such as more, bigger, longer, shorter and taller.			
10. Use a balance scale to compare the weight of two objects and identify which is heavier.			
WORKING WITH DATA			
4.1 Collect, organize and display data using appropriate statistical and graphical methods.			
1. Pose questions about objects and events in the environment that can be used to guide the collection of data.			
2. Collect data and record the results using real graphs and picture graphs.			
3. Arrange information in a systematic way using counting, sorting, lists, and graphic organizers.			
4.2 Analyze data sets to form hypotheses and make predictions			
4. Describe data using the terms more, less and the same.			
5. Identify and extend patterns from organized data to make predictions. For example: More boys than girls in our class watch television every day. We predict that the same will be true for another kindergarten class.			
4.3 Understand and apply basic concepts of probability			
6. Describe the likelihood of the future occurrence of events based on patterns and personal experiences using terms such as likely, unlikely or certainly.			
7. Engage in simple probability activities and discuss the results.			

Correlated GOALS 2000
Criterion Referenced Test

KINDERGARTEN CORRELATED GOALS 2000 CRT

The Goals 2000 Mathematics Curriculum was written as a companion to the 1998 Mathematics Framework. The Goals 2000 resources cited in this 2007 Model for Mathematics Curriculum are aligned to the 2005 Mathematics Curriculum Framework, 2007 Curriculum Standards and the fourth generation Connecticut Mastery Test.

The Kindergarten Criterion Referenced Test Part A from the Goals 2000 Mathematics Curriculum is aligned to the kindergarten sequenced GLEs and can be used for pre- and post-assessment. The Kindergarten Criterion Referenced Test Part B may also be used for pre- and post-assessment and integrated when appropriate. Student progress must be recorded by keeping a record of observations or a folder of student work samples. It is important to integrate items from Part B into the assessment process.

Please use the link below to access the electronic version of the complete document, which includes other activities, such as opportunities for open-ended and challenge experiences that must be examined for alignment prior to use.

http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=321084

Standard	State Framework	Performance Activity	Performance Task
Algebraic Reasoning	**K.1.1.1** Describe the rule used to sort.	**What's my rule?** Give the student a set of objects, such as buttons, and ask the student to sort them and describe the sorting rule used. Then ask the student to sort the same objects in a different way and describe the new sorting rule. [Fall Winter]	**Multiple Sorts/Multiple Rules** Ask the student to sort a set of objects and describe the rule; then sort the same set of objects in a different way, and describe the second rule. [Nov.]
	K.1.1.3	**Pattern Making** In advance, prepare an AB pattern that repeats five times using two colors of Unifix cubes. For example: R Y R Y R Y R Y R Y Give the student a large collection of the Unifix cubes, including more than the two colors, (buttons, keys, leaves or different pattern block shapes would be good as well) and ask the student to copy and build the same pattern underneath yours. If the student successfully builds a copy that repeats the pattern five times, ask the student to make the pattern longer, perhaps to the edge of the table. [Winter Spring]	**Pattern Extensions** Start an ABBABB pattern with Pattern Blocks and have the student extend it. Include ABC.

Standard	State Framework	Performance Activity	Performance Task
Numerical and Proportional Reasoning	**K 2.1.1**	**Rote Counting** Ask the student to count out loud starting from 1. If the student counts beyond 100, ask the student to stop. Record the highest correct number. Successful performance is the ability to count correctly to 30 by the end of the year. [Fall] Assess rote counting three times during the year and enter the highest number on the record card each time. [Winter] Assess rote counting for a third time and enter the highest number on the record card. [Spring]	**Recording Highest Number** Observe the student rote count and record the highest number.
Numerical and Proportional Reasoning	**K 2.1.3**	**What's the Correct Order?** Give the student a set of button cards from 10-20 or from 20-30. Ask students to arrange them in order. [Winter Spring]	**Matching and Sequencing** Give the student a set of button cards 1-30 and a set of numeral cards. Ask the student to match each set with a card and arrange the sets in order. [Spring]

Standard	State Framework	Performance Activity	Performance Task
Numerical and Proportional Reasoning	**K 2.1.4**	**Recognize Ordinals** Make a row of five Unifix cubes, each a different color - such as red, yellow, blue, green, and white, when facing the student. Sit next to the student. Ask the student to tell you the color of the first cube; then ask for the color of the third cube. If successful, ask the student to tell the position of the green cube (fourth) and the white cube (fifth, or last). [Spring]	**Identifying Ordinals** Given a row of five Unifix cubes, each a different color, ask the student to name the color of the fourth cube, the first cube, the last cube, etc.
Numerical and Proportional Reasoning	**K 2.1.5**	**Making Halves** Fold a paper in 1/2. Color 1/2 of a shape. [Spring]	**Making Halves** Given 3 choices, point to item that represents 1/2. Given 3 shapes, fold them in half.
Numerical and Proportional Reasoning	**K 2.2.9**	**Match Making** In advance, put out four counting mats of 2, 5, 1, and 3 Unifix cubes. Give the student a shuffled set of numeral cards 1-20. Ask the student to place the matching numeral card next to each set. Observe how the student approaches the task. Successful performance is the correct matching for all four sets. [Winter] Repeat the task, but place 7, 5, 10 and 8 Unifix cubes on the mats. [Spring]	**Identifying Numerals** Ask the student to tell each number as you show a set of number cards.

Standard	State Framework	Performance Activity	Performance Task
Numerical and Proportional Reasoning	**K.2.2.9**	**I Can Write My Numerals** Show the student a mat with one Unifix cube on it. Ask the student to tell you how many and then write the same numeral. Then add a cube to the mat and again ask the student to tell how many and write the numeral. Repeat for up to ten cubes. [Winter] Ask the student to count aloud from 1 to 30 and write each numeral after it is said. [Spring]	**Recording Amounts of Objects** Ask the student to write the number on a small chalkboard that tells how many are in a small set or in picture of objects. Repeat for 2 or 3 different amounts.
Numerical and Proportional Reasoning	**K 2.2.10**	**Oral Story Problem** Give the student a handful of pennies. Tell the student you are going to read aloud a story problem about pennies - and that you will read it twice. Then read the problem. "Jimmy had three pennies. Maria gave him five more pennies. How many pennies does Jimmy have in all?" Read the problem again. Note whether the student solves the problem with or without counting out pennies. [Winter]	
Numerical and Proportional Reasoning	**K 2.2.12**	**Estimating** Show the students a transparent plastic bag that contains ten Unifix cubes. [Winter] Repeat the task, but use a bag of twenty cubes. [Spring]	**Estimating and Comparing** Ask the student to estimate which of two sets is more; (ask why they made that choice); then have the student count each set and tell which is more. Ask the student to name the number which is one more than the larger set.

Standard	State Framework	Performance Activity	Performance Task
Numerical and Proportional Reasoning	**K 2.2.13**	**How much money do I have?** Place a pile of 10 pennies in front of the student and ask the student to count them. [Spring]	**How many pennies?** Observe students as they engage in tasks that require counting and trading pennies.
Geometry and Measurement	**K 3.2.5**	**Position: Shape and Jigsaw Puzzles** Place a puzzle frame and pieces in front of a student. Ask the student complete the puzzle. If successful, continue to provide puzzles of increasingly complexity or increase the number of puzzle pieces. [Winter.]	**Geoboards: Shapes and Positions** Ask the student to build a square on the geoboard. Ask the student to place a Unifix cube inside the square; then place the cube, in turn, near the top, near the bottom, outside, to the left, and to the right of the square.
	K 3.3.8	**Estimating Lengths** In advance, precut two strips of oaktag - make one equal in length to 5 Unifix cubes snapped together, and the other 10 cubes. Give the student the two strips and ONE Unifix cube and ask the student to estimate the length of each strip. Record the estimates. Repeat, but use longer strips - 8 and 15, for example. [Spring] **Estimating Area** In advance, cut a 3-inch by 5-inch rectangle from a sheet of oaktag (or use a 3 x 5 index card). Give the student ONE Color Tile and ask the student to estimate how many tiles would cover the rectangle. Record the estimate. (Note: although to the adult the unit is a square inch - to a student, the Color Tile is nonstandard.) Repeat, but use a 4 x 6-inch rectangle or index card. [Spring]	**Estimate and Measure** Ask the student to estimate the length of an object, such as a pencil, in Unifix cubes, and then measure the object using the cubes. **Spatial Relationships 1** Place a red, a yellow, and a blue Pattern Block together to form a design. Ask the student to estimate how many green triangles will cover the design. Then have the student cover and count.

Standard	State Framework	Performance Activity	Performance Task
		Estimating Volume In advance, find a jar or other container that will hold from 8 to 12 Unifix cubes when filled. Show the jar and ONE cube to the student and ask the student to estimate how many cubes will fit in the jar. Record the estimate. Repeat, but select a jar that will hold from 12 to 20 Unifix cubes. [Spring] **Estimating Weight** In advance, find two objects, one of which is obviously heavier than the other. Place the objects in front of the student and ask the student, before picking them up, to guess which is heavier. Then ask the student to pick them up and describe them. [Spring]	**Estimating and Measuring Volume** Fill a small jar with walnut-sized objects (less than ten should fill the jar) and ask the student to estimate the number in the jar. Then count. Select a somewhat larger jar and ask the student to guess if all the walnuts in the first jar will fit in the second jar. Then transfer them. Next, ask the student to estimate how many more walnuts could be added to the jar and fill it. Then count and fill. **Estimating Weight** Ask the student to select two different small objects in the classroom, one which is heavier than the other. Ask the student to predict what will happen when the objects are each placed in a pan of the balance. Then place the objects in the pans and discuss.

Standard	State Framework	Performance Activity	Performance Task
Geometry and Measurement	**K 3.3.8**	**How long is that?** Continuing from Activity 21, give the student a handful of at least 12 Unifix cubes and ask the student to measure each strip. Record if successful. Repeat, but use longer strips - 8 and 15, for example. [Spring] **How big is that?** Continuing from Activity 23, give the student a pile of Color Tiles (at least 20), and ask the student to find the area of the rectangle. Record if successful. Repeat in Spring, but use a 4 x 6 rectangle or index card. [Spring] **How much will fit inside?** Continuing from Activity 25, give the student at least 30 more Unifix cubes and ask the student to find out how many will fill the jar. Record if successful. Repeat, but use a larger container that holds 15 to 25 cubes. [Spring]	**Non-Standard Measures** Ask the student to build a Unifix cube train with a length of eight. Then ask the student to find an object in the room that is shorter than the train, another that is about the same length, and a third object that is longer than the train. **Spatial Relationships 2** Ask the student to take a handful of Color Tiles and build a flat design. Have the student take a second handful and build another flat design. Ask the student which design is larger, then estimate the number of tiles in each design; and then count and compare the areas. **Estimating and Measuring Volume** Fill a small jar with walnut-sized objects (less than ten should fill the jar) and ask the student to estimate the number in the jar. Then count. Select a somewhat larger jar and ask the student to guess if all the walnuts in the first jar will fit in the second jar. Then transfer them. Next, ask the student to estimate how many more walnuts could be added to the jar and fill it. Then count and fill.

Kindergarten-Part B Mathematics CRT

Note: These problems are grouped by standard, not grade-level expectation. However, it is important for students to experience problems such as these, even if they cannot yet read them independently. To use any or all of the problems you may need to use concrete materials and create individual worksheets for recording student responses.

Algebraic Reasoning

Sidewalk Patterns

Suzie has yellow and green chalk. She makes 12 squares on the sidewalk using a yellow and green pattern. What will her pattern look like?

Dinosaurs

Give each child a cup of dinosaurs. Tell them that before they can play with the dinosaurs they need to show what they discovered about them.

Broken Necklace

My sister just broke Mom’s necklace. She is putting it back together by putting red beads, green beads, and blue beads on the string in a pattern. What will the next 6 beads on the string look like?

Pattern Train

Using 3 pattern blocks make a train. Show which one is a car. Ask, “What would your train look like if your train had 3 cars?”

Rock Collecting

Pat loves to collect rocks and looks for rocks every day. On the first day she found a little rock. On the second day she found a big rock. On the third day she found a little rock. If this pattern continues, what size rock will Pat collect on the 10^{th} day?

Flowers

You are planting flowers in a garden. You are planting in a pattern. The first is yellow, then red, then orange. If you continue this pattern what color will the 10^{th} flower be?

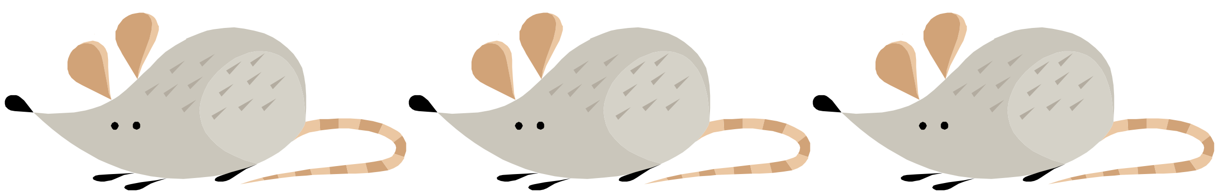
Farmer Fred

Farmer Fred wants to line up his 10 chicks and 10 ducks for a parade around the barnyard. He wants them to be in a pattern. What could the line look like?

Numerical and Proportional Reasoning

Example: Mice in the Meadow

Three mice are in the meadow. How many ears in all?



Cupcakes

There are 6 children in our class. If someone brings in 12 cupcakes to celebrate a birthday how many cupcakes will each child get?

Pumpkins

Five little pumpkins sitting on a gate. They each have 2 Δs for eyes and 1Δ for a nose. How many Δs in all?

Gingerbread Men

I have 5 gingerbread men. I want to use raisins for the eyes. How many raisins do I need?

Favorite Sandwich

Mary's favorite sandwich is a peanut butter and jelly. She eats one everyday this week at school. How many sandwiches did Mary eat this week?

Goldilock's Next Adventure

Papa Bears always have large bowls. Mama Bears always have medium bowls. Baby Bears always have small bowls. When Goldilocks entered the house she saw 4 large bowls, 3 medium bowls, and 2 small bowls. How many bears lived at the house? Show the bears that lived there.

Rabbits

If there were 10 rabbits and 2 rabbits could share a carrot, how many carrots would we need?

Cookies to Share

Joey brought in 8 cookies to eat for snack. There are 16 kids in his class. How can they share the cookies equally?

Fair Share

Three dinosaurs were sharing 10 leaves. What would a fair share for each dinosaur be?

Eyes

Half of our Kindergartners have blue eyes. How many children have blue eyes?

Pizza for Two

Do you like pizza? Show how you and a friend could share a round pizza equally.

Pizza for Four

Do you like pizza? Show how you and 3 friends could share a square pizza equally.

Pizza for Six

Do you like pizza? Show how you and 5 friends could share a rectangular shaped pizza equally.

Hatching Chicks

It takes 21 days for our chicks to hatch. If today is day 11, how many more days until our chicks will hatch?

Mittens on a Line

We are going to hang some mittens on a line. The first mitten is red, the second mitten is green, the third mitten is yellow, and the fourth mitten is red. The mittens continue in this pattern. What color will the 6th mitten be?

Beanie Baby Beds

Anna has 10 Beanie Babies. She and her mom have decided to make beds for them. Each bed will hold 2 Beanie Babies. How many beds will Anna and her mom have to make?

Geometry and Measurement

Painting

I want to paint my wall with triangles and squares. I use more triangles than squares. What would my wall look like?

Popsicle-stick Shapes

Sue has 19 popsicle-sticks. She wants to make 5 square shapes. Can Sue make her 5 squares if she uses her 19 sticks?

Sorting with Blocks

Close your eyes and pick out 8 pattern blocks. Now, open your eyes and put the blocks in groups. Explain your answer.

Rods for Roads

The town road crew is going to build 2 roads of the same length. Use the Cuisinaire rods to show two different roads of the same length. Which road uses more rods?

Working with Data

Zoo

We went to the zoo and saw a tiger, a lion, and a giraffe. Which is your favorite animal? Ask 10 other children their favorite animal. How can you show the class's favorite animal?

Surveys

Mrs. Brown is allergic to cats. We need to find out how many kids have cats at home. How can we organize to do this? (Other survey questions to do with the class: How many brothers, sisters, like pizza, want juice or milk.)
*Provide clipboards and have 1 student per day do the survey.

Tom's Blocks

Tom has a big tub of pattern blocks. Each of you can grab a handful. I want to know what shapes are in your hand. How can you show which shapes you have?

Curriculum Standards Connections

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS. Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

~ *COMPONENT STATEMENT: 1.1. UNDERSTAND AND DESCRIBE PATTERNS AND FUNCTIONAL RELATIONSHIPS.*

Grade Level Expectations

1. **Sort and classify objects by a variety of attributes (size, shape, color, texture, orientation, position and use), and explain the reason for each sort. (See also GLE 4.3.3.)**

Provide children with daily opportunities to sort and classify varied objects and explain their reasoning.

- Provide students with a collection of keys to sort according to one characteristic such as length, size or type of keyhole.
- Use any available collections such as shells, beans, rocks or buttons and have children glue the sorted objects to a large index card or piece of oak tag and place in a center so that other children can guess the reason for the sort.
- Encourage children to classify objects in the classroom such as old crayons or pencils by characteristics, e.g., color, length, and points or no points.
- Have children find all of the objects in the room that have a common attribute or use, such as all smooth objects or everything that can be used to make a picture.

2. **Describe and make comparisons of qualitative and quantitative changes of a given pattern using terms such as warmer, softer, more, one more, less, one less, bigger, smaller, longer and shorter. (See also GLEs 3.3.8, 3.3.9 and 3.3.10.)**

- When discussing the weather, ask children to compare daily temperatures using language such as, “Today is cooler than yesterday.”

- Have children monitor the growth of a plant or pet using comparative language.

- During calendar time, have children discuss what happens to the collection of counters for each day of the month/year. Ask them to explain how yesterday's collection differs from today's collection (one less) and predict what will happen to the number of counters tomorrow (one more).

3. **Recognize, reproduce, extend and create repeating patterns using movement, sounds, color, shapes, numbers and textures. (See also GLE 3.3.6.)**

4. **Identify and extend visual, auditory and physical patterns in order to make predictions.**

- Identify patterns in the environment such as floor tiles or windows.

- Recognize, copy, extend and create repeating patterns using objects, numbers and geometric figures, e.g., triangle, square, triangle.

- Recognize, copy, extend and create auditory repeating patterns (e.g., the patterns in songs, poems and/or rhymes).

- Have a group of five children stand in line in front of the class (audience). The child leading the activity should whisper instructions that follow a pattern to each person in line. At the leader's signal, the children in line silently carry out the whispered instructions, e.g., the first child smiles, the second frowns, the third smiles, etc. The audience should then be asked to silently repeat the pattern. The leader can choose an audience member to explain what the pattern was and then come up to the front with a new group to repeat the activity using a different pattern.

- Show cards that illustrate physical action (snapping, clapping, etc.). Have each child choose two or three different cards as elements for a repeating pattern. The child should then create a pattern and demonstrate it for the class to copy and extend.

- Have a child create a kinesthetic pattern, such as stomping and clapping or right arm raised then left arm raised, for classmates to copy and extend.

- Once children have identified, copied and extended patterns, give them opportunities to explain how they know what the next, or missing, element in a pattern will be. Example: clap, stomp, stomp, clap,_____, stomp

❖ **Possible Assessment Opportunities**

❖ Have each child individually create and demonstrate a repeating pattern using concrete objects, songs, rhymes and/or body movements.

Ask questions such as:

1. Explain how you made your pattern.
2. Why did you decide to make this particular pattern?
3. Where have you seen or heard a pattern that is similar to your pattern?
4. Can you make your pattern a different way (using shapes, colors, size, position, numbers or letters)?

Intervention: Provide visual or physical models for a two-element pattern for the child to copy and extend. Have the child then create a new pattern using the same models.

Challenge: Encourage children to create their own repeating patterns using four or five elements.

- Have children explore arranging a set of objects.

❖ **Possible Assessment Opportunities**

❖ Given a collection of objects, such as buttons, or trucks and cars, have children sort and classify the objects according to their own rules; use the sorted objects to create a pattern based on similarities and differences (e.g., car, truck, car…or according to the number of button holes).

Intervention: Use a small collection of objects and provide cues for sorting. Create AB patterns from the sorted objects.

Challenge: Include variations of ABC patterns.

A SAMPLE INTEGRATED LESSON – KINESTHETIC AND AUDITORY PATTERNS

Context: José really likes music time. He enjoys recognizing different patterns during finger-plays. What patterns do you notice in the finger plays such as, "Ten Little Monkeys" and "The Eensy Weensy Spider?" Is there more than one pattern?

Grade Level Expectations: 1.1.3, 1.1.4, 4.1.3

Time: One instructional period, which can be during music or physical education

Objective: The children will recognize and copy a kinesthetic or auditory pattern.

Procedure:

1. Select a child to copy and describe a teacher–made kinesthetic or auditory pattern from the songs in the context.

2. The children demonstrate auditory or kinesthetic patterns from familiar nursery rhymes.

- **Possible Assessment Opportunities**

  - Children play "Simon Says" using kinesthetic patterns that they create. The class plays the game by copying the leader's patterns exactly. The winner becomes the new leader and demonstrates new patterns for the children to copy.

  Intervention: Give a child cards illustrating physical actions from which to create a pattern.

  Challenge: Create another pattern using the same cards and then translate the elements into another representation of the pattern.

Or use the following lesson:

MAKING A RECORD OF PATTERN CORES

This lesson focuses on elements that constitute a pattern core or unit. Identifying the core element or unit that is repeated is a necessary early concept that students must understand to recognize and create repeating patterns. Students will be able to identify repeating patterns; recognize and create core elements of repeating patterns; and record repeating patterns. http://illuminations.nctm.org/LessonDetail.aspx?ID=L495

Interdisciplinary Framework Connections				
Science	**English/Language Arts**	**Social Studies**	**Visual and Performing Arts**	**Physical Education**
A INQ. 3 Make predictions based on observed patterns (e.g., look for patterns in leaves, flowers, etc). **K.1 A.3** Count objects in a group and use mathematical terms to describe quantitative relationships such as same as, more than, less than, equal, etc. **K.3 A7.** Describe and record daily weather conditions. **K.3 A.8** Relate seasonal weather patterns to appropriate choices of clothing and activities (e.g., discuss patterns in calendar and day).	**2.1a** Recognize patterns in text (e.g., have children recite simple poems/ rhymes).	• Create timelines that sequence events and people, using days, weeks, months (e.g., explore the pattern of our day; identify patterns in our community).	**Music** • Perform easy rhythmic, melodic and choral patterns accurately (e.g., copy then create simple AB patterns). • Echo short rhythms and melodic patterns (e.g., sing songs). **Art** • Look for patterns in pictures.	• Demonstrate accuracy in memorizing and reproducing simple movement phrases. • Recognize and apply the concepts of body space, effort and relationships in developing movement sequences and game strategies (e.g., copy, extend, and create body patterns/dance).

Vocabulary: pattern, patterns, next, before, after, more, most, less, bigger, smaller, longer, one more, one less, over, under, size, shape, color, day, week, year, days of the week, few, fewer, fewest, month, hour, season, element, core elements, sort, classify, extend, texture

Resources:

Electronic Resources:

A to Z Teacher Stuff http://lessonplanz.com/Preschool/

Kinderplans.com http://www.kinderplans.com/content.cfm?pageid=132

Kinderart Littles http://www.kinderart.com/littles/dinosaur.shtml

SuperKids (Educational software Review) http://www.superkids.com/aweb/pages/reviews/multisub/preschoo/

Center for Distance and Online Learning http://teams.lacoe.edu/teachers/index.asp

Teach, Learn, Communicate http://www.alfy.com/teachers/teach/thematic_units/Patterns_Shapes/PS_1.asp

Internet4Classrooms http://www.internet4classrooms.com/kplus_subjects.htm

Gayle's Preschool Rainbow http://www.preschoolrainbow.org/counting-theme.htm

National Library of Virtual Manipulatives http://nlvm.usu.edu/en/nav/grade_g_1.html

Let's Size It Up – Goals 2000

Turkey – Goals 2000

Unifix Patterns – Goals 2000

Structured Observations: Pattern Assessment – Goals 2000

Pattern Questions - Goals 2000

Teacher References:

Picking Apart Patterns AIMS magazine. Volume 8 issue 5

Teddy Bears Go to the Movies and *Teddy Bears Go Hiking*. Primarily Bears, AIMS

Sorting and Patterning in Kindergarten: *From Activities to Assessment.* Elizabeth J Ziemba and Jo Hoffman, January 2006, Volume 12, Issue 5, Page 236

Algebra in the PreK-2 Curriculum? Teaching Children Mathematics, NCTM Sept. 2005

Children's Literature:

The Eensy Weensy Spider by Mary Ann Hoberman

A Pair of Socks, by Stuart J. Murphy

The Table of Phinneas Fable, by George Green

Pattern Bugs, by Trudy Harris

The Button Box, by Margarette Reid

What Comes in 2's, 3's, and 4's? by Suzanne Aker

Cookie's Week, by Cindy Ward

One Fish, Two Fish, Red Fish, Blue Fish by Dr. Seuss

The Boy and the Quilt, by Shirley Kurtz

Pattern Fish, by Trudy Harris

Elmer, by David McKee

Baby Rattlesnake, by Te Ata

Ten, Nine, Eight, by Molly Bang

Puppies in the Snow, by James Young

Classroom Materials: collections such as buttons, shells and colored cubes

Notes:

***NUMERICAL AND PROPORTIONAL REASONING*. Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.**

COMPONENT STATEMENT: 2.1. UNDERSTAND THAT A VARIETY OF NUMERICAL REPRESENTATIONS CAN BE USED TO DESCRIBE QUANTITATIVE RELATIONSHIPS.

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

1. ***Represent quantities of up to 30 objects in a set.***

2. ***Compare sets of up to 30 objects and use the terms more, less or the same to compare the two sets and identify a set with one more or one less than a given set.***

   - Provide numerous opportunities to count and use counting words when reciting poems or rhymes, singing songs, playing games and reading books.

   - Have children arrange sets of different amounts of objects in one-to-one correspondence. Ask questions such as:

     1. Which group has more?
     2. Which group has less?
     3. Do these have the same amount? How do you know?

   - Make a group of objects. Have the children count and create a group that is the same as the given group. Make another group that has more or less than the original group. Describe how your group is different from the original group. Ask questions such as:

1. Is your group a lot more or a lot less? A little more? A little less?

2. Can you tell how many more are in this group? How do you know?

3. Can you match the number of objects in a set to the number names?

4. What number comes after_____? Before_____?

- Using dominoes, dot cards, or a set of up to 10 objects, count the dots or objects and say the number name that tells the amount. Match that amount with the correct numeral or written symbol.

3. Order sets of up to 30 objects from least to greatest.

- Give children opportunities to count and compare quantities in familiar situations, beginning with 10 and moving to greater quantities, as the children are ready.

- Example: Some children are playing outside at school. Three of the children are on the playscape and four are playing catch in the field. Ask questions such as:

1. How many children are on the playscape?

2. How many children are playing catch?

3. How many children are on the playground?

- During snack or lunchtime have the children compare their food or drink. Ask questions such as:

1. How many children had milk? (Have the children count themselves.)

2. How many children had juice?

3. How many children had water?

4. Give the milk, water and juice drinkers different colored counters to be placed in lines of one-to-one correspondence on a table for all to see and have the children decide which was the most, middle and least.

4. **Identify the ordinal position of objects: first, second, third, fourth, fifth and last.**

- When children are in line, have a child chose who is first in line. Ask the child (the line leader) to identify the child who is second in line. Repeat this process for the children who are third through fifth and last in line.
- Using familiar objects or a series of pictures of familiar objects ask the children to identify which object is first, second, third, fourth or last.
- Give directions and discuss activities or events using the terms first, second, third … last.

5. **Use a variety of models and familiar objects to compare two parts of a whole and describe the parts as being closer to a whole or closer to very little**

- Cut shapes such as squares, circles or triangles into two unequal parts. When comparing the pieces to a whole, ask questions such as:

    1. Which piece is closer to the whole square, circle or triangle?
    2. Which piece is closer to very little of the square, circle or triangle?

6. **Use a variety of models and familiar objects to:**

- **Identify one whole and one half of an object.**
- **Recognize a half and put two halves of an object together to make a whole.**
- **Form a whole from two smaller sets that have equal amounts.**
- Divide fruit or other edible snacks into two equal parts; give each child a half. Have children explain why the two halves would be a whole if they were put back together.

❖ **Possible Assessment Opportunities**

❖ Use shapes or pictures on colored papers, cut each paper into two equal parts.

Give each child a half of one paper and ask her or him to find the other half that to make the whole shape or picture. Ask the child to explain the thinking used to find the missing half.

Intervention: Place a rectangular piece of paper in front of the child with a line drawn to divide the paper into two equal parts. Give the child two more rectangular pieces of paper that are the same size (congruent), and different colors. Ask the child to use the second piece of paper to cover the whole rectangular piece in front of her and ask which is called one whole. Then have the child use the additional two pieces of paper to show one half of the rectangle by sliding one piece over the other until the top paper is aligned with the drawn line and shows only one half of the bottom rectangular piece. Have the child repeat finding one half by sliding the paper in the opposite direction. Once the child understands what one half of the rectangle looks like, have the child find one half of other pieces of rectangular paper. (This could be done on a computer as well.)

Challenge: Cut various shapes and pictures into three unequal parts. Have the child reassemble the wholes using the parts and identify each step of the assembly as yielding a shape or picture that is closer to very little, one half, or one whole.

COMPONENT STATEMENT: 2.2. USE NUMBERS AND THEIR PROPERTIES TO COMPUTE FLEXIBLY AND FLUENTLY AND TO REASONABLY ESTIMATE MEASURES AND QUANTITIES.

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

7. **Count by rote to at least 30.**

8. **Count and group up to 30 objects by tens. (See also GLE 2.2.14.)**

❖ **Possible Assessment Opportunities**

❖ Have children count 20 familiar objects from their environment; place the counted items aside to keep track of them.

Intervention: Place counters in each grid of a 10-frame while counting. The grid can be made on a cookie sheet with masking tape and magnets used as counters. This approach provides auditory, visual and motor cues.

Challenge: Children can count as many objects as they are capable of and place the objects in groups of 10 and then count by tens.

9. **Identify the numerals 1-10 and match each numeral to appropriate sets of objects. (See Sample Integrated Lesson.)**

10. ***Act out and solve addition and subtraction story problems that reflect real-world experiences and practical problems using sets of up to 10 objects and describe the strategy or reasoning used to solve a problem. For example: Put two black crayons in the bin together with four black crayons; then count to determine the total number of black crayons.***

    - Use regular classroom opportunities such as the distribution of supplies or snacks and the organization and replacement of materials in the designated centers or storage places to have children solve contextual problems.

11. ***Write the number sentences that correspond to story problems using addition, subtraction and equal symbols (+, -, =) correctly.***

    - When children have developed to the point where they can use symbols correctly, record the situations from GLE 10 as number sentences.

12. **Estimate the amount of objects in a set using 10 as a benchmark, and then count to determine if the amount is more or less than 10. (Example: Ask students to estimate or make an *eye guess* of the number of pattern block triangles they can hold in two hands or the number of blocks in one scoop).**

13. **Recognize and name pennies and dimes.**

14. **Count pennies and trade pennies for objects.**

    - Give students a collection of pennies and dimes and ask them to organize or sort the coins into two piles; one pile of pennies and one pile of dimes.
    - Place up to 10 pennies in plastic bags and give one bag to each child. Have the children use the pennies to purchase objects from the storekeeper "one object per penny."
    - Once children can shop with 10 pennies in a bag. Ask them to count and organize pennies into bags of ten pennies each for further shopping and trading opportunities.

SAMPLE INTEGRATED LESSON – HAPPY FACES

Context: Many things make people happy. Some people feel happy when they eat good food — like pancakes. Sunny days make other people happy. A boy named David is happy on sunny days. How happy would David be if he had the same weather that we have had? Use your classroom calendar/weather chart to help David find the answer. The animals in this story were happy because they helped make pancakes.

Grade Level Expectations: 2.1.1, 2.1.2, 2.2.7, 2.2.8, 2.2.9, 2.2.10, 3.3.7

Time: Multiple days

Objectives: Children will determine how many objects are in a set.

Children will create corresponding sets.

Children will use the calendar/weather chart to identify and record weather conditions.

Materials: Pancakes for Breakfast by Tomie DePaola, numeral cards for the numbers 1-5, worksheet with 18-20 happy faces printed on it, enough round counters so that each child can have 20, musical instruments, the monthly class calendar/weather chart with the sunny days marked with a sun or a happy face, a blank calendar, and crayons.

Procedure: (for several sessions)

1. Read the picture book *Pancakes for Breakfast.*
2. Ask the children if the lady in the story had pancakes for breakfast. How do they know?
3. Sing this song to the tune of *If You're Happy and You Know It…* show the numeral card for the number you are using in the song.

If you'd like to eat some pancakes, clap [two] times,

If you'd like to eat some pancakes, clap [two] times,

If you'd like to eat some pancakes, then your face (hands, head, feet…) will surely show it,

If you'd like to eat some pancakes, clap [two] times,

(In subsequent verses, replace the number with one, three, four or five, and the action with other motions such as tap your head, stomp your feet, or with the sounds of musical instruments such as sticks, tambourines or maracas.)

4. Give each child a copy of the happy face worksheet and some counters. Ask the children, "How many different animals helped to make the pancakes in this story?" Reread the story and have each child place a counter on a happy face every time we see a different animal. Have children count the number of happy faces they have covered by touching the counters.

5. Look at the monthly calendar and count the happy faces, representing sunny days, for the current month.

❖ Possible Assessment Opportunities

❖ Have the children identify one thing that makes them happy. Give the children a blank calendar and have them put happy face stickers in the boxes for all the days when they participated in that activity. Once a week, have the children share their calendar, count their happy days and tell the number of cumulative days they were happy.

Intervention: Have the child count the happy days by putting a counter on each box with a sticker and then removing the counters while counting out loud.

Challenge: Provide the children with calendars with different numbers of happy faces on them. The children should compare the amounts on the calendars and then come up with a scenario of what that calendar could represent. For example, A little boy was happy when he could read. He read five days last week. A little girl loved gymnastics and was happy two days last week. The boy had more happy days.

6. Show children the numeral cards and have them identify each numeral by clapping the number of times represented by the numeral.

7. When all the cards have been used and the corresponding faces covered, show the numeral cards in random order again, and have the children remove from the faces the number of counters that you are showing on each card.

❖ Possible Assessment Opportunities

❖ Have a child or adult show a numeral card. Children should clap accordingly and then count out the correct number of counters by placing each counter on a different happy face. Show additional number cards in random order. As the children work, note which children can count out all the groups without hesitation and which cannot. Show the children numeral cards from 1-5.

Intervention: Give the child a paper with only six happy faces and use the numeral cards 1-6 in order. Once the child is successful, mix the order of the number cards.

Challenge: Ask the child to give a total number of faces covered.

8. Ask the children what season is shown in the story. Discuss the clues they used to answer the question.

9. Ask the children about the weather is in the story. Discuss the clues used to answer that question.

Interdisciplinary Framework Connections			
Science	**English/Language Arts**	**Visual and Performing Arts**	**Physical Education**
A.3 Count objects in a group and use mathematical terms to describe quantitative relationships such as same as, more than, less than, equal, etc. **A INQ 4** Reads, writes, listens and speaks about observations of the natural world. **A INQ 9** Count, order and sort objects by their properties. **A.7** Describe and record daily weather conditions. **A.8** Relate seasonal weather patterns to appropriate choices of clothing and activities.	• Identify current knowledge and awareness on a selected topic before a reading activity. • Draw conclusions and use evidence to substantiate them by using texts heard, read and viewed. • Select and organize visual and auditory information to answer a specific question.	**Music** • Sing a song from memory.	• Follow classroom rules, activity-specific rules, safety practices, procedures, etiquette and good sportsmanship in various physical activity settings. • Work cooperatively with peers of varying skill levels.

Vocabulary: more than, less than, same, equal, count, one more, one less, close to, closer to, near, very little, more, less, bigger, smaller, few, most, number, numeral, count, how many, counting mat, estimate

Resources:

Electronic Resources:

More Counting: http://math.rice.edu/~lanius/counting/index2.html

Let's Count to 5: http://illuminations.nctm.org/LessonDetail.aspx?id=U57

Building numbers to 10: http://illuminations.nctm.org/LessonDetail.aspx?id=U147

Preschool and Kindergarten Math: http://www.edhelper.com/

Counting and Skip Counting: http://wwws.aimsedu.org/aims_store/home.php?cat=126

Understanding a Child's Development of Number Sense: http://illuminations.nctm.org/Reflections_preK-2.html (text and video)

Chrysanthemum – Goals 2000

Elephants Play – Goals 2000

Counting Jar – Goals 2000

Mr. Mix-Up – Goals 2000

Number Assessment Interview – Goals 2000

Teacher References:

Elementary and Middle School Mathematics Teaching Developmentally, by J. Van de Walle, 5th Ed p. 116-121

The Young Child and Mathematics, by Juanita V. Copley

Research Ideas for the Classroom: Early Childhood Mathematics, edited by *Jensen*, p. 44

Children's Literature:

I Can Count the Petals on a Flower, by John and Stacy Wahl

The Very Hungry Caterpillar, by Eric Carle

What Do Plants Need? An AIMS Booklet for K.

How Many Snails? by Paul Giganti

Ten Black Dots, by Donald Crews

City by Numbers, by Stephen Johnson

Moon to Sun, by Sheila White Samton

Down in the Daisies, by L. Coats and E. Bolam

Quack and Count, by Keith Baker

One Gorilla, by Atsuko Motozumi

Annabell Swift, Kindergartener by Amy Schwartz

Mouse Count, by Ellen Stall Walsh

Benny's Pennies, by Pat Brisson

One White Sail, by S. T. Garne

Ten Flashing Fireflies, by Phileman Sturges

Pancakes for Breakfast, by Tomie dePaola

A Caribbean Counting Book by Faustin Charles and Roberto Arenson

Classroom Materials: snacks, toys, shoes, clothing, items from nature (shells, rocks, leaves, flowers), items from daily living (silverware, napkins, dishes, chairs, mats), books, markers, crayons, interlocking cubes, blocks

Notes:

GEOMETRY AND MEASUREMENT. Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 3.1. USE PROPERTIES AND CHARACTERISTICS OF TWO- AND THREE-DIMENSIONAL SHAPES AND GEOMETRIC THEOREMS TO DESCRIBE RELATIONSHIPS, COMMUNICATE IDEAS AND SOLVE PROBLEMS.

Grade-Level Expectations

1. **Identify and describe familiar shapes (triangles, squares, rectangles and circles) and solids (cubes, spheres, cylinders, cones and prisms) in the environment.**

    - Ask children to identify all the squares or circles that they can find in a particular location or situation.
    - Challenge the children by saying "I spy a rectangle or a triangle, who can see it as well?
    - Describe objects and shapes using descriptive language, such as round, pointed or straight, and geometric terms and names.

2. **Compare and sort familiar shapes and solids in the environment and contextual situations**. **(See also GLE 1.1.1.)**

    - Organizing objects into categories during informal sorting experiences at school focuses the children's attention on the attributes of objects to help develop an understanding of how things go together. Ask questions such as:

        1. How do we decide where to store new toys go in our classroom?
        2. Can you describe how I sorted ___________?
        3. What is the same about this group of toys? What is different?

    - Provide opportunities to identify and sort collections of two- and three-dimensional shapes in the environment. Record data about the numbers of each shape found using tables and tallies.

- Sort and classify a set of objects by descriptive characteristics using graphic organizers such as a nonintersecting Venn diagram or two separate circles made out of yarn. Then identify the categories and have children place the objects in the correct category creating a real graph.

3. **Construct small sets of shapes and solids using a variety of materials.**

   - Provide children with opportunities to make geometric shapes and objects out of materials such as clay or pipe cleaners. Children can sort the shapes they have created and describe how they sorted.

❖ **Possible Assessment Opportunities**

❖ Supply children with geometric shapes and figures objects that have been presorted according to size, shape or attributes such as roundness. Ask questions such as:

1. Can you think of a reason that these items are sorted this way?

2. Can you find other objects that could be placed in this group?

Intervention: Model by showing a group of different size rectangular objects such as writing paper, drawing paper, books and chart paper and ask the children to describe what each of the objects has in common.

Challenge: Ask the children to choose a way the items could be sorted differently and then re-sort accordingly.

~ *COMPONENT STATEMENT: 3.2. USE SPATIAL REASONING, LOCATION AND GEOMETRIC RELATIONSHIPS TO SOLVE PROBLEMS.*

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

4. **Describe location, direction and position of objects or parts of objects, using terms such as under/over, inside/outside, next to/near, top/bottom, in front of, first and last.**

- Give children opportunities to describe the location of familiar objects in the room. Ask questions such as: Where is the kitchen area? What or who is near the window?

- When the children line up, ask about their positions in line, requesting increasing detail as the year progresses. For example: a. Kim is next to or in front of Jason. b. José is in front of Chris and behind Kim and Jason. Chris is not first in line, he is last in line.

5. Complete simple shape and jigsaw puzzles and explain the reasoning used to solve the problem.

- Provide children with opportunities throughout the year to use *shape sorter* puzzles and activities.

- When children are completing puzzles, ask a child why he tried to place a piece in a certain space. Choose another piece and ask the child how she knew that it would not fit in that same space.

COMPONENT STATEMENT: 3.3. DEVELOP AND APPLY UNITS, SYSTEMS, FORMULAS AND APPROPRIATE TOOLS TO ESTIMATE AND MEASURE.

Grade-Level Expectations

6. Recognize events that reoccur (at specific times of the day or week).

- When discussing daily routines, ask the children about the first thing they usually do when they wake up in the morning, then the second thing that they usually do. Repeat the question for the evening routine asking about the last thing that they do before they go to bed.

- Ask when teeth are usually brushed.

- Discuss the time of day and sequence in which meals are usually eaten (breakfast, lunch, dinner or supper).

- Investigate patterns in the day, week, month and year.

- Talk about the class schedule for activities such as art, music, quiet time or circle time.

7. **Locate yesterday, today and tomorrow on a calendar to sequence events and use terms like before and after to compare events.**

- Use a calendar to find today's date. Ask questions such as:

  1. Can you point to yesterday's date? Can you point to tomorrow's date?

  2. Does tomorrow come before or after today?

- When talking about the day, ask questions such as:

  1. What did you do before you came to school today?

  2. What will you likely do before you come to school tomorrow? (Use terms such as definitely, probably and not likely.)

  3. What did you do when you went home after school yesterday?

  4. What are you likely to do when you get home after school today? (Use terms such as likely, maybe and not likely.)

8. **Use nonstandard units, physical referents (like a finger) or everyday objects such as links, Unifix cubes or blocks to compare, estimate and order measures of length, area, capacity, weight and temperature, and describe the reasoning and strategies used.**

- Use different multiple nonstandard units to measure the same item. Ask questions such as:

  1. Why did we get different amounts of units?

  2. Which unit did we use the most of and why?

  3. Which units did we use the least number of pieces and why?

- Give students numerous opportunities throughout the year to identify, place or line up objects from smallest to largest or from largest to smallest and explain how they made the decisions they did.

- Measure the attribute of size as it relates to the length, area and capacity. Use multiple nonstandard units such as paper clips, Unifix cubes, straws, etc., for the children to lay end-to-end for length, or cover a surface for area, or fill a container for capacity. Ask questions such as:

  1. Did it take the same number as you estimated?
  2. If not, was your estimate more or less?
  3. Why do you think there was a difference?

- Have the children compare the lengths or weights of two objects and identify which is longer, shorter, heavier or lighter. Ask questions such as:

  1. How do you know which object is longer or taller?
  2. Could we find another way to tell how much shorter an object is? (Use nonstandard units such as Unifix cubes.)
  3. Do our toys weigh the same or does one weigh more or less than another? How could we find out?
  4. Is there a way to find out how much more something weighs? (Use nonstandard units to compare the amount of weight.)

9. **Describe and order small sets of familiar objects by size, length or area using comparative language such as more, bigger, longer, shorter and taller. (See also GLE 3.3.8.)**

   - Provide children with various objects and have them order them according to their length.

10. **Use a balance scale to compare the weight of two objects and identify which is heavier.**

    - Have children hold two objects of obviously differing weights, one in each hand, to compare the weights.
    - Once children determine which object is heavier, guide the children through how to use a balance scale to compare the same two objects, correlating the lower side of the scale with the heavier object.

SAMPLE INTEGRATED LESSON – THE ART SHOW

Context: The annual school art show will be next month. The art teacher wants to make sure that all types of art work are in the show. She would like your class to create designs using shapes.

Grade-Level Expectations: 3.1.1, 3.1.2, 3.1.4

Time: One instructional period

Objective: The children will be able to use shapes and spatial sense to create "Shape Designs."

Materials: art paper, a variety of cut out shapes in various colors, shape tracers (templates), pattern block shapes, glue, crayons, paint.

Procedure: (In the art or regular classroom)

1. Display art prints that were created using geometric shapes and designs and discuss them with the children.
    - Have the children identify the shapes that the artist used to create the work. The children should use terms such as above, below, next to, under/over, etc., to describe the location, direction and position of the shapes.
2. Using the art prints share with the children how real artists use space.
3. Hand out the art paper and have the children carefully look at its size to give a sense of the space needing to be covered and ask them to plan or think about the design they will create using the full space of the paper.
4. The design must have a minimum of three familiar shapes. (Some children may need to create a design using only two shapes.) The children can create different sizes and types of the shapes in the design.
5. Children may choose to use shape tracers, pattern blocks, cut out pattern block shapes, or draw or cut out their own shapes. The children can add color to their design using crayons, paint or colored paper.
6. Display the children's completed designs. Have each child choose a design (other than hers) and describe the shapes (including position, location and direction) while the other children try to identify the correct design from the class display.

- **Possible Assessment Opportunity**

  - As children are working on their designs, circulate and ask them to identify and describe shapes and their positions, locations and directions.

Intervention: Arrange three different shapes (e.g. cut-outs, attribute or pattern blocks) in front of the child. Ask questions such as:

1. Which shape is to the left of the square? Can you make a picture of this design?

2. Can you point to the shapes or blocks that match the shapes in your picture and tell me their names? Describe where they are in the picture you created.

3. Using three-dimensional blocks from the play area, ask the child to create a design that looks like a house. Have the child copy the design on art paper by drawing, tracing or using cut-outs. What shape could you use to finish the house in your design? If you wanted to make a tall building what shapes would you use? How would you place the shapes?

Challenge: Have the children examine art work to find familiar shapes in the work. Ask the children to write or tell a story about the shapes that they see and why they think they are included in the design. The story should include identifying the shapes as well as their position, location, and direction. (For example: There is a picture of an amusement park. There was a ride that was shaped like an orange triangle on top of a purple rectangle. It looked scary. On the left of that ride was a huge circle Ferris wheel.) Have the children use the shapes they saw in the art work and create their own unique design.

<table>
<tr><th colspan="4">Interdisciplinary Framework Connections</th></tr>
<tr><th>Science</th><th>English/Language Arts</th><th>Visual and Performing Arts</th><th>Physical Education</th></tr>
<tr><td>A.INQ.9. Count, order and sort objects by their properties.</td><td>• Organize information in proper sequence to use in a summary and/or retelling.
• Generate and respond to questions.
• Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.).
• Use oral language to communicate a message.
• Determine purpose and choose an appropriate written, oral or visual format.
• Publish and/or present final products in a myriad of ways, including the use of the arts and technology.
• Use appropriate language as related to audience.</td><td>Art
• Use different media techniques and processes to communicate ideas, feelings, experiences and stories.
• Use elements of art and principles of design to communicate ideas.
• Select and use subject matter symbols and ideas to communicate meaning (e.g., use art materials to create sorting pictures, such as cutting out pictures and sorting them, creating pictures of shapes, making collages, etc.).</td><td>Responsible Behavior
• Follow class rules, activity-specific rules, safety practices, procedures, etiquette and good sportsmanship in various physical activity settings (e.g., identifying and categorizing the rules for indoor and outdoor activities).</td></tr>
</table>

Vocabulary: sort, alike, different, objects, shape, same, square, rectangle, triangle, circle, cube, rectangular prism, sphere, quadrilateral, rhombus, straight, inside, outside, top, bottom, close, closer, similar, more, less, most, least, size, length, weight, area, capacity, lighter, heavier, longer, shorter, sides, faces

Resources:

Electronic Resources:

Amazing Attributes: http://illuminations.nctm.org/LessonDetail.aspx?id=U186

What's My Rule for Sorting? http://illuminations.nctm.org/LessonDetail.aspx?ID=L494

Sorting: http://www.sciencenetlinks.com/lessons.cfm?DocID=19

Sorting Self-Assessment: http://www.readwritethink.org/lesson_images/lesson378/venn-assessment.pdf

Teacher Resources:

NCTM Principals and Standards, by Date and Probability Standards K-2

Engaging Young Children in Mathematics, by Douglas H. Clements

Adding It Up! by National Research Council

Elementary and Middle School Mathematics, by John Van De Walle

Investigations with Pattern Blocks, by Marcia Miller and Martin Lee

Children's Literature:

The Shapes Game, by Paul Rogers

The Legend of Spookley, The Square Pumpkin, by Joe Troiano

Circus Shapes by Stuart Murphy

Sea Shapes, by Suse MacDonald

This is the Way We Go to School, by Edith Baer

The Shape of Things, by Dale Ann Dodd

Shape Spotters, by Megan Bryant

Notes:

WORKING WITH DATA: PROBABILITY AND STATISTICS**. Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.**

COMPONENT STATEMENT: 4.1. COLLECT, ORGANIZE AND DISPLAY DATA USING APPROPRIATE STATISTICAL AND GRAPHICAL METHODS.

Grade-Level Expectations

1. **Pose questions about objects and events in the environment that can be used to guide the collection of data.**
   - Guide the children to ask questions that can be answered by each person contributing data on topics such as:
     - favorites: fruits, colors, seasons, pets, books, TV programs;
     - measures: time to complete a task, temperature, height, distance jumped, weight of various objects; and
     - number-family members, birth dates, letters in a name.
2. **Collect data and record the results using real graphs and picture graphs.**
   - When creating real graphs, have children use actual objects to represent data.
   - When creating picture graphs, have children use pictures in a one-to-one correspondence to the data being represented.
3. **Arrange information in a systematic way using counting, sorting, lists and graphic organizers. (See also GLE 1.1.1.)**
   - When children are sorting objects, encourage them to organize the objects by the same attributes or criteria used for the sort.
   - Use representative tallies or marks, and organizers such as yarn loops or hula hoops.

~ *COMPONENT STATEMENT: 4.2. ANALYZE DATA SETS TO FORM HYPOTHESES AND MAKE PREDICTIONS.*

Grade-Level Expectations

4. **Describe data using the terms more, less and the same. (See also GLE 1.1.2 and GLEs 3.3.8, 3.3.9 and 3.3.10.)**

   - Describe data collected and arranged according to GLEs 1, 2 and 3.

     ❖ **Possible Assessment Opportunities**

     ❖ Have each child be responsible for displaying data in a real or picture graph and explaining the answer to a question similar to those suggested in GLE 1.

     Intervention: Prompt the child with specific questions such as: What question did we ask to get these data? How should we organize the data? (Can we use the items, pictures of the items, or marks?) Should we use hoops or paper?

     Challenge: Ask the child to offer suggestions for a question that might have been used to gather data that is already displayed. Ask if the child can display the same data in a different way.

5. **Identify and extend patterns from organized data to make predictions. For example: More boys than girls in our class watch television every day. We predict that the same will be true for another kindergarten class.**

   - After surveying the class to answer the question "Who reads more than 2 books every day?", organize the data by gender and describe the results. Since boys read more than girls in our class, can we predict that the same will be true for another kindergarten class? If not, what do we need to do to be able to make a prediction?

COMPONENT STATEMENT: 4.3. UNDERSTAND AND APPLY BASIC CONCEPTS OF PROBABILITY

Grade-Level Expectations

6. **Describe the likelihood of the future occurrence of events based on patterns and personal experiences using terms such as likely, unlikely or certainly**.

    - After children have become accustomed to the class schedule, which might include art on Wednesday mornings, ask if it is likely, unlikely or certain that art class will be on Wednesday afternoon.

7. **Engage in simple probability activities and discuss the results.**

    - Display a large spinner divided into four equal parts. Color three sections blue and one section yellow. Have children take turns spinning the spinner. Discuss the results as a class.

    - Place four same size balls in a box (three yellow and one blue). Have four children select one of the four balls from the box, without looking, and record the results. Display the four balls while the children discuss the results and compare them to the spinner test.

SAMPLE INTEGRATED LESSON — ACHOO!

Context: Mrs. Brown is allergic to cats and they make her sneeze, so she has a pet dog at home. Many of the children have pets at home and some have cats as pets. We want to find out how many children have cats at home.

Grade Level Expectations: 4.1.1, 4.1.2, 4.1.3, 4.2.4, 2.1.2

Time: One instructional period with additional time for displaying data contributed by the children

Objective: Children will collect and organize data that answer a question. Children will represent the data in different ways and count to compare the data.

Materials: Bulletin board; wall or chart paper; photographs of each child with or without the pet; photographs of pets or pictures of cats, dogs, fish, birds and any other living and nonliving (stuffed animal) pets the children have. Chalk or yarn circles large enough for the children to stand in.

Procedure: Ask the children to answer the question: Who has a pet at home?

- Have those children with pets stand in one circle and those without pets in another adjacent circle. Count the children in each circle by pointing to each one by one. Record the number of children in each category, using circles with pictures, Post-its or tallies. Have the children sit and count the number in each category along with the teacher.

- Ask questions such as: Are there more children who have no pets at home than have pets at home? How can you tell?

- Now ask the children who have pets to organize themselves in the circles by whether the pets they have are living or not living. Compare the data by asking which circle has more or less children.

- Ask the children who have living pets to identify the type of pet they have and then lead the children in displaying the data using a picture graph of actual photographs or pictures cut from magazines or downloaded from the internet. Ask the children to identify and name the types of living pets they see.

❖ **Possible Assessment Opportunities**

❖ Prompt the children to describe the number of each type of pet using the terms more, less or the same.

Intervention: Sit with the child and have the child organize up to 10 mixed pictures of living and nonliving (stuffed) animals into two groups. Ask the child to count the number in each group and describe the group using more, less and the same.

Challenge: Have the children decide on a question and survey another class. Ask the children to decide on the best way to share the results with classmates and explain why they chose the question and how their data compare to the data on class pets.

Interdisciplinary Framework Connections		
Science	**English/Language Arts**	**Physical Education**
A.3 Count objects in a group and use mathematical terms to describe quantitative relationships such as same as, more than, less than, equal, etc. **A INQ 4** Reads, writes, listens and speaks about observations of the natural world. **A INQ 9** Count, order and sort objects by their properties.•	• Draw conclusions and use evidence to substantiate them by using texts heard, read and viewed. • Follow classroom rules, activity-specific rules, safety practices, procedures, etiquette and good sportsmanship in various physical activity settings.	• Select and organize visual and auditory information to answer a specific question. • Work cooperatively with peers of varying skill levels.

Resources:

Electronic Resources:

How Old Are You? - Goals 2000

Sylvester's Pebbles - Goals 2000

Recognizing Possible and Impossible - Goals 2000

Notes:

Grade 1

CONTENTS

The Learner at This Level

THE FIRST GRADE CHILD:

- Loves to ask questions.
- Learns best through discovery.
- Likes to "work" and to explain things.

ALGEBRAIC REASONING

- Describes counting and number patterns.
- Identifies, extends and translates one- and two-attribute patterns.
- Rationalizes what belongs in the pattern and what does not.
- Describes and demonstrates equivalence.
- Iterates relative positions (outside, inside, top, bottom, left, right).
- Models real-life situations of addition and subtraction by using models, pictures and open sentences.
- Identifies patterns in counting.
- Explores the patterns of days, months, and seasons.
- Makes the connections in simple ratio patterns (one bird has two legs, two birds have four legs).
- Creates generalizations about patterns.
- Arranges several things one after another in a series or pattern according to their differences.

NUMERICAL AND PROPORTIONAL REASONING

- Develops number sense by counting real-world objects, sounds and movements.
- Understands that the last number said is the quantity.
- May be able to see at a glance the number of items in a small collection.
- Counts and groups by twos, fives and tens.
- Counts back from 10 by ones.
- Develops a deeper understanding of quantities to 100 by using 10 as a referent.
- Models a two-digit number by making groups of tens and ones with objects, such as sticks or snap cubes, before using commercial base-ten materials.
- Understands that counting by ones gives the same number as counting by a combination of tens and ones.

- Solves problems with objects or graphic representation and invents their own problem solving strategies.
- Writes number sentences only after many problems have been solved using objects and the solutions have been discussed.
- Sees the part-whole relations in addition and subtraction situations.
- Constructs and understands the different ways a quantity can be represented, e.g., seven is three and four; seven is two and five; seven is three less than 10.
- Masters basic adding and subtracting combinations using real-world problems, not by memorizing facts in isolation.
- Begins to solve problems without having real objects to count.
- Describes fractions as fair (equal) shares of the whole (unit) or set.
- Can be confused because the whole may consist of one piece or many pieces.

GEOMETRY AND MEASUREMENT

- Begins using informal units of measure to focus directly on the attribute being measured and discussion will then focus on what it means to measure that attribute.
- Needs frequent opportunities to estimate measures, during measurement activities.
- Uses plane, "two-dimensional," and solid, "three-dimensional" figures and their appropriate geometric names, position and direction while putting together and taking part figures (e.g., such as two squares put together can make a rectangle).
- Describes sorting and classifying criteria by moving from simple feature description, (e.g., "short" or "like a box"), to the description of geometric features, (e.g., "it has four sides" or "it is squarish").
- Creates groupings based on how shapes are alike and different using one or two attributes.
- Tells time by counting the hours.
- Creates two- and three-dimensional designs/patterns and replicates them from memory.

WORKING WITH DATA AND PROBABILITY

- Records work through multiple representations in written symbols and/or drawings.
- Becomes a more flexible thinker when experiencing many different ways to graph information
- Can see that graphs and charts display information about attributes and data and that different types of graphic representations tell different things about the same data.
- Constructs individual graphs and summarizes the results.
- Makes and discusses predictions about probability experiments.

Mathematics Background for Teachers

MATHEMATICS BACKGROUND FOR GRADE 1 TEACHERS

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS

Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies

Central Understanding: The same pattern can be represented in many different forms.

Background: A child's capacity to efficiently construct mathematical ideas expands with a more developed understanding of relationships. Relationships recognized through sorting, classifying and patterning activities provide a foundation for algebraic reasoning. In their informal math experiences, young children explore numeric and geometric relationships and establish their own rules. As a formal sense of pattern emerges, children need experiences that are hands-on, varied and connected to contextual situations to recognize the conventions of patterns. Recognition of number patterns strengthens the understanding of number properties and strategies necessary for addition and subtraction of whole numbers.

NUMERICAL AND PROPORTIONAL REASONING

Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

Central Understanding: Relationships between and among numbers can be described in a systematic way.

Background: The development of number concepts is a continuous process that provides the foundation for much of what is taught in mathematics (Copley, p.48). The conceptual understanding of number develops gradually as a result of exploring numbers in a variety of ways and contexts. The ability to create, compare and describe sets of objects and numbers in meaningful contexts is essential for the understanding of the sequential relationship and relative magnitude of whole numbers and builds flexible thinking that supports problem solving and estimation. Enumerating the objects in a set is central to the understanding of number and operations. The connection between counting whole numbers and the operations of addition and subtraction is developed through the joining and separating of sets using models and number lines. Problems can be solved through the actions of adding to, taking away from and comparing numbers. It is these actions or comparisons, in context that give a problem meaning, not the memorization of a number sentence or fact.

GEOMETRY AND MEASUREMENT

Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

Central Understanding: Attributes can be determined through composing and decomposing shapes and solids.

Background: The study of shapes should focus on the attributes and properties of both two- and three- dimensional figures. (Copley, p.112) In order to move through the various levels (van Hiele) of geometric thinking children must be exposed to many experiences and participate in numerous activities. Explorations of geometric figures help develop a more meaningful understanding of their attributes and properties. In the explorations of shapes and solids comparisons can be made based the attributes of length, weight, area, and volume through the use of measurement.

WORKING WITH DATA: PROBABILITY AND STATISTICS

Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

Central Understanding: Information about attributes can be organized to see relationships.

Background: Sorting and classifying helps children make better sense out of their world and handle increasingly complex relationships. The systematic organization of information incorporates mental actions such as ordering, grouping and summarizing. The ability to organize information develops naturally from sorting and classification activities. It is important that children learn ways to organize information so they can begin to see relationships, make predictions and make generalizations.

Correlated Grade-Level Expectations

Click here to access correlated grade-level expectations for Grade 1 on the State Department of Education Web site.

Sequenced Grade-Level Expectations

GRADE 1 SEQUENCED GLES

Grade-Level Expectations	Fall	Winter	CMT	Spring
ALGEBRAIC REASONING				
1.1 Understand and describe patterns and functional relationships.				
1. Sort, classify and order numbers and objects by one and two attributes including size, shape, color, texture, orientation, position and use, and explain the reason or rule used.				
2. Recognize, extend and create one- attribute and two-attribute patterns, e.g., size and shape, counting, e.g., by 5 or10, and number patterns, e.g., *n* + 2. Describe the pattern and the rule used to make it.				
3. Replicate a pattern using a different representation, e.g., from color to shape.				
4. Develop and test generalizations based on observations of patterns and relationships.				
1.2 Represent and analyze quantitative relationships in a variety of ways.				
5. Model real-life situations that represent the result of counting, combining and separation of sets of objects (addition and subtraction of whole numbers) with objects, pictures, symbols and open sentences.				
1.3 Use operations, properties and algebraic symbols to determine equivalence and solve problems.				
6. Demonstrate understanding of equivalence or balance with objects, models, diagrams, operations or numbers, e.g., using a balance scale, or an arm balance showing the same amount on both sides.				
NUMERICAL AND PROPORTIONAL REASONING				
2.1 Understand that a variety of numerical representations can be used to describe quantitative relationships.				
1. Represent and identify whole numbers up to 100 as groups of tens and ones using models and number lines.				
2. Compare and order quantities of up to 100 objects, including naming a number that is one or 10 more or less than a given number.				
3. Describe and estimate quantities using benchmark amounts such as zero, 10 and 100.				
4. Identify ordinal numbers up to 10th with an ordered set of objects, e.g., point to the fifth crayon lined up on the table.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
5. Use a variety of models and familiar objects to compare two parts of a whole object and describe the parts as being closer to very little, one half or one whole.				
6. Use a variety of models and familiar objects to: • Make a whole of equal size parts of familiar objects. • Show and identify equal size pieces of a whole as halves, thirds or fourths • Identify pieces of a whole as not being halves, thirds or fourths.				
7. Determine half of a whole set of up to 20 objects.				
8. Describe ratios in terms of the patterns that develop in the relationships between quantities, e.g., if one cat has four legs, then two cats have eight legs.				
2.2 Use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.				
9. Count by rote to at least 100.				
10. Count on from a given amount, orally and with models, and count back from 10.				
11. Count and group at least 100 objects by tens.				
12. Identify, read and write numerals to 100.				
13. Create problems and write one- and two-digit number sentences that reflect contextual situations and real world experiences. Solve the problems using a variety of methods including models, pictures, pencil and paper, estimation and mental computation, and describe the reasoning or strategies used. For example: Tell a story or draw a picture for a problem that can be solved using the number sentence 10 + 6 = 16.				
14. Solve contextual problems using all addition sums to 18 and subtraction differences from 10 with flexibility and fluency.				
15. Estimate the amount of objects in a set using zero, 10 and 100 as benchmarks and then determine if the estimate was reasonable.				
16. Identify and name pennies, nickels, dimes and quarters.				
17. Determine and compare sets of pennies and dimes valued up to $1.00; trade sets of pennies for dimes and vice versa. For example: José has three dimes and eight pennies. Andrea has two dimes and 17 pennies. If they do not have the same amount of money, who has more or less? How much more or less?				

Grade-Level Expectations	Fall	Winter	CMT	Spring
GEOMETRY AND MEASUREMENT				
3.1 Use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.				
1. Identify and describe familiar two- dimensional shapes and three-dimensional solids in the environment and contextual situations.				
2. Copy two- and three-dimensional designs from visual memory.				
3. Compare and sort familiar shapes and solids and designs found in the environment and contextual situations				
4. Construct shapes and solids using a variety of materials and create two-dimensional shapes and designs with a line of symmetry.				
3.2 Use spatial reasoning, location and geometric relationships to solve problems.				
5. Describe location, direction and position of objects or parts of objects, using terms such as left, right and opposite.				
3.3 Develop and apply units, systems, formulas and appropriate tools to estimate and measure.				
6. Know the days of the week in order and locate dates, days, weeks and months on a calendar. Use the information to solve problems involving the planning and sequencing of events.				
7. Solve problems involving telling time to the nearest hour using digital and analog clocks. Estimate and compare the length of time needed to complete a task using comparative language such as longer, shorter, more or less.				
8. Use nonstandard units or physical referents to estimate answers to measurement problems involving length, area, weight, temperature, volume and capacity, and then justify the reasonableness of the answers. Suggested materials include Unifix or locking cubes, paperclips, Popsicle sticks, square tiles, water and sand				
9. Use nonstandard units, references or direct comparison of objects (appearance), to order objects by length, area and capacity.				
10. Explore using standard units of measure (inch and centimeter) to communicate measurement in a universal manner.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
WORKING WITH DATA				
4.1 Collect, organize and display data using appropriate statistical and graphical methods.				
1. Pose questions that can be used to guide data collection, organization and representation.				
2. Collect and systematically organize and represent the data that answers the questions using lists, charts and tables, tallies, glyphs (coded pictures) picture graphs, and bar graphs.				
4.2 Analyze data sets to form hypotheses and make predictions				
3. Describe data that have been organized and make comparisons using terms such as largest smallest, most often or least often.				
4.3 Understand and apply basic concepts of probability				
4. Describe and explain the likelihood of the occurrence of various events in the student's world using terms such as possible impossible, likely, unlikely or certain.				
5. Engage in simple probability activities and games including the use of number cubes and spinners; record, graph and describe the results of the activities and games.				

Correlated GOALS 2000
Criterion Referenced Test

GRADE 1 CORRELATED GOALS 2000 CRT

The Goals 2000 Mathematics Curriculum was written as a companion to the 1998 Mathematics Framework. The Goals 2000 resources cited in this 2008 Model for Mathematics Curriculum are aligned to the 2005 Mathematics Curriculum Framework, 2007 Curriculum Standards and the fourth generation Connecticut Mastery Test.

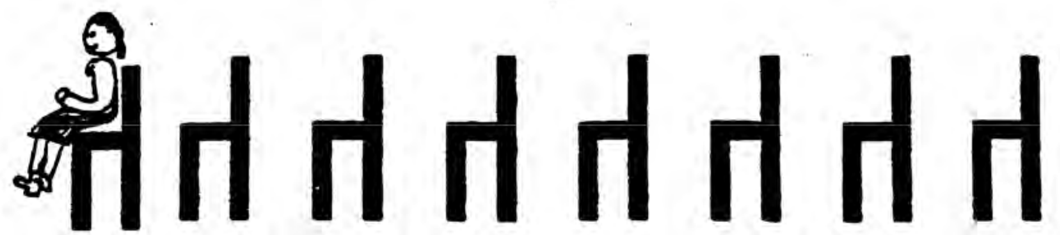
The Grade 1 Criterion Referenced Test Part A from the Goals 2000 Mathematics Curriculum is aligned to the Grade 1 sequenced GLEs and can be used for pre- and post-assessment.

Please use the link below to access the electronic version of the complete document, which includes other activities, such as opportunities for open-ended and challenge experiences that must be examined for alignment prior to use.

http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=321084

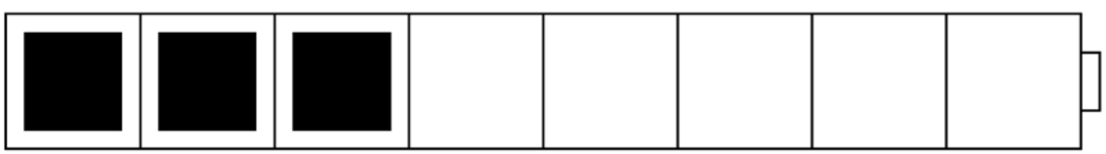
GLE 2.1.4

1. There is a row of chairs. Tanya is sitting in the first chair. Joe will sit in the fifth chair. Circle the chair Joe will sit in.



GLES-1.2.5, 2.2.13, 2.2.14

Use this example to complete questions 2-4.
Here is a picture of a cube train with 8 cubes, 3 black and 5 white.



This train can be described with a number sentence

3 + 5 = 8

GLES-1.2.5, 2.2.13, 2.2.14

2. Color in the train below with 1 black and 7 white cubes.

Write a number sentence that describes the train.

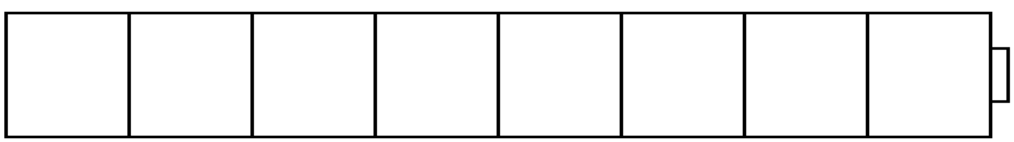
____

3. Color in the train below with all 8 cubes the same color.

Write a number sentence that describes the train.

____

4. Choose 7 of your cubes. Make a cube train with them. Color in the train below.



Write a number sentence that describes the train.

____

GLE 1.3.6

A number sentence is shown below.

☺ ☺ **+** ☺ ☺ ☺ **=** ☺ ☺ ☺ ☺ ☺

2 + 3 = 5

Complete the 3 number sentences below, so that each one is different.

5. ___________ + ___________ = 5

6. ___________ + ___________ = 5

7. ___________ + ___________ = 5

GLE 2.2.14

8a. Circle all the problems with answers that are less than 8.

$$\begin{array}{r} 5 \\ \underline{+3} \end{array} \qquad \begin{array}{r} 9 \\ \underline{+1} \end{array} \qquad \begin{array}{r} 2 \\ \underline{+4} \end{array}$$

$$\begin{array}{r} 4 \\ \underline{+3} \end{array} \qquad \begin{array}{r} 3 \\ \underline{+6} \end{array} \qquad \begin{array}{r} 2 \\ \underline{+7} \end{array}$$

8b. Circle all the problems with answers that are less than 3.

$$\begin{array}{r} 9 \\ \underline{-1} \end{array} \qquad \begin{array}{r} 7 \\ \underline{-6} \end{array} \qquad \begin{array}{r} 6 \\ \underline{-2} \end{array}$$

$$\begin{array}{r} 8 \\ \underline{-6} \end{array} \qquad \begin{array}{r} 7 \\ \underline{-5} \end{array} \qquad \begin{array}{r} 10 \\ \underline{-8} \end{array}$$

GLE 1.1.2
Use the number chart to help you answer questions 9-12.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

9. What numbers come next?

2, 4, 6, ________ , ________

10. What numbers come next?

1, 3, 5, ________ , ________

11. What numbers come next?

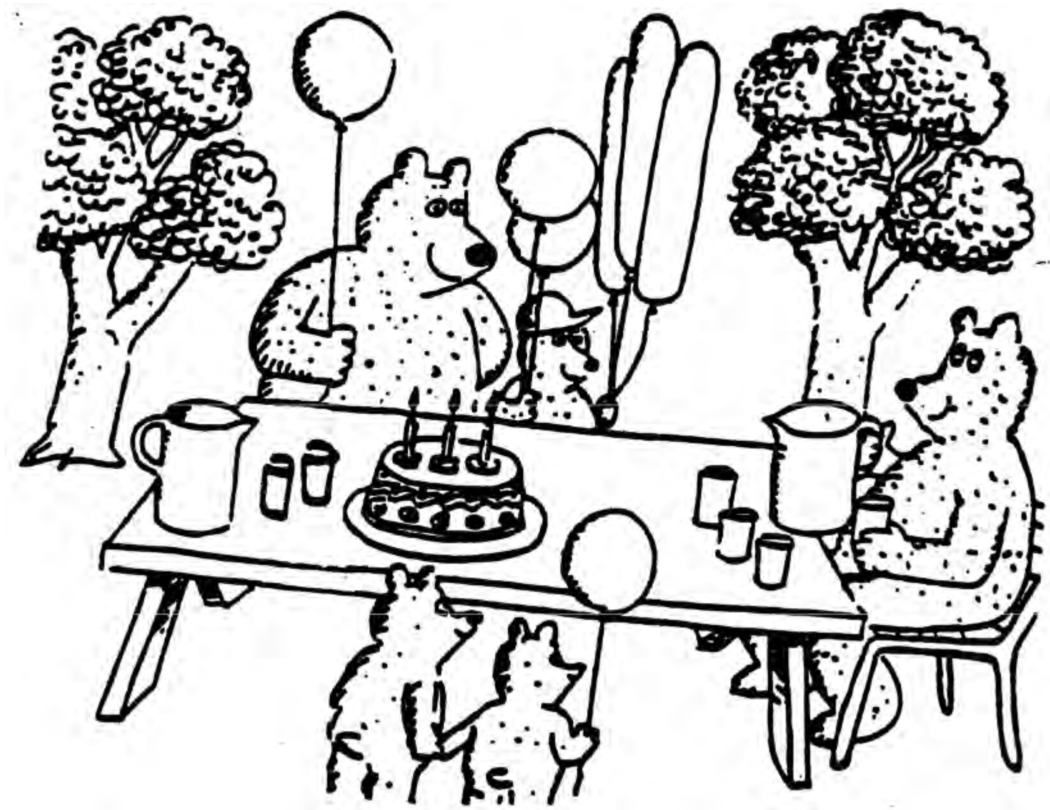
9, 19, 29, 39, ________ , ________

12. What numbers come next?

58, 57, 56, ________ , ________

GLES 2.2.13, 2.2.14

Look at the picture. There are lots of things in the picture. Think about what you see. Think about how many you see.



13. Put an "X" on each bear in the picture. How many bears are there?

____

GLES 2.2.13, 2.2.14

14. Circle each cup on the table. How many cups are there on the table?

____

15. What are there exactly three of?

____

16. What are there exactly two of?

____

17. Can each bear have at least one balloon?

____

18. If each bear drinks two cups of juice, how many cups of juice do all the bears drink?

____

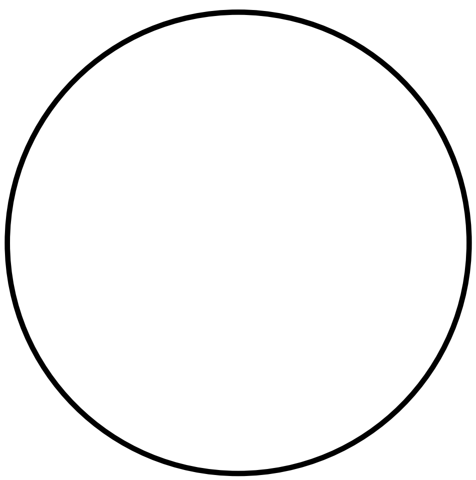
GLE 2.2.14

19. Jill has 4 dogs. Alonzo has 1 more dog than Jill. Rosa has 1 more dog than Alonzo. How many dogs does Rosa have?

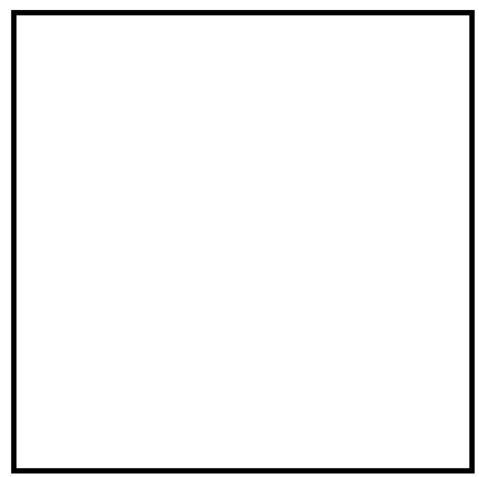
GLES 2.1.5, 2.1.6

Color one half of each shape.

20.



21.



GLE 2.1.6

22. Show two ways to divide this figure into two equal parts.

GLES 3.1.1, 3.2.5

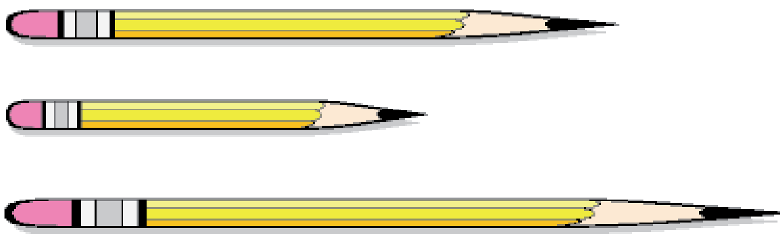
1. Follow these directions.

- **a. Draw a rectangle.**
- **b. Draw a square on top of the rectangle.**
- **c. Draw a triangle on the bottom of the rectangle.**

Draw here:

GLE 3.3.9

24.



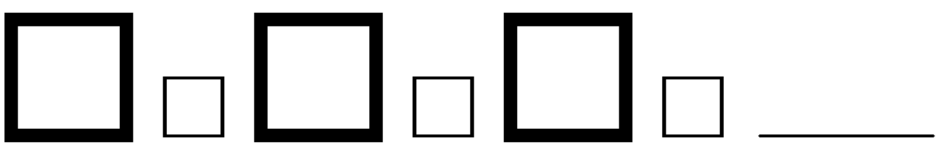
a. Circle the longest pencil.

b. Put an X on the shortest pencil.

GLE 1.1.2

25. What comes next in the pattern? Draw it.

26. What comes next in the pattern? Draw it.



27. What comes next in the pattern? Draw it.

GLES 1.2.5, 2.2.13, 2.2.14

28. Finish this story. Fill in the blanks with numbers so the story makes sense.

There were 8 birds on a fence.
There was a loud noise, so ____________ birds flew away.
There were ____________ birds left on the fence.

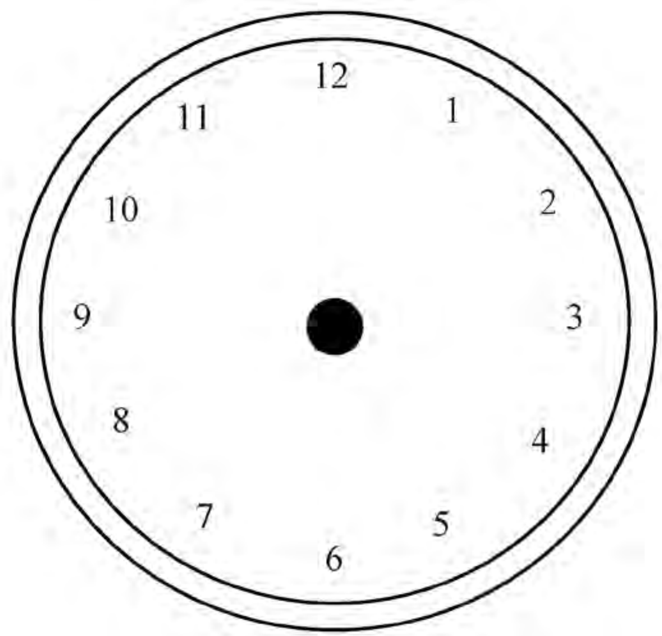
Draw a picture to show your story.

29. Ben found 5 pencils and 3 scissors in his desk. Then he found 4 more pencils. How many pencils did he find?

____

GLE 3.3.7

30. Draw the hands on the clock to show four o'clock.



GLES 2.2.16, 2.2.17

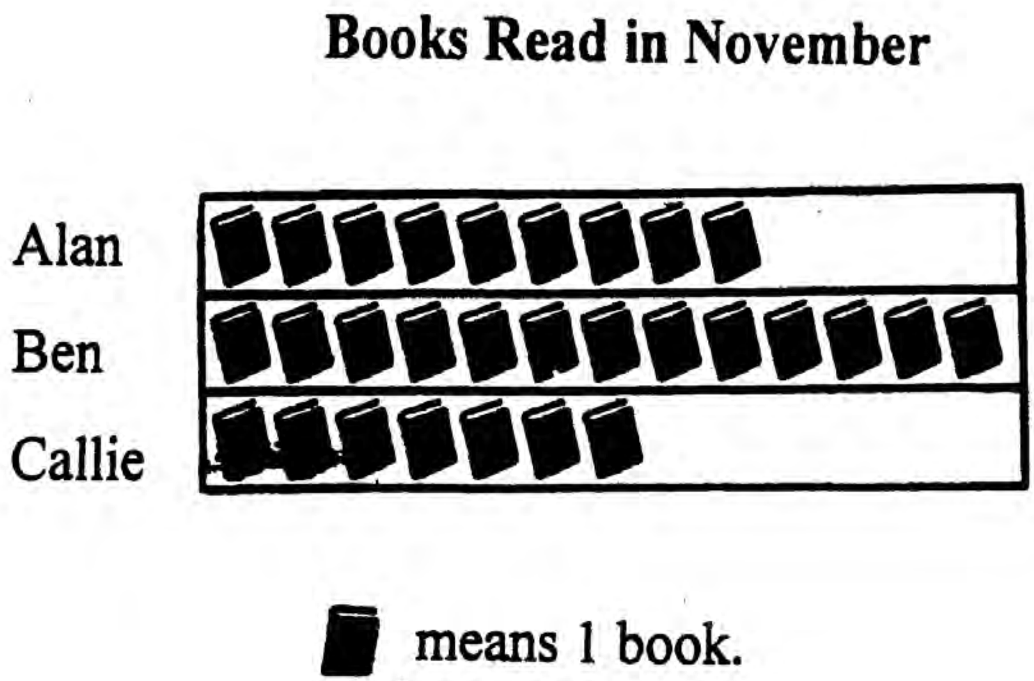
31. A toy boat costs 12¢.

31A. Show one way you could pay for the boat by putting an "X" on each coin you would use.

31B. Show another way. Put an "X" on the coins.

GLE 4.2.3

32.



How many books did Alan read in November?

____

GLE 3.3.6

Use the calendar below to answer the questions that follow.

APRIL

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

33. What day of the week does April 10 fall on?

____

34. How many Saturdays are in April?

____

35. What is the last day of April?

____

36. One day before April 9 is April ____________________

GLE 2.2.12

37. Use the number line below to answer the questions that follow.

←————————————————————————→

0 1 2 3 4 5 6 7 8 9 10 11 12

37a. Put an X on a number between 5 and 9.

37b. Circle a number greater than 10.

37c. Put a box around a number smaller than 6.

GLEs 2.2.14, 2.2.17

Your class runs the school store. Use the information in the box to answer the questions below.

School Store Prices			
Pencil	2¢	Pen	5¢
Ruler	7¢	Eraser	3¢

40. How much will it cost to buy a pencil and an eraser?

____

41. How much will it cost to buy a ruler and a pencil?

____

42. How much will it cost to buy 2 pencils and 1 pen?

____

43. How much more does a pen cost than a pencil?

____

44. How much more does a ruler cost than an eraser?

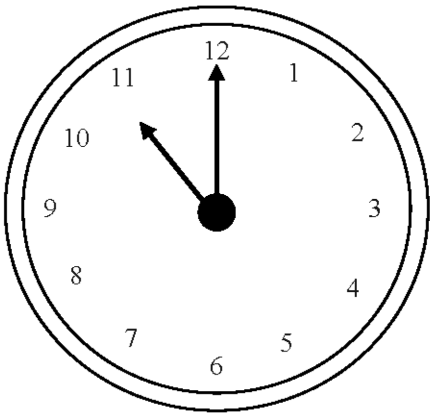
____

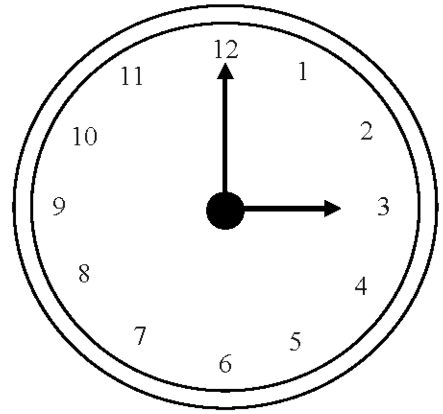
45. You have a nickel and two pennies. What can you buy at the store that uses all the money you have?

____

GLE 3.3.7

Match each clock face to the time.

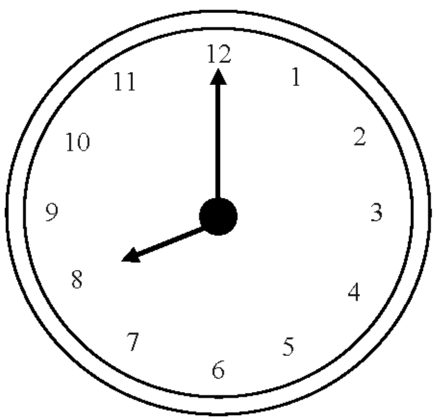




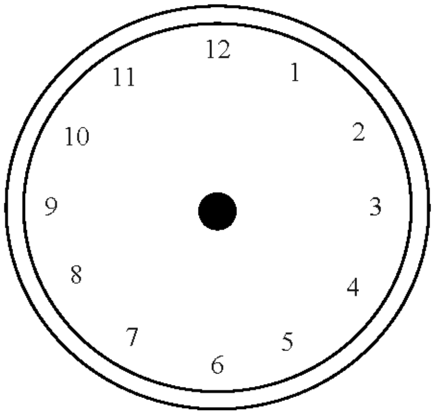
3:00

8:00

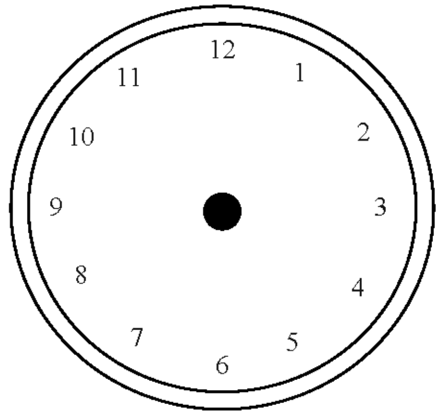
11:00



47. Draw on the clock face to show the time.



5:00



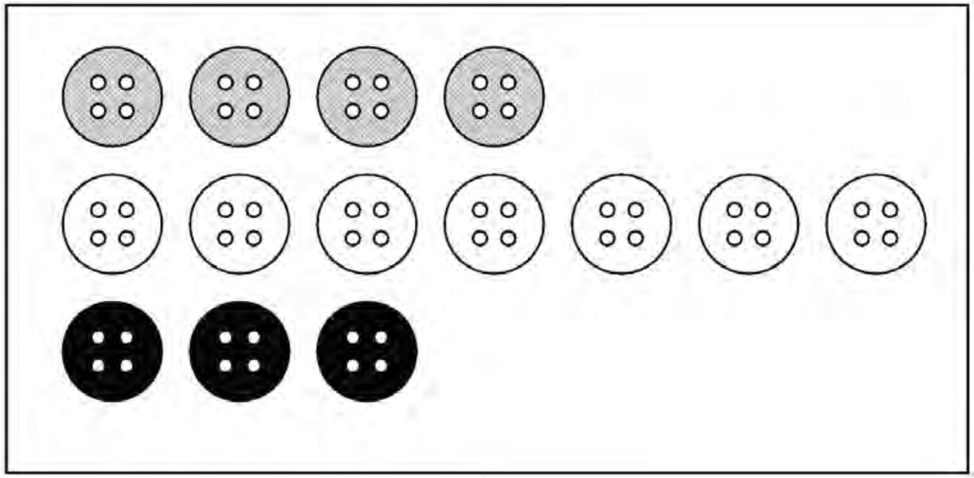
10:00

GLEs 2.2.13, 2.2.14

48. Use the number 10.
Write an addition story problem that has the number 10 for the answer.

GLE 4.2.3

49. Button Graph



1. How many black buttons? __________

2. How many gray buttons? __________

3. Which has more buttons, gray or white? __________

4. How many more white buttons than black buttons? __________

5. Tell something else about the graph. ______________________________

____

____

GLEs 3.3.8, 3.3.9

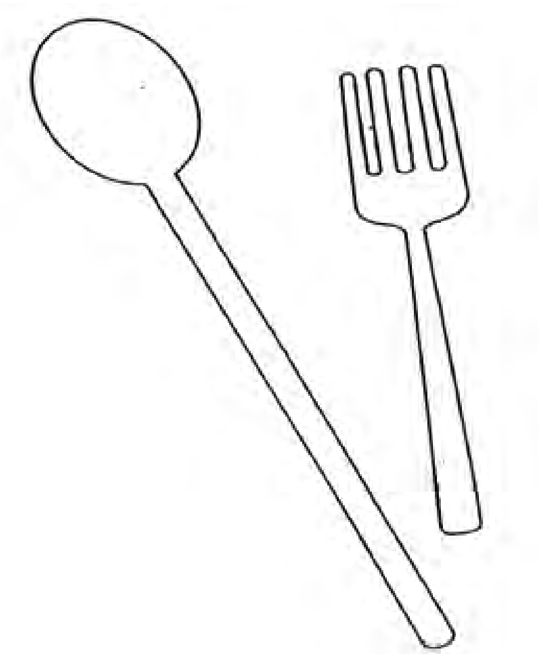
Find some paper clips.

Estimate how many to measure the fork. __________ .

Measure __________ .

Estimate how many to measure the spoon. _________.

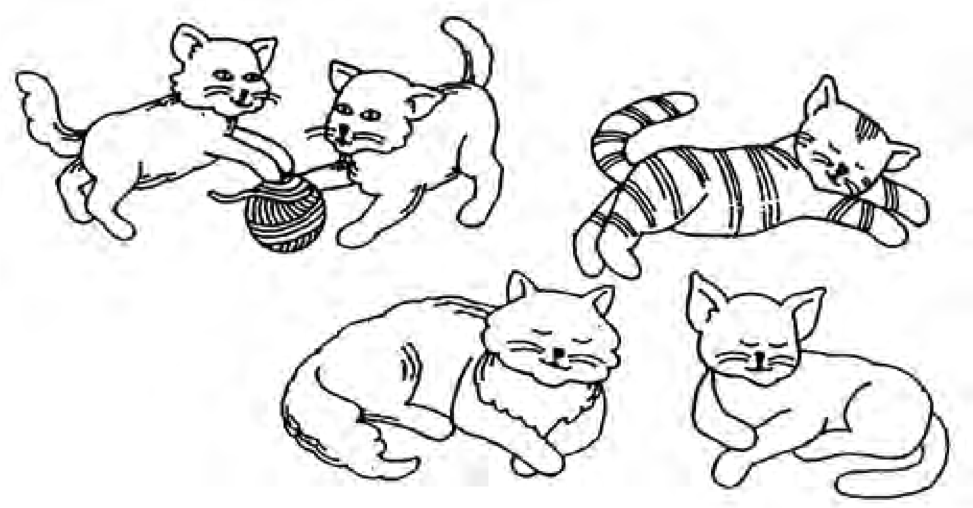
Measure __________ .



Tell how many more paper clips you used to measure the spoon. _______________.

GLEs 2.213, 2.2.14

Write a subtraction number story about these cats. Tell where each number came from.



Write another story problem about the cats. Give it to a friend to solve.

Section B:
An adult should interview students & record their responses.

GLE 2.2.14

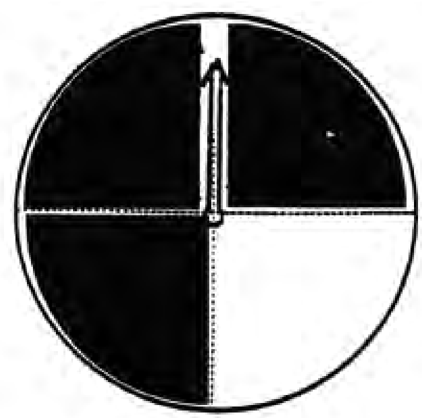
B1. **There are 5 cats on a fence. There are 3 cats in the tree. Jeff says there are 2 cats in all. Kate says there are 8 cats in all.**

Who is right? ________________________________
How do you know? ____
____
____
____

Section B:

GLE 4.3.5

B2. You have a spinner with four equal sections. Three sections are black and one is white.



a. If you spin the spinner, what is more likely to come up, black or white?

____

b. Why do you think that? ____

____

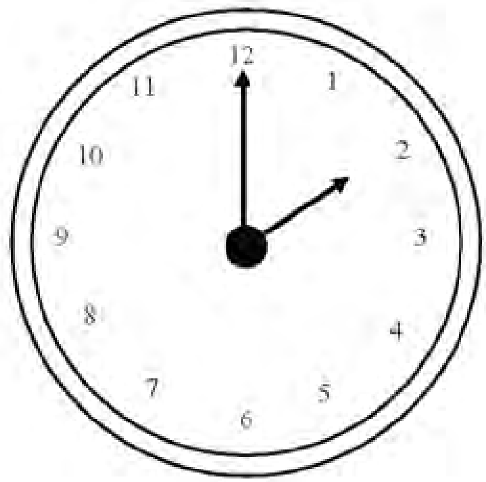
____

____

Section B:

GLE 3.3.6

B3. What time does this clock show?



GLE 1.1.1

B4. Give the student a set of sorting materials such as Attribute blocks or sorting bears.

Ask the student to sort the set in some way.

Then ask the student to describe the sorting rule.

If successful, ask the student to try sorting the same set in a different way and then to describe the new rule.

Section B:

GLE 3.3.6

B5. Ask the student to name the days of the week in order.

B6. Ask the student to name the months of the year.

GLE 3.3.8

B7. Select two objects which, when held, appear to be about the same weight.

Give them to the child. Also have a pan balance available.

Ask the child to tell you which object is the heaviest.

GLEs 1.1.2, 4.1.2

B8. Give the student a collection of objects such as candy hearts, Unifix Cubes or jelly beans. The question is: What do we know about this collection of objects?

Ask the student to sort them.

Have the student place the sorted objects on grid paper to make a real graph.

On a second sheet of grid paper, have the student use crayons in matching colors to make a bar graph.

Ask the student to tell you something about the graph.

Curriculum Standards Connections

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS. Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 1.1. UNDERSTAND AND DESCRIBE PATTERNS AND FUNCTIONAL RELATIONSHIPS

Grade-Level Expectations

1. **Sort, classify and order numbers and object by one and two attributes and including size, shape, color, texture, orientation, position and use, and explain the reason or rule used. (See also GLE 3.1.3.)**

   - Arrange a set of objects in a pattern according to the differences between the objects, e.g., blocks by size, or containers by how much they can hold.

2. **Recognize, extend and create one- attribute and two-attribute, e.g., size and shape, counting, e.g., by five or 10, and number, e.g., *n* +2, patterns. Describe the pattern and the rule used to make it.**

   - Group objects into sets of two, five, or 10 to explore patterns in skip counting.

   - Use numbers or objects to generate and discuss various numeric or geometric patterns. (What comes next in a repeating pattern?)

3. **Replicate a pattern using a different representation, e.g., from color to shape.**

   - Read stories, poems or rhymes that have organizational patterns, such as in a Dr. Seuss book, and have the children identify the pattern and express the pattern using a different representation.

   - Use technology to represent a variety of patterns, e.g., Kid Pix software can be used to publish picture patterns.

4. **Develop and test generalizations based on observations of patterns and relationships. (See also GLE 2.1.2.)**

- Explore and describe objects in the environment using simple ratios, e.g., one bird has two legs, two birds have four legs.
- Discover numeric patterns on hundreds charts, e.g., the digits in the tens place and ones place when examining rows and columns on the chart.
- Discusses the difference between the numbers when we go to the left, the right, the number above and the number below using a hundreds chart (one less, one more, 10 less, 10 more).
- Use objects and/or a number line to explore the patterns in numbers 0 to 100.
- Use calendars to identify patterns in school and classroom routines.

❖ **Possible Assessment Opportunities**

❖ Identify the relative position of whole numbers on a number line 0 to 100; describe the position based on observable patterns.

Intervention: Provide numbers and a number line of more familiar numbers (e.g., 0 to 20, 0 to 50).

Challenge: Expand to numbers and number lines beyond 100.

COMPONENT STATEMENT: 1.2. REPRESENT AND ANALYZE QUANTITATIVE RELATIONSHIPS IN A VARIETY OF WAYS.

Grade-Level Expectations

5. **Model real-life situations that represent the result of counting, combining and separation of sets of object (addition and subtraction of whole numbers) with objects, pictures, symbols and open sentences.**

COMPONENT STATEMENT: 1.3. USE OPERATIONS, PROPERTIES AND ALGEBRAIC SYMBOLS TO DETERMINE EQUIVALENCE AND SOLVE PROBLEMS.

Grade-Level Expectations

6. **Demonstrate understanding of equivalence or balance with objects, models, diagrams, operations or numbers, e.g., using a balance scale or an arm balance showing the same amount on both sides.**

   - Play pretend "seesaw" to demonstrate equivalence. For example, using the teacher as the middle of a seesaw, have four children come and stand on one side, then have two children stand on the other side. Discuss what would happen to the seesaw and why. Invite children to show and explain how to balance the seesaw. Provide numerous opportunities using a variety of numbers, as the children's sense of number increases.

   - If children are having difficulty with the "seesaw" representation of equivalence, use actual balance scales with objects or weights to show balance or equivalence.

SAMPLE INTEGRATED LESSON – LIVING AND NONLIVING THINGS

Context: Living things are all around us. It is important to know the difference between things that are alive and things that are not alive because living things require certain conditions to continue to live.

GLEs: 1.1.1, 1.2.5, 4.1.1, 4.1.2, 4.1.5

Time: One extended instructional period plus additional time for organizing the data

Objective: The children will compare objects using attributes and organize their findings.

Materials: A collection of pictures of living and nonliving objects from home and school including many similar items (these could be digital pictures taken by students), organizers for sorting and paper for representing their collections.

Procedure:

1. Discuss the terms living and nonliving. Ask the children how they know the difference between things that are living and nonliving to assess their background knowledge in this area.
2. Have the children identify living and nonliving things within the classroom. Ask the children whether you should make one list of all their answers. If the answer is no, then ask for suggestions for organizing their data. If the answer is yes, have the children define what type of organizer would help them quickly tell which items are living or nonliving.
3. Continue identifying living and nonliving items from outside the classroom.
4. Separate the living group into two different categories by common characteristics. Ask the children to guess your rule.
5. Ask a child to separate the nonliving group into two separate categories. Have other children guess the rule. Access prior knowledge by having the child share his or her rule for sorting with the class.
6. Place children in pairs. Provide each group with a set of pictures of living and nonliving objects.
7. Have the pair identify attributes for sorting and explain their thinking. Ask questions such as:
    - a. What are the differences between these living and nonliving things?

- b. How do you know these are all living things?
- c. What are the differences between the different categories you chose?

8. Question the children to guide them to explain, in sequence, how they classified and organized their items
9. Students should record their results using an organizer such as lists or tallies using a large poster “T” chart or glyphs.

❖ **Possible Assessment Opportunities**

❖ Children can use digital pictures, pictures from magazines or from the Internet, glue them to index cards, and sort into two categories: living and nonliving. The children sort the living category into groups based on similarities and create a picture graph to display the data. Use questions from the possible learning activities to assess their understanding of classification and organization of information.

Intervention: Provide an outline for the picture graph.

Challenge: Further sort and graph the nonliving items by their similarities by at least two attributes (e.g., texture, weight, hardness, etc.).

Interdisciplinary Framework Connections				
Science	**English/Language Arts**	**Social Studies**	**Visual and Performing Arts**	**Physical Education**
A.1. Describe the similarities and differences in the appearance and behaviors of plants, birds, fish, insects and mammals (including humans). **A.1.** Describe characteristics that distinguish living from nonliving things (i.e., sort living and nonliving things). **A INQ.1** Make observations and ask questions about objects, organisms and the environment. **A.INQ.9**. Count, order and sort objects by their properties.	• Organize information in proper sequence to use in a summary and/or retelling. • Generate and respond to questions. • Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.). • Use oral language to communicate a message. • Determine purpose and choose an appropriate written, oral or visual format. • Publish and/or present final products in a myriad of ways, including the use of the arts and technology. • Use appropriate language as related to audience.	**Humans and Environment Interaction** • Explain ways in which humans use and interact with the environment (e.g., how we use sorting in our everyday life, such as sorting our clothes by seasons).	**Art** • Use different media techniques and processes to communicate ideas, feelings, experiences and stories. • Use elements of art and principles of design to communicate ideas. • Select and use subject matter symbols and ideas to communicate meaning (e.g., use art materials to create sorting pictures, such as cutting out pictures and sorting them, creating pictures of shapes, making collages, etc.).	**Responsible Behavior** • Follow class rules, activity-specific rules, safety practices, procedures, etiquette and good sportsmanship in various physical activity settings (e.g., identifying and categorizing the rules for indoor and outdoor activities).

Vocabulary: pattern, patterns, next, before, after, more, less, bigger, smaller, longer, one more, one less, 10 more, 10 less, over, under, size, shape, color, day, week, year, days of the week, few, fewer, fewest, add, subtract, ratio, ordinal numbers, attribute, hundreds chart, translate a pattern, balance, sort, classify, extend

Resources:

Electronic Resources:

Trains and Tunnels – Goals 2000

Pattern Block Puzzles – Goals 2000

Pattern Questions – Goals 2000

A to Z Teacher Stuff http://lessonplanz.com/Preschool/

SuperKids (Educational software Review) http://www.superkids.com/aweb/pages/reviews/multisub/preschoo/

Center for Distance and Online Learning http://teams.lacoe.edu/teachers/index.asp

Abouteducation.com http://math.about.com/library/blone.htm

Illuminations (Repeating and growing patterns) http://illuminations.nctm.org/LessonDetail.aspx?ID=L157

Apples 4 the teacher http://www.apples4theteacher.com/math/games/100-number-chart-one.html

Teach Learn Communicate http://www.alfy.com/teachers/teach/thematic_units/Patterns_Shapes/PS_1.asp

Songs for Teaching http://www.songsforteaching.com

National Library of Virtual Manipulatives http://nlvm.usu.edu/en/nav/grade_g_1.html

What Does Your Pattern Look Like? – Goals 2000

Strips – Goals 2000

Teacher References:

Navigating through Algebra in Prekindergarten-2 NCTM

Algebra in the PreK-2 Curriculum? Teaching Children Mathematics, NCTM, September 2005

Children Literature:

The Boy and the Quilt, by Shirley Kurtz

The Table of Phinneas Fable, by George Green

One Fish, Two Fish, Red Fish, Blue Fish, by Dr. Seuss

Moon to Sun by Sheila Samton

Artic Fives Arrive, by Elinor J. Pinczes

One Watermelon Seed, by Celia Baker Lottridge

Ten Old Pails, by Nicholas Hellar

Fish Eyes - A Book You Can Count On, by Lois Elhert

From One to One Hundred, by Terri Sloat

Ten Sly Piranahs, by William Wise

One is a Snail, *Ten is a Crab*, by April Sayre

The Shapes Game, by Paul Rogers

Classroom Materials: Objects to use to create patterns or sets (e.g., blocks, counters, etc.), hundreds charts, spinners, number lines

Notes:

NUMERICAL AND PROPORTIONAL REASONING*. Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 2.1. UNDERSTAND THAT A VARIETY OF NUMERICAL REPRESENTATIONS CAN BE USED TO DESCRIBE QUANTITATIVE RELATIONSHIPS.

Grade-Level Expectations

1. **Represent and identify whole numbers up to 100 as groups of tens and ones using models and number lines. (See also GLEs 2.2.11 and 2.2.12.)**

   - Use opportunities during the day to count (the number of books on a shelf, the number of steps between locations, or the number of chairs in a room).

   - Represent the days of the month using bundles of 10 sticks and single sticks.

2. **Compare and order quantities of up to 100 objects, including naming a number that is one or ten more or less than a given number. (See also GLE 1.1.4.)**

   - Provide opportunities to count, compare and order objects in the classroom (especially use objects assembled for art, science and social studies lessons). Have children count by ones and group and count by tens.

   - Using hundreds charts, have the students identify one more, one less, 10 more, 10 less than given numbers.

   - Have children count a group of more than 20 objects. Use Unifix or interlocking cubes to build the two-digit number by matching the cubes with the objects and then putting the cubes in stacks of tens and ones. Write the number on the board or a chart. Ask questions such as:

1. How many tens? How many ones? How do you know?

2. If one stack of 10 is added, what will the number become? How do you know?

3. If two ones are taken away, what will the number become? How do you know?

❖ **Possible Assessment Opportunity**

❖ Write a two-digit number on a dry-erase board. Have the children build that number with interlocking cubes. Erase the number in the tens place and put in a higher or lower number.

Ask questions such as:

1. What is the number now?

2. How has it changed?

Intervention: Count a group of less than 20 objects. Build the number as a group of 10 and ones as a model. Have the child copy the model and then describe the number that was built using appropriate vocabulary. Repeat with other numbers that are less than 20 and then build numbers larger than 20.

Challenge: Have the child count a collection of at least 100 objects. Ask the child to model how the collection was counted using interlocking cubes and explain why that method was chosen. Have the child demonstrate another possible way to count the same collection.

3. Describe and estimate quantities using benchmark amounts such as zero, 10 and 100.

- Make a set of cards with groupings of two through 10 dots in many different arrangements. Play "Flash Math." Quickly show a group for one or two seconds. Ask questions such as:

1. How many did you see?

2. How do you know?

- Use a 10-frame to model groupings for each of the numbers, 4 through 10.

- Practice recognizing groups of objects represented by pennies, dice, dominoes, etc., over several weeks.
- Use objects collected for GLE 2 and have students estimate using benchmarks.
- Create a “Traveling Estimating Jar.” Each week one child takes home two (one large and one smaller) plastic jars or containers. Have the child place a large amount of the same kind of item such as shells or ziti in the large jar. Have the child put 10 of the ziti in the smaller jar to be used as a referent. The children examine both jars during the week to estimate the number of objects in the larger jar and record their predictions. For the class discussion, take out 10 items from the large jar and place them in the smaller jar, so that jar now contains 20 items. Have the children revisit their estimates and make changes if they wish, explaining their thinking and strategies used.

4. Identify ordinal numbers up to 10th with an ordered set of objects (e.g., Point to the fifth crayon lined up on the table.).

5. Use a variety of models and familiar objects to compare parts of a whole object and describe as being closer to very little, one half or one whole.

- Cut the radius on two contrasting colored paper plates. Interlock the paper plates, rotate the plates to various positions and ask questions such as:

  1. Is this closer to very little?
  2. Is this closer to one half or one whole of the entire plate?

6. Use a variety of models and familiar objects to:

- **Make a whole of equal size parts of familiar objects.**
- **Show and identify equal size pieces of a whole as halves, thirds or fourths.**
  - Create opportunities to solve problems sharing objects among different numbers of children and use mathematical language to explain their thinking (one apple shared with two children; one pizza shared with four children).
  - Cut a construction paper rectangle into two, three or four parts. Hold up the pieces so that the children can describe whether or not the pieces are equal. Use correct language to describe the pieces.

- **Identify pieces of a whole as not being halves, thirds or fourths.**
    - Have children divide construction paper squares or paper plate circles into two, three or four parts. Have children identify the wholes that are correctly divided into fair shares and those that are not.

7. **Determine half of a whole set of up to 20 objects.**
    - Take sets of two, four, six, eight or 10 objects, such as candy, crayons, cubes or beans, and have the children divide the set into two equal parts.
    - Give children numerous opportunities to make two equal parts (halves) of a set objects, by making one-to-one matches. Example: With 10 objects, there should be five in each half.

8. **Describe ratios in terms of the patterns that develop from the relationships between quantities e.g., if one cat has four legs, then two cats have eight legs.**

COMPONENT STATEMENT: 2.2. USE NUMBERS AND THEIR PROPERTIES TO COMPUTE FLEXIBLY AND FLUENTLY AND TO REASONABLE ESTIMATE MEASURES AND QUANTITIES

Grade-Level Expectations

9. **Count by rote to at least 100.**

10. **Count on from a given amount, orally and with models, and count back from 10.**

11. **Count and group at least 100 objects by tens. (See also GLE 2.1.1 and 2.2.12.)**
    - Build numbers to 100 using real-world items in groups of 10.
    - Count singles and groups of 10 using bundles of sticks or cups with 10 objects each.

12. **Identify, read and write numerals to 100. (See also GLE 2.1.1, 2.2.11, 2.2.13 and 2.2.14.)**

13. **Create problems and write one- and two-digit number sentences that reflect contextual situations and real world experiences. Solve the problems using a variety of methods including models, pictures, pencil and paper, estimation and mental computation, and describe the reasoning or strategies used. For example: Tell a story or draw a picture for a problem that can be solved using the number sentence 10 + 6 = 16. (See also GLE 2.1.1, 2.2.12 and 2.2.14.)**

- Have children model and name the number sentence they are modeling, such as “two and three are five”; draw the combination and write the sentence below the picture.

14. **Solve contextual problems using all addition sums to 18 and subtraction differences from 10 with flexibility and fluency.**

- Have children arrange objects to build all possible combinations for a specific sum.

❖ **Possible Assessment Opportunities**

❖ Put some counters in each hand. Tell the children how many you have all together. Open one hand and ask how many are in the other hand.

Intervention: Put two small groups of counters on the table. Count all the counters. Place a paper over one group and ask how many are under the paper.

Challenge: Have child take as many counting objects as they can handle to model and make as many addition and subtraction sentences as possible. The child should create a context for one of the number sentences so that others can write down the number sentence, draw a picture of it can and solve the problem (can be placed in a center).

15. **Estimate the amount of objects in a set using zero, 10 and 100 as benchmarks and then determine if the estimate was reasonable.**

16. **Identify and name pennies, nickels, dimes and quarters.**

17. **Determine and compare sets of pennies and dimes valued up to $1.00; trade sets of pennies for dimes and vice versa. For example: José has three dimes and eight pennies. Andrea has two dimes and 17 pennies. If they do not have the same amount of money, who has more or less? How much more or less?**

- Give children a cup of up to 40 pennies. Ask the children to count the pennies out in groups of 10 and trade for dimes.

SAMPLE INTEGRATED LESSON – MORE OR LESS

Context: Rebecca and Marie thought that doing math was sometimes boring. Their teacher asked them to create an interesting activity for math. Try the activity they invented called “More or Less” and see if you find it interesting. Maybe your teacher would let you invent your own math activity.

Grade-Level Expectations: 2.1.2

Objective: Children will be able to identify one more, one less, 10 more, 10 less, through exploring number patterns on a hundreds chart.

Materials: Large hundreds chart displayed in the classroom; individual hundreds charts for each team; the names of students to “draw out of a hat”; cards with numbers from 1 to 100 on them; two different colored chips; and a soccer ball with 10 more, 10 less, one more, one less written in the pentagons or sections on the ball.

Procedure

1. Display a classroom hundreds chart large enough for students to see and distribute smaller hundreds charts to each team.
2. Divide the class into teams of three or four students.
3. The teacher draws a card from the number cards and asks all the children to place one of their colored chips on that number.
4. The teacher draws a child’s name from the hat and calls on that child to catch the ball.
5. The soccer ball is tossed to the chosen child. The pentagon, where the child’s left thumb touches the ball, gives the description of the new number (one more, one less, 10 more, 10 less).
6. The child reads the words under their thumb on the pentagon and each child in the room places the second chip on the appropriate number.
7. A point is awarded to the team of the child who caught the ball if it can show the right answer on the class hundreds chart (the original number and the new number).
8. The other teams respond in some manner, such as a round of applause, or thumbs up if the answer is correct. The point is then awarded.

9. Continue this process until all children have had a turn to catch the ball.

10. The winning team received the most points.

Teacher Note: If a number in the 90s was chosen and the child's thumb is on a 10-more pentagon, then ask the children questions such as:

1. What can we do to find the answer?
2. How could you make sure you were right?
3. What we have to do to this hundreds chart to show the answer?

❖ Formative Assessment Opportunities

- ❖ Provide each child with a hundreds chart and paper. Call out a number and say plus one, minus one, plus 10 or minus 10. The children should write the information down as a number sentence and then find the correct answer. Continue this process using various numbers.

Intervention: Children may use the hundreds chart as they did in the game to locate the correct answer.

Challenge: Ask the children to find the answer without using the hundred's chart and then explain how they knew the correct answer.

- ❖ Organize the children in small groups of no more than 5 members. Each group needs a hundreds chart, colored pencils or markers, a set of number cards and a spinner, marked with the following 4 sections: one more, one less, 10 more, and 10 less. Taking turns, each child pulls a number card, reads the number aloud and circles it on the hundreds chart, then spins the spinner. Using a hundreds chart, the child identifies one less, one more, 10 less, or 10 more than the pulled number and shades it in on the hundreds chart. One point is given for each correct answer. The goal is for each child to earn 5 points or 10 points, depending on the size of the group and skill level.

Intervention: Divide the hundreds chart into strips that include the target number and have them count up or down to find the answer.

Challenge: Compare the shaded areas and discover the patterns. Find out what happens to the pattern if we use five more, or five less.

Interdisciplinary Framework Connections				
Science	**English/Language Arts**	**Information and Technology Literacy**	**Visual and Performing Arts**	**Physical Education**
A INQ.1 Make observations and ask questions about objects, organisms and the environment.	• Use content vocabulary appropriately and accurately. • Listen to and respect the opinions of others about written, oral and visual texts. • Develop and discuss multiple responses while reading, listening and viewing.	• Use content-specific technology tools and software. • Demonstrate the ability to use basic features (entering information/ data, editing, calculating, manipulating text, sound and graphics, saving files) of personal productivity software.	• Use the elements of art and the principles of design to communicate ideas.	• Work cooperatively and productively with partners or in small groups to complete assigned tasks.

Vocabulary: same, equal, count, ones, tens, group of 10, a 10, regroup, tens place, ones place, 10-frame, add, subtract, sum, difference, combination, fact families, number sentence, more than, less than, one more, one less, close to, closer to, shorter, longer, taller, referent, almost, about, unit, set, unit fraction, fraction, equal parts, fair share, whole, portion, halves, thirds, fourths, penny

Resources:

Electronic Resources:

Buttons – Goals 2000

Ladybugs and Leaves – Goals 2000

Log Cabins – Goals 2000

Lets Count to 20! http://illuminations.nctm.org/LessonDetail.aspx?id=U153

Toy Shop Numbers! http://illuminations.nctm.org/LessonDetail.aspx?ID=L216

Toss and Make – Goals 2000

All in My Family – Goals 2000

Tell Me a Story – Goals 2000

Hidden Numbers – Goals 2000

Teacher References:

Elementary and Middle School Mathematics, Teaching Developmentally, by John Van de Walle, 4th and 5th editions

A Collection of Math Lessons: Grades 1-3, by Marilyn Burns

Research Ideas for the Classroom; Early Childhood Mathematics, by Robert J. Jensen

"Your Better Half," *Teaching Children Mathematics.* Colomb, Joanne & Kennedy, Kimberly, p.180–190, November 2005

Children's Literature:

Two Ways to Count to Ten, by Ruby Dee, 1988

The King's Commissioners, by Aileen Friedman

The Baseball Counting Book, by Barbara B McGrath

Catch that Goat, by Polly Alakija

Anno's Counting House, by Mitsumasa Anno

Island Counting 1 2 3, by Frane Lessac

My Granny Went to Market: A Round the World Counting Rhyme, by Stella Blackstone and Christopher Corr

Give Me Half! by Stuart J. Murphy

Classroom Materials: snacks, toys, shoes, clothing, items from nature (shells, rocks, leaves, flowers), items from the classroom (books, markers, crayons, furniture, white board, bulletin board) interlocking cubes, blocks, collections of items that are all the same size

Notes:

GEOMETRY AND MEASUREMENT. Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 3.1. USE PROPERTIES AND CHARACTERISTICS OF TWO- AND THREE-DIMENSIONAL SHAPES AND GEOMETRIC THEOREMS TO DESCRIBE RELATIONSHIPS, COMMUNICATE IDEAS AND SOLVE PROBLEMS.

Grade-Level Expectations

1. **Identify and describe familiar two- dimensional shapes and three-dimensional solids in the environment and contextual situations.**

    - Provide children with old magazines and newspapers from which to cut out pictures of objects shaped liked triangles, rectangles, squares, and circles.

    - Go on a shape hunt around the classroom, school, or outdoors.

    - Show children a shape for a few seconds and have them try to draw the shape from memory. Have the children show each other their drawings and discuss the characteristics of the shape in their drawings. Then show the original shape again. Start with simple shapes and then progress to complex shapes and solids.

    - Use a geoboard and create a shape with one elastic. Copy the shape onto dot paper. Use two elastics to create a shape and copy the design on dot paper.

2. **Copy two- and three-dimensional designs from visual memory.**

    - Place a three dimensional solid in a bag. One child places his/her hand in the “feely bag,” feels around, and describes the attribute of the solid to the remainder of the class without naming it. If the child needs help identifying the solid ask possible clarifying questions such as:

  - How many sides does your solid have?
  - Does it have any round or curved parts?
  - Are any of the sides longer than the others? Are all sides equal?
  - Does your solid have any points? How many?

- Provide pipe-cleaners for the children to make frames of solids by wrapping the pipe cleaners around a model of the solid to create a frame of that solid.
- Build solid figures from clay, simple nets for cubes and rectangular prism, straws, etc.
- Using geoblocks and have the children trace the faces and identify the shape of each face.

3. **Compare and sort familiar shapes and solids and designs found in the environment and contextual situations. (See also GLE 1.1.1)**

   - Describe the attributes of objects and shapes using appropriate mathematics terms and language and have the children use those attributes to sort the objects.
   - Have the children sort the cut out pictures (GLE 3.1.1) and attempt to find congruent squares, rectangles, circles or triangles.
   - Have children create designs using shapes or solids. Display the designs and have the class sort them by the shapes and solids included in the designs.

4. **Construct shapes and solids using a variety of materials and create two-dimensional shapes and designs with a line of symmetry.**

   - Children explore symmetry by examining leaves, using mirrors with pattern blocks, folding paper or by making inkblot designs.

❖ **Possible Assessment Opportunity**

❖ Choose different pattern blocks to put together and make a new shape that has a line of symmetry. Ask children to explain how they know the new shape has a line of symmetry.

Intervention: Give the child an image of half a symmetrical pattern block design and have the child build the missing half or find the pattern block image that will complete the design.

Challenge: Have children create images with a line of symmetry using technology or pictures. Cut the images along the line of symmetry and paste onto blank pieces of paper. Have another student draw, sketch or build the missing half of the image.

COMPONENT STATEMENT: 3.2. USE SPATIAL REASONING, LOCATION AND GEOMETRIC RELATIONSHIPS TO SOLVE PROBLEMS.

Grade-Level Expectation

5. **Describe location, direction and position of objects or parts of objects, using terms such as left, right and opposite.**

COMPONENT STATEMENT: 3.3. DEVELOP AND APPLY UNITS, SYSTEMS, FORMULAS AND APPROPRIATE TOOLS TO ESTIMATE AND MEASURE

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

6. ***Know the days of the week in order and locate dates, days, weeks and months on a calendar. Use the information to solve problems involving the planning and sequencing of events.***

- Provide one blank calendar per month. The name of the month and the weekdays are written in on the first day of the month. Every Monday review the days of the week by starting with the first day of the week (Sunday). Each day children write in the correct number for that date and answer questions about yesterday's and tomorrow's days and dates.

- Use calendars to plan and sequence school activities and classroom routines.

- Sequence a variety of events in pictorial form. Some suggested ideas are: photographs of people aging, trees or other plants changing according to the seasons, steps to tying shoes, making a sandwich, or popcorn or a cake.

7. Solve problems involving telling time to the nearest hour using digital and analog clocks. Estimate and compare the length of time needed to complete a task using comparative language such as longer, shorter, more or less.

- Use clocks during daily schedules to help develop a sense of time by announcing when there are 5 minutes remaining a for an activity or 15 minutes before an activity should commence.

8. Use nonstandard units or physical referents to estimate answers to measurement problems involving length, area, weight, temperature, volume and capacity, and then justify the reasonableness of the answers. Suggested materials include Unifix or locking cubes, paperclips, Popsicle sticks, square tiles, water and sand.

- Give the children different lengths of string and have them measure the width of a doorway. Talk about why their answers are different and the kinds of problems this can cause.

- Children measure the width of their desks by counting how many widths of their hands it would take to go from one end of the desk to another. They compare the results and discuss what would happen to the number of hands of the teacher's hand were used instead.

- Children can discuss whether they should use links or meter sticks to measure the length of the gym. Why?

- Provide opportunities for children to work with a variety of objects as "units" to fill, cover or match and produce a number called measure, e.g., measure the area of the desktop with an index card unit and literally cover the entire desk with index cards. Ask students to report their findings using language such as: "I measured with index cards and the desk can be covered with __ cards."

9. **Use nonstandard units, references or direct comparison of objects (appearance), to order objects by length, area and capacity.**

   - Make lists of things to measure in the classroom. Place a piece of masking tape along the dimension of each object to be measured. Make sure to include curves or other distances that are not straight lines. Designate the units to be used and have the children estimate before they actually measure.

   - Children measure a distance more than once by covering it using different nonstandard units each time and comparing the results.

   - Give each pair of children commercially available links or large paper clips. Have each child use the links to make a chain as long as his or her arm. Then, have the children in each pair compare their chains to determine whose arm-chain is longer (or shorter). Arm-chains can be used to measure objects in the classroom.

   - Measure the length of desks using the length of a pencil. Will the amount of pencils used to measure the length change if the size of the pencil changes? Children verify predictions by measuring the desks with a pencil of a different length and explain what happened.

   - Repeat the activities above using metric or standard rulers.

10. **Explore using standard units of measure (inch and centimeter) to communicate measurement in a universal manner.**

SAMPLE INTEGRATED LESSON — MEASURING SHADOWS

Context: Shadow tag is one of Josie's favorite games. She noticed that shadows were not always the same length. She wants to know if it is better to play the game at a particular time of day.

Grade-Level Expectations: 3.3.7; 3.3.8; 3.3.10; 4.1.2; 4.2.3

Time: Two instructional periods

Objectives: Children will be able to measure using a given non-standard unit.

Materials: Sidewalk chalk, string, paper and pencil, 12-inch rulers, straws or some other "unit"

Procedure:

1. Read the first verse of "*My Shadow*" by Robert Louis Stevenson. Ask the children what they think it means to have a shadow "go in and out."

2. Have the children play shadow tag. A person is tagged when his/her shadow is stepped on by another person. Discuss the different lengths of shadows and how and why they differ. Ask the class:

   a. Was there an easy way to tag someone? Explain.

   b. Can a person change the length of his shadow? Explain.

   c. When do you think would be the easiest time of day to tag someone?

3. At the beginning of the day, have the children work in pairs to measure each other's shadows. Use chalk to mark the top and bottom of the shadow. Cut a piece of string the same length as the distance between the marks.

4. Measure the string using a given nonstandard unit, such as straws, laid end to end, and then have the children count the number of units.

   Intervention: Have a partner assist and replace string with masking tape so the children can lay the straws directly on top of the tape for a more accurate measuring surface.

Challenge: Measure the shadow and string to the nearest inch.

5. Tape children's strings to a large piece of paper titled, and label it with their name and the length and a.m.

6. Repeat the activity at the end of the day. Tape everyone's string to the large piece of paper next to the string from the morning measurement and label it p.m.

7. Have the children compare their measurements, paying special attention to the time of day and the shadow lengths of those who they estimate are close in height.

8. Discuss any changes of opinion on how a shadow can "go in and out."

❖ **Possible Assessment Opportunities**

❖ Have the children measure their own shadows on three more different days. Compare the information by making a chart or table. Ask questions such as:

1. Was the morning or afternoon shadow longer?

2. What is the measurement of your shortest shadow? Longest?

3. How much longer is your longest shadow from your shortest shadow?

Intervention: Children can determine longest and shortest by counting the unit of measure and counting up from the shortest measure to the longest measure.

Challenge: Use their measurements to the nearest inch and use addition or subtraction to answer the questions or use a ruler or yard stick as a number line to find the answers. Order the shadows for entire class from longest to shortest or vice versa.

9. Decide the best time of day to play shadow tag and explain why.

Interdisciplinary Framework Connections			
Science	**English/Language Arts**	**Visual and Performing Arts**	**Physical Education**
1.1 A 11 Describe the apparent movement of the sun across the sky and the changes in the length and direction of shadows during the day. **1.4 A 17** Estimate, measure and compare the sizes and weights of different objects and organisms using standard and nonstandard measuring tools. **A INQ. 2** Use senses and simple measuring tools to collect data.	• Use content vocabulary appropriately and accurately. • Listen to and respect the opinions of others about written, oral and visual texts. • Develop and discuss multiple responses while reading, listening and viewing.	• Use the elements of art and the principles of design to communicate ideas.	• Demonstrate developmentally mature form in the fundamental movement skills: locomotor and nonlocomotor. • Recognize and apply the concepts of body space, effort and relationships in developing movement sequences and game strategies. • Work cooperatively and productively with partners or in small groups to complete assigned tasks.

Vocabulary: sort, alike, different, objects, diagram, shape, same, square, rectangle, triangle, circle, straight, color, inside, outside, top, bottom, close, closer, similar, cube, cylinder, pyramid, sphere, rectangular prism, cone, about, measure, longer, longest, shorter, shortest, taller, tallest, smaller, smallest, heavier, heaviest, lighter, lightest, compare, the days of the week, month, date, months of the year

Resources:

Electronic Resources:

Color & Shapes of Animals: http://school.discovery.com/lessonplans/programs/animalColorsShapes/

Learning to Measure with Ladybug: http://illuminations.nctm.org/LessonDetail.aspx?ID=L69

My Favorite Place: http://artsedge.kennedy-center.org/content/3809/

Shape Hunt Chant: http://www.readwritethink.org/lesson_images/lesson776/chant.pdf

Boxes Boxes – Goals 2000

How Big Am I? – Goals 2000

Popcorn Math – Goals 2000

Measure that Object – Goals 2000

Does It Fit? – Goals 2000

Teacher References:

NCTM Algebra and Geometry Standards K-2

Engaging Young Children in Mathematics, by Douglas H. Clements

Adding It Up, by National Research Council

Investigating with Pattern Blocks, by Marcia Miller

Children's Literature:

Mapping Penny's World, by Loreen Leddy

My Map Book, by Sara Fanelli

Farmer Mack Measures His Pig, by Tony Johnston

So Many Circles, So Many Squares, by Tana Hoban

The Long and the Short of It, by Nathan and McCourt

What Makes a Shadow? by Clyde Robert Bulla

How Big is a Foot? by Rolf Moyller

So Many Circles, So Many Squares, by Tana Hoban

Dollars and Cents for Harriet, by Betsy Maestro

What's Smaller than a Pygmy Shrew? by Robert E. Wells

Tiger Math, by Ann Whitehead

Much Bigger Than Martin, by Steven Kellogg

The Shapes Game, by Paul Rogers

Telling Time with Big Mama Cat, by Dan Harper

Nothing Sticks Like a Shadow by Ann Tompert

I Can See My Shadow by National Geographic

The Shapes Game, by Paul Rogers

Notes:

WORKING WITH DATA: PROBABILITY AND STATISTICS. **Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.**

COMPONENT STATEMENT: 4.1. COLLECT, ORGANIZE AND DISPLAY DATA USING APPROPRIATE STATISTICAL AND GRAPHICAL METHODS.

Grade-Level Expectations

1. Pose questions that can be used to guide data collection, organization and representation.

- Provide opportunities for the children to pose questions and collect data about themselves, e.g., likes and dislikes, the time they go to bed, number of people in their families, types of animals as pets, and measures such as arm span. Ask questions such as:

    1. What kind of information would it be important to know about ourselves? Why?

    2. What question could we ask to find out that type of information?

2. Collect and systematically organize and represent the data that answers the questions using lists, charts and tables, tallies, glyphs (coded pictures) picture graphs, and bar graphs.

- Once data have been collected, ask questions such as:

    1. How should we group the information or data?

    Example: Have the children draw pictures of the pets they have or wish they had and then decide how to group the pictures. Different classifications would produce different graphs, such as grouping by type of pet, by type of body covering such as fur, feather, skin or scale, or by the number of legs.

2. Use the pictures to create class picture graphs that answer the questions posed.

Have the children reflect on their organization of data and justify their selection with talking, writing or with pictures.

- Have children collect data and complete graphic organizers that answer the question: How much time do we spend reading?
- Have the children examine scoops of various brands of raisin bran cereal to make inferences about the "best" or "worst" brand of cereal. The children should count and record the number of raisins in each scoop and display the data in a bar graph.
- Read *Cactus Hotel* and gather and graph data of the life cycles of the various plants and animals.

❖ **Possible Assessment Opportunities**

❖ Have the children help the school librarian figure out what books to order for first graders

The children should work in small groups to develop a survey that will help identify the types of books first graders like to read. Children survey other first graders and collect the data, keeping track of responses using tally marks. Have each group organize the collected data into a bar graph compose a recommendation to share with the librarian.

COMPONENT STATEMENT: 4.2. ANALYZE DATA SETS TO FORM HYPOTHESES AND MAKE PREDICTIONS.

Grade-Level Expectations

3. Describe data that have been organized and make comparisons using terms such as largest, smallest, most often or least often.

⁓ *COMPONENT STATEMENT: 4.3. UNDERSTAND AND APPLY BASIC CONCEPTS OF PROBABILITY*

Grade-Level Expectations

4. **Describe and explain the likelihood of the occurrence of various events in the student's world using terms such as possible, impossible, likely, unlikely or certain.**

    - Ask children to describe the likelihood of various events. Use examples such as: it will rain tomorrow, you will have two birthdays this year, three children will be absent tomorrow, a rock dropped in water will sink.

    - Provide each child with "certain" and "impossible" cards which they display when presented with a series of situations such as landing on red when a spinner is all red or landing on red when the spinner is colored only yellow and green.

5. **Engage in simple probability activities and games including the use of number cubes and spinners; record, graph and describe the results of the activities and games.**

    - Have children predict how often heads and tales come up when a coin is tossed. While working in pairs, toss a coin 10 times and tally the number of heads and tails. Make a class record of the results by combining the tallies. Compare the class results with the predictions

    - Have the children roll a number cube; spin a spinner, or reach blindly into a container to select a colored marble (that is returned to the bag), a dozen times. They then color the appropriate square in a bar graph for each pick. Ask questions such as:

        1. Did some results happen more often or less often than others?

        2. Do you think some results are more likely to happen than others?

SAMPLE INTEGRATED LESSON – OUR TOWN

Context: Your class has been asked to describe your town for the local newspaper. The class has been asked to tell about specific types of geographical features such as mountains, lakes, meadows, forests and farmland. You must also describe man-made features such as roads, parks and buildings. You can only use information from the spaces near your neighborhood and school to help you describe your town.

Objective: Children will identify major physical and man-made features of their town using data they have identified and collected from areas around their home, neighborhood and school. Children will make generalizations about their town based on the data they have collected.

Materials: State map, town or city map, K-W-L graphic organizer (Know, Want to know, Learned)

Procedure:

1. Discuss, define and list geographical and man-made features.
2. Brainstorm why geographical features might be important to a town or to other places the children may know.
3. Access prior knowledge about man-made and geographical features in your town, doing a K-W-L chart with the children
4. Brainstorm categories with the children that would be appropriate for classifying the information from No. 1 above.
5. Locate your town on a state map and discuss its relationship to other places the children may have heard of or visited in the state.

   Ask the children:

   a. What other towns or places are near our town?
   b. How are they like our town? How are they different?
   c. Are there other towns that you have visited that are very different from our town?
   d. Do you know what area of the state your town is located in? What region of the country your state is located in?
6. Have the children observe their yards or areas near their home and describe the geography and man-made features.

7. Discuss ways to categorize the items described in No. 6.

8. Ask questions such as:

    - How do you know these are all related?

    - What are the differences between the features?

9. Create a class pictograph of the types and the number of features of the children have identified.

❖ **Possible Assessment Opportunities**

❖ Make generalizations about the features of our town from data and graphs. Investigate other towns and make comparisons about similar features, such as parks, hills, bodies of water, trees, types of buildings, etc.

Intervention: Make comparisons about the neighborhood where they live and the area around the school. Comparisons could also be made between the child's neighborhood and that of a friend or relative, if they are not the same location.

Challenge: Research another town or geographic location with different physical and man-made features. Create a second pictograph with this information and make comparisons to the data they collected about their town. Represent and display the same information in a different way.

❖ Have the children observe and record the types and number of wild animals (such as birds, squirrels or deer) they saw in their town over a specific period of time, or they could research the types of animals in geographic area. They can then make a pictograph of their data and make generalizations about the animals in their town.

Intervention: Provide children with pictures and a list of animals that might be found in their neighborhood. Children record sightings by placing check marks next to each animal listed. Use the same pictures to create pictographs.

Challenge: Investigate another area of the country using print and electronic resources. Make a pictograph of the findings, and compare to the results from the town. Offer possible reasons for the differences and or similarities.

Interdisciplinary Framework Connections			
English/Language Arts	**Social Studies**	**Visual and Performing Arts**	**Physical Education**
• Organize information in proper sequence to use in a summary and/or retelling. • Generate and respond to questions. • Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.). • Use oral language with clarity and voice to communicate a message. • Research information from multiple sources for a specific purpose. • Determine purpose and choose an appropriate written, oral or visual format. • Publish and/or present final products in a myriad of ways, including the use of the arts and technology. • Use appropriate language as related to audience.	**Humans and Environment Interaction** • Explain ways in which humans use and interact with environment, e.g., how we use sorting in our everyday life, such as sorting our clothes by seasons). • Define and identify natural and human characteristics of places. • Locate major physical and human features in the New England region and the United States (e.g., sort , classify and graph items such as roads, mountains, lakes, buildings, etc.).	**Art** • Use different media techniques and processes to communicate ideas, feelings, experiences and stories. • Use elements of art and principles of design to communicate ideas. • Select and use subject matter symbols and ideas to communicate meaning (e.g. use art materials to create sorting pictures, such as cutting out pictures and sorting them, creating pictures of shapes, making collages, etc.).	**Responsible Behavior** • Follow class rules, activity-specific rules, safety practices, procedures, etiquette and good sportsmanship in various physical activity settings, (e.g., identifying and categorizing the rules for indoor and outdoor activities).

Vocabulary: sort, alike, different, objects, diagram, picture graph, pictograph, bar graph, data, collect, organize, tally, tally marks, largest, smallest, most often, least often, glyphs, likely, unlikely, certain, impossible, tables, charts,

Resources:

Electronic Resources:

Eye to Eye: http://illuminations.nctm.org/LessonDetail.aspx?ID=L169

A Shoe In: http://illuminations.nctm.org/WebResourceReview.aspx?ID=5

Exploring Data: http://mathforum.org/workshops/usi/dataproject

Making Glyphs: http://illuminations.nctm.org/LessonDetail.aspx?ID=L114

Our Favorites – Goals 2000

Popcorn Math – Goals 2000

Teacher References:

NCTM Algebra and Geometry Standards K-2

Engaging Young Children in Mathematics, by Douglas H. Clements

Adding It Up, by National Research Council

Project Learning Tree, by American Forest Foundation

Challenging Young Children Through Sorting & Classifying: http://www.findarticles.com/p/articles/mi_qa3673/is_200410/ai_n9429975

Children's Literature:

Guess Who My Favorite Person Is, by Byrd Baylor

Cactus Hotel, by Brenda Guberson

The Mouse Who Owned the Sun, by Sally Derby

Daley B, by Jon Blake

Chickens Aren't the Only Ones, by Ruth Heller

No Fair, by Carol Holtzman

Notes:

Grade 2

CONTENTS

The Learner at This Level

THE SECOND-GRADE CHILD:

- Enjoys games and working with manipulatives.
- Likes working alone and slowly.
- Needs to have closure and complete an assigned task.
- Relies on the teacher for help.

Chip Wood. *Yardsticks: Children in the Classroom Ages 4-14*. pages 74-75

ALGEBRAIC REASONING

- Explores the pattern in part-whole activities that establishes connections to addition and subtraction.
- Recognizes that the = symbol in equations means a relationship, not just instructions to compute.
- Describes simple ratios in patterns using models or pictures.
- Begins to translate verbal information into algebraic expressions.

NUMERICAL AND PROPORTIONAL REASONING

- Uses base-10 models and pictures to show the quantitative value of a number.
- Begins to see a group of 10 as a single set, named "a ten."
- Needs many experiences with and without models over a long period of time to develop a deep understanding of large numbers.
- Masters basic addition and subtraction facts by using their inverse relationship, efficient strategies and the commutative property (addition only).
- Uses place value charts and models to further develop the written number name and number symbols.
- Uses number patterns, pictures, arrays and other models to explore multiplication and division.
- Begins to estimate using number meanings, models, basic facts, and mental computation, rather than rules for rounding.
- Represents the relationship between the equal-size pieces and the whole or set using models.
- Develops an understanding of fractional parts and the relationship between the numerator and the denominator using models, familiar objects and fraction sentences.
- Uses benchmark numbers to develop patterns to explore estimation strategies.

GEOMETRY AND MEASUREMENT

- Can compose and decompose two-dimensional shapes, e.g., combining a square and a triangle to make a pentagon or finding two congruent triangles in a rectangle.
- Begins to quantify attributes of objects.
- Has the ability to measure length as an iteration of units.
- Recognizes the relationship between the size of the unit and the number of units needed to represent a given length.
- Understands the need for standard units of measure and uses measuring instruments such as rulers, scales and clocks.
- Begins to read an analog clock using the skill of "reading a meter" with a pointer on a numbered scale.

WORKING WITH DATA

- Begins with real or hands-on graphing experiences and moves to representational and symbolic graphing.
- Builds decision making along several dimensions at the same time:

    1. What question are we answering?
    2. What is a good attribute? Why am I choosing this unit?
    3. What is an appropriate procedure?
    4. What instrument is needed to count the units? (Jensen, p. 180)

- Needs ongoing experiences of increasing complexity in organization and summarization through graphing.
- Records information through multiple graphic representations (e.g., two column graph, Venn diagram, pictograph).

Mathematics Background for Teachers

MATHEMATICS BACKGROUND FOR GRADE 2 TEACHERS

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS

Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

Central Understanding: Relationships shown through number patterns extend the understanding of number properties and operations.

Background: Translating the procedures and rules that govern patterns into mathematical expressions establishes the connection of patterns to algebraic representations. Conceptual understanding and procedural fluency are intertwined and equally necessary to support the examination of patterns. The exploration of the structures of our number system leads to the ability to discover relationships and make generalizations. These generalizations make apparent the connections between and among numeric and geometric concepts.

NUMERICAL AND PROPORTIONAL REASONING

Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

Central Understanding: In the base-10 numeration system, number relationships can be described and represented in a variety of ways to support conceptual understanding and computation.

Background: Base-10 numeration includes counting in units and multiples of ones, tens and hundreds as representation of one quantity or number. Many of the ideas that contribute to computational fluency and flexibility with numbers are extensions of how numbers are related to 10. Decomposing and composing a number leads to efficient ways to think about quantities and computation. When numbers are taken apart and recombined displaying different relationships, basic facts are easier to remember. Similarly, the inverse relationship of addition and subtraction are reinforced.

GEOMETRY AND MEASUREMENT

Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

Central Understanding: Attributes can be compared by applying measurement to an object, situation or event.

Background: Measuring units depends upon and strengthens understanding of number through counting and comparison. Standard units of measurement become common referents for identification and description of objects. Geometric shapes and solids are identified, composed and decomposed based upon attributes and measurement.

WORKING WITH DATA: PROBABILITY AND STATISTICS

Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

Central Understanding: The same information can be organized in different ways.

Background: The gathering of data should be based on student-generated questions. The question to be answered must be formulated clearly to direct an investigation. In order to make data collection meaningful, it is necessary to identify an attribute or characteristic that can be measured. Different classifications of the same attributes will produce different organizations of the information or data collected.

Correlated Grade-Level Expectations

Click here to access correlated grade-level expectations for Grade 2 on the State Department of Education Web site.

Sequenced Grade-Level Expectations

GRADE 2 SEQUENCED GLES

Grade-Level Expectations	Fall	Winter	CMT	Spring
ALGEBRAIC REASONING				
1.1 Understand and describe patterns and functional relationships.				
1. Sort, classify and order objects and numbers in more than one way and by one and two attributes and describe the rule used. Use attributes such as size, shape, color, texture, orientation, position and use; and characteristics such as symmetry and congruence.				
2. Recognize, extend, and create repeating, growing, number; e.g., skip counting, odd/even, counting on by 10; and one and two attribute patterns. Describe the pattern and the rule used to make it.				
3. Replicate the pattern using a different representation, e.g., letters to numbers.				
4. Use patterns and the rules that describe the patterns to identify a missing object, objects with common or different attributes, and the complement of a set of objects.				
5. Analyze and describe observable changes in patterns using language that describes number characteristics and qualitative characteristics such as attributes, orientation and position.				
1.2 Represent and analyze quantitative relationships in a variety of ways.				
6. Model real-life situations that represent the addition and subtraction of whole numbers with objects, pictures, symbols and open sentences.				
1.3 Use operations, properties and algebraic symbols to determine equivalence and solve problems.				
7. Demonstrate an understanding of equivalence or balance of sets using objects, models, diagrams, numbers whole number relationships (operations) and the equals sign, e.g., 2 + 3 = 5 is the same as 5 = 2 + 3 and the same as 4 + 1 = 5.				
NUMERICAL AND PROPORTIONAL REASONING				
2.1 Understand that a variety of numerical representations can be used to describe quantitative relationships.				
1. Locate, label, compare, and order whole numbers up to 1,000 using pictures, place value models, number lines, and benchmarks of 0, 10 and 100, including naming the number that is 10 or 100 more or less than a given number.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
2. Represent whole numbers up to 1,000 by modeling and writing numbers in expanded forms, e.g., 37 = (3 x 10) + (7 x 1), and regrouped forms, e.g., (2 x 10) + (17 x 1) = 37, and use the forms to support computational strategies.				
3. Represent multiplication and division (with factors of 1, 2, 5 and 10) using a variety of models and strategies such as arrays, pictures, skip counting, extending number patterns, and repeated addition and subtraction; describe the connection between multiplication and division.				
4. Use a variety of models and familiar objects to compare, order and estimate parts of a whole using the unit fractions ½, ⅓, ¼.				
5. Use a variety of models to represent and describe parts of groups as unit fractions ½, through ⅒.				
6. Estimate and determine ½, ⅓, ¼ of a small group of up to 20 objects, such as finding ½, ⅓, ¼ of 12 cookies.				
7. Describe ratios in terms of the linear patterns that develop from the relationships between quantities, e.g., In a pattern of green, green, red blocks there are always two green blocks for one red block.				
2.2 Use numbers and their properties to compute flexibly and fluently and to reasonably estimate measures and quantities.				
8. Count whole numbers to 1,000 and beyond.				
9. Count on by tens from a given amount, e.g., 17, 27, 37, etc.				
10. Read and write numerals up to 1,000.				
11. Skip count by twos, fives, tens and hundreds to 1,000 and beyond.				
12. Determine whether a set of objects has an odd or even number of items by pairing objects and creating arrays.				
13. Create word problems and write and solve two- and three-digit number sentences that reflect contextual situations and real-world experiences involving addition and subtraction. Construct and solve open sentences, e.g., □ + 5 = 11. Solve the problems using a variety of methods including models, pictures, pencil and paper, estimation and mental computation, and describe the reasoning or strategies used.				
14. Solve problems using addition and subtraction facts involving sums and differences to 20 with flexibility and fluency.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
15. Add two-digit numbers with and without regrouping. Subtract two-digit numbers without regrouping and with regrouping using models.				
16. Determine when an estimate for a problem involving two- and three-digit numbers is appropriate or when an exact answer is needed.				
17. Use a variety of strategies to estimate solutions and to determine if a solution to a computation or word problem reflecting real-world experiences involving addition and subtraction of two- and three-digit whole numbers is reasonable.				
18. Determine and compare the value of pennies, nickels, dimes, quarters and half dollars.				
19. Count, compare and trade sets of pennies, dimes and dollars up to $10.00				
GEOMETRY AND MEASUREMENT				
3.1 Use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.				
1. Identify, describe and draw polygons (triangles, quadrilaterals including trapezoids and rhombuses, pentagons and hexagons), solids, and other familiar two- and three- dimensional objects in the environment.				
2. Compare and sort familiar polygons, solids, and other two- and three- dimensional objects in the environment.				
3. Construct polygons, solids and other two- and three-dimensional objects using a variety of materials and create two-dimensional shapes and designs with one or more lines of reflective symmetry (lines that divide the shape or design into two congruent parts).				
3.2 Use spatial reasoning, location and geometric relationships to solve problems.				
4. Investigate and predict the result of putting together and taking apart two- and three-dimensional shapes in the environment, e.g., use objects to find other shapes that can be made from three triangles or a rectangle and a triangle.				
3.3 Develop and apply units, systems, formulas and appropriate tools to estimate and measure.				
5. Know the months of the year in order and locate dates, days, weeks and months on a calendar. Use the information to write and solve problems involving calendars.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
6. *Solve problems involving telling time, including estimating and measuring the length of time needed to complete a task, to the half-hour using analog and digital clocks.*				
7. Use measurement tools such as thermometers to measure temperature, basic rulers to measure length to the nearest half-inch or centimeter, and balance scales to measure weight /mass in grams.				
8. Use nonstandard referents and standard benchmarks to estimate and measure the following: • length (to the nearest inch, half-inch, foot, yard, centimeter or meter); • area (in square inches); • capacity (in liters and cups); • weight (in grams); • temperature; and • volume (using water or sand).				
9. Describe the strategy used to determine an estimate and determine if the estimate is reasonable.				
10. Describe the relationships between and centimeter and meter among inch, foot and yard.				
WORKING WITH DATA				
4.1 Collect, organize and display data using appropriate statistical and graphical methods.				
1. Pose questions that can be used to guide data collection, organization, and representation.				
2. Collect and systematically organize and represent the data that answer the questions using lists, charts and tables, tallies, glyphs (coded pictures), picture graphs and bar graphs.				
4.2 Analyze data sets to form hypotheses and make predictions				
3. Describe data that have been organized and make comparisons using terms such as largest, smallest, most often or least often.				
4. Determine patterns and make predictions from data displayed in tables and graphs.				
4.3 Understand and apply basic concepts of probability				
5. Describe and explain the likelihood of the occurrence of various events. State possibilities, make predictions and test the predictions in practical situations.				
6. Conduct simple probability investigations involving activities of chance and games with number cubes and spinners; record, graph and describe the results of the investigations.				

Correlated GOALS 2000
Criterion Referenced Test

GRADE 2 CORRELATED GOALS 2000 CRT

The Goals 2000 Mathematics Curriculum was written as a companion to the 1998 Mathematics Framework. The Goals 2000 resources cited in this 2008 Model for Mathematics Curriculum are aligned to the 2005 Mathematics Curriculum Framework, 2007 Curriculum Standards and the fourth generation Connecticut Mastery Test.

The Grade 2 Criterion Referenced Test Part A from the Goals 2000 Mathematics Curriculum is aligned to the Grade 2 sequenced GLEs and can be used for pre- and post-assessment.

Please use the link below to access the electronic version of the complete document, which includes other activities, such as opportunities for open-ended and challenge experiences that must be examined for alignment prior to use.

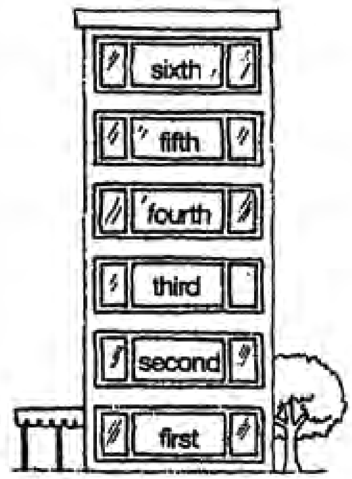
http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=321084

Grade 2 Mathematics CRT

GLE 1.1.1

1. Jan lives on the top floor.
   Todd lives 3 floors below Jan.
   Sue lives on the bottom floor.
   John lives 4 floors above Sue.
   Eric lives above Todd.
   Gina lives 2 floors below Eric.
   Gina lives on the second floor.

   Draw a picture of the building.
   Write the name of the person who
   lives on each floor.



GLE 2.2.14

2. What two numbers add up to 10 and also have a difference of 6?

   $\square + \triangle = 10$ $\quad\quad$ $\square - \triangle = 6$

   What number Is $\square$?

   What number is $\triangle$?

   Tell how you decided.

GLEs 2.1.1; 2.2.14

3. Copy the story.
   Fill in the shapes with numbers.
   The story must make sense.

> Rosa hopped □ times on her left foot.
> She hopped △ times on her right foot.
> She hopped ○ more times on her right foot than her left foot.

Which shape has the greatest number? Why?

GLES 2.2.14; 2.2.17

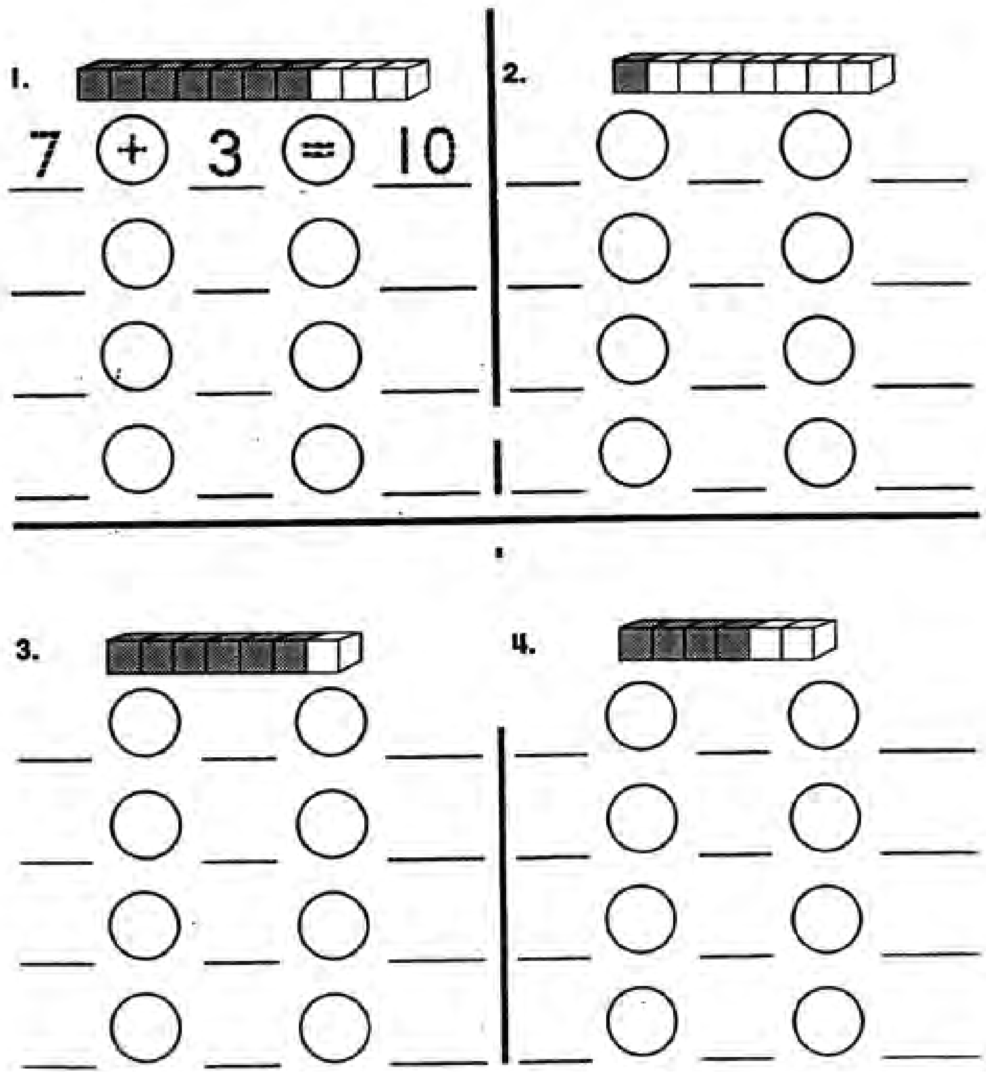
4. Show 2 ways to find the sum of all the numbers in the squares.

1	2	3	4
4	3	2	1

Compare your ways with a classmate.
Tell which way you like best and why.

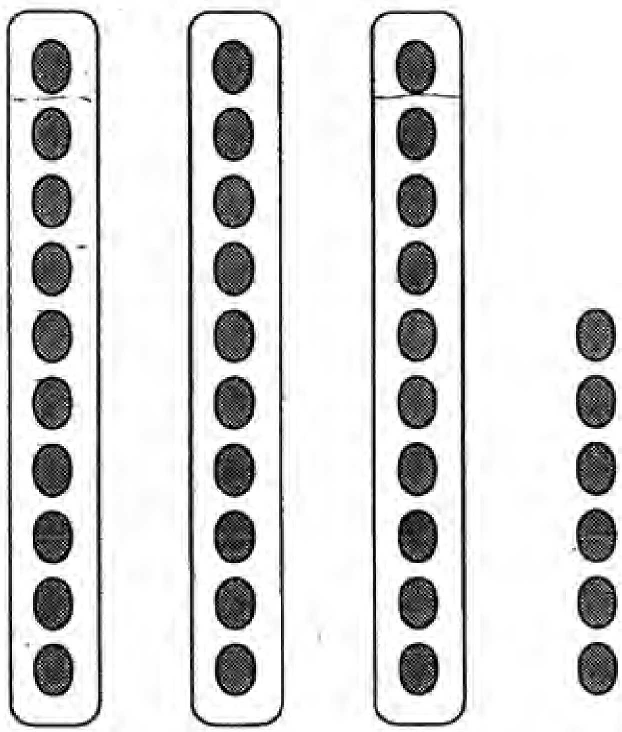
GLE 2.2.14

5. Fact Families. Write the fact families.



GLEs 1.3.7; 2.1.2

6.



What number is this? __________

Write it in expanded form. __________

If you add ten to the number, what number would you have? ________

Draw a beanstick picture to show the new number.

Write the new number in expanded form. _______________

GLEs 1.3.7; 2.1.2

7. Build different models for the number 24.

Use place value ten-rods and ones.

In each box draw a picture to show different ways to make 24.

Then fill in the number sentence to show the expanded form for each picture.

24	24	24
____ + ____ = 24	____ + ____ = 24	____ + ____ = 24

GLEs 1.2.7; 2.2.13; 2.2.14; 2.2.15

8. Choose your own number between 30 and 50.

   My number is ____________.

   Use ten-rods and ones to build the number in as many ways as you can.

   Draw a picture for each way and write a number sentence to go with it.

   Record your answers here. Use another piece of paper if needed.

   How do you know that you have shown all the possible ways?

GLE 2.1.1

9. Which is greater, 27 or 72? Explain why.

GLEs 2.1.2; 2.2.15

10. Fill in the blanks to show 3 different ways to solve the same problem 24 + 33.

a. 24 + 33 = ________________

b. 24 + 33 = ________________

c. 24 = ______
+ 33 = ______

_____ + ____ = _____

GLEs 2.2.15; 2.2.17

Show 2 different ways to do this problem: 32 + 46.

GLEs 2.1.2; 2.2.15

11. Finish this sample problem.

$$\begin{array}{rcl} 54 & \longrightarrow & 50 + 4 \\ \underline{+37} & \longrightarrow & \underline{30 + 7} \\ & & 80 + 11 = \_\_\_\_\_\_ \end{array}$$

Fill in the blanks.

$$\begin{array}{rcl} 46 & \longrightarrow & \underline{40} + \_\_\_ \\ \underline{+28} & \longrightarrow & \_\_\_ + \underline{8} \\ & & \overline{} \\ & & \_\_\_ \; \_\_\_ = \_\_\_ \end{array}$$

$$\begin{array}{rcl} 36 & \longrightarrow & \_\_\_ + \_\_\_ \\ \underline{+19} & \longrightarrow & \_\_\_ + \_\_\_ \\ & & \overline{} \\ & & \_\_\_ \; \_\_\_ = \_\_\_ \end{array}$$

GLEs 2.2.13; 2.2.14

12. Four cats were sitting on the deck.
Two cats jumped off.
How many cats are on the deck now?

Write the number fact sentence that you would use to solve the problem.

____

a. Write your own story problem to go with this number sentence.

$4 + 2 =$ ______

____

____

____

b. What is the answer to your problem?

GLEs 2.2.13; 2.2.15

13. Erik had 27 picture books.
    He gave 12 of the books to Janice.
    How many books will Erik keep?

    Write a number sentence to solve the problem. ______________

    a. Complete this number sentence.

       45 – 23 = _________

    b. Write a story problem to match the number sentence in problem 2.

       ____

       ____

       ____

       ____

GLEs 2.2.13; 2.2.15

14. Alexis has 32 gummy fish.
    Jed has 14 of them.
    How many more gummy fish does Alexis have?

    Write a number sentence to solve the problem. ______________

    a. Solve the equation.

    51 – 19 = _________

    b. Write a story problem to match the number sentence in problem a.

    ____

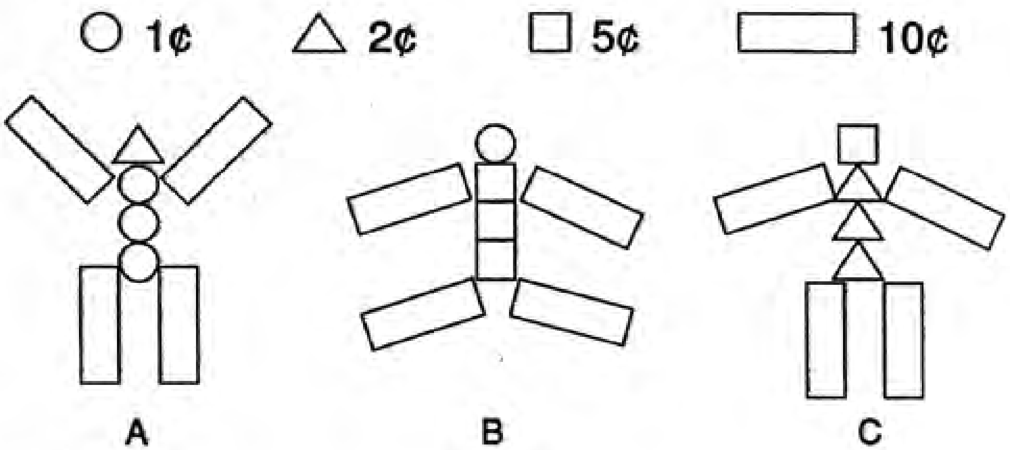
    ____

    ____

    ____

GLE 2.2.19

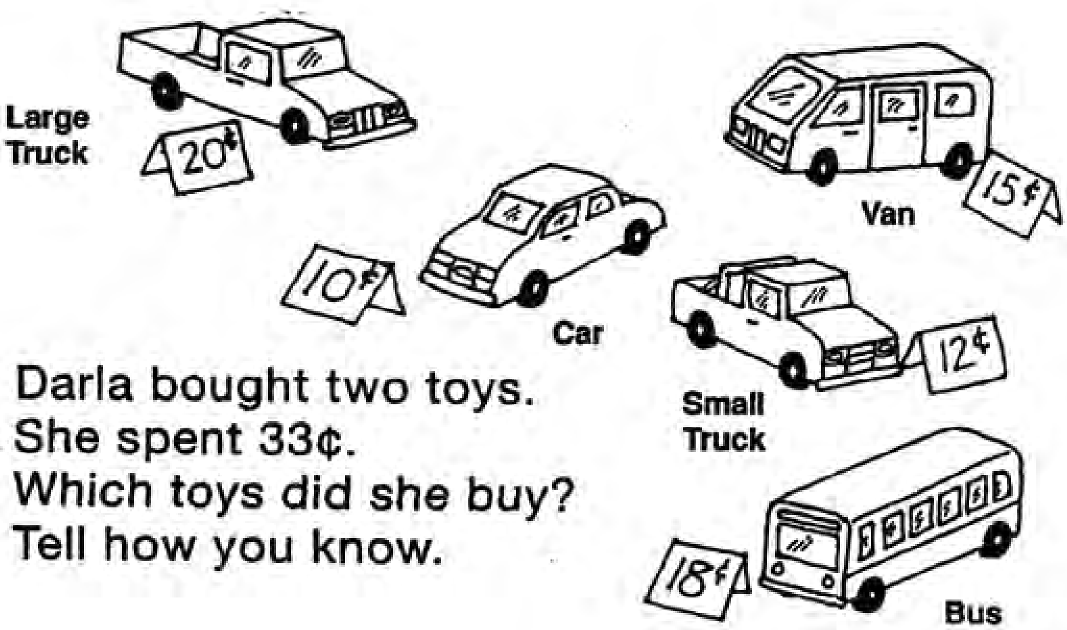
15. Which sticker doll costs the most?
Cost of shape stickers:



Tell how you know.

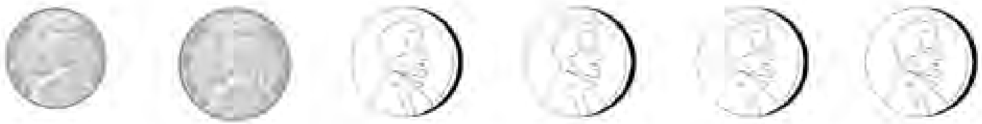
GLE 2.2.19

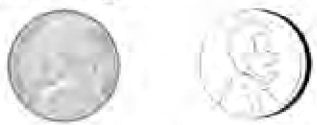
16.



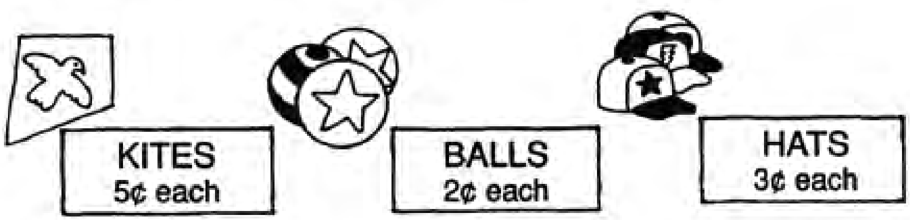
Darla bought two toys.
She spent 33¢.
Which toys did she buy?
Tell how you know.

GLEs 2.2.18; 2.2.19

17. Chris had 

Chris bought two things.
Now Chris has 

What do you think Chris bought? ______________________



If Chris had bought three things, what could he have bought?

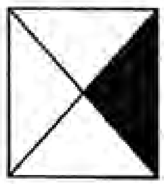
GLE 2.2.18

18. Fred has 8 nickels.
    Ted has 7 dimes.
    If Ted trades Fred for all the nickels, how many dimes should Ted give Fred?

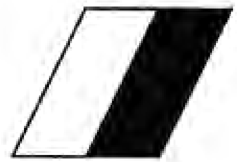
    Explain your thinking.

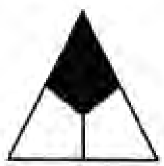
GLE 2.1.4

19. Draw lines to match each shaded part with its fraction name.

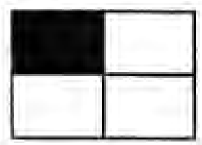


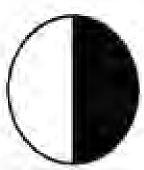
$\frac{1}{3}$



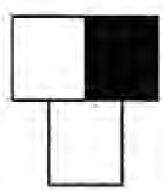


$\frac{1}{2}$





$\frac{1}{4}$



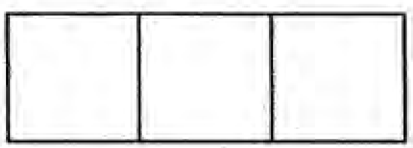
GLE 2.1.5; 2.1.6

20. Is the shaded part ½ ?

Explain. ____

____

**a. Label each part of the shape with its fraction name.
Write the matching fraction sentence.**



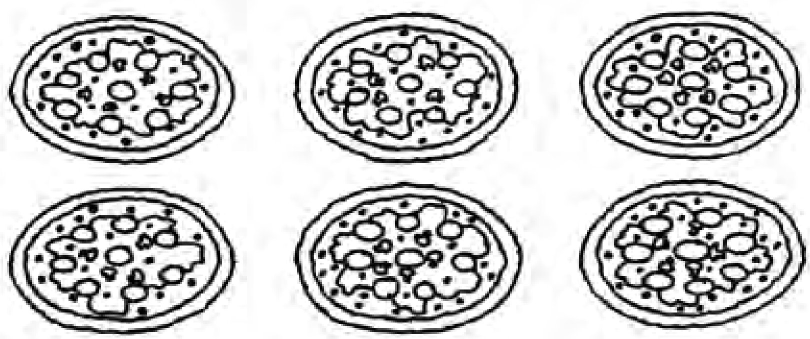
______ + ______ + ______ = 1

**b. You have 8 balloons.
Half of the balloons pop!
How many balloons are left?** ______

Draw a picture and use it to solve the problem.

GLEs 2.1.4; 2.1.6

21. Four people want to share these six pizzas.
Give each person the same amount.
Show and tell how you would do this.



Could you do this problem in another way?
Draw 6 more pizzas and show and tell how.

GLE 2.1.5

22. Would you rather have one-half of the melon or one-third of the melon? Why?

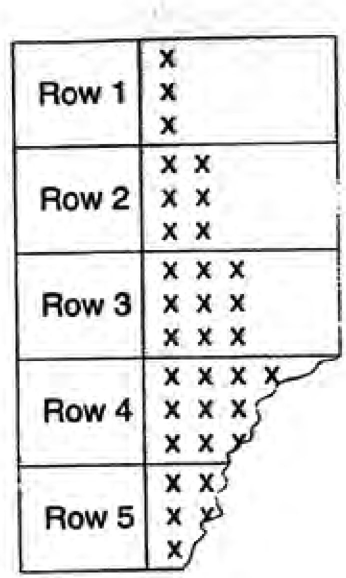
Why would someone make a different choice?

GLEs 1.1.4; 2.1.7

23. Mr. King bought more than one fruit basket like this one.
He got 8 apples in all.
How many oranges, pears, and grapes did he get?
Tell me how you know.

GLEs 1.1.2; 1.1.4; 2.1.7

**24. How many x's are in Row 5?
Tell how you decided.**



GLE 2.1.3

25. Fill in the blanks.

a.

x x x x x x

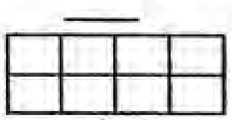
_____ + _____ + _____ = _____

3 groups of _____ = _____

3 x _____ = _____

---

b.

2 

$2\overline{)10}$

2 x _____ = _____

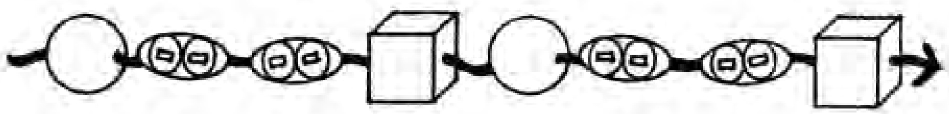
GLE 2.1.3

26. Brad put cookie dough on a baking sheet.
He made 4 rows of cookies.
Each row had 5 cookies.
How many cookies did he put on the baking sheet?

Draw a picture of the cookie sheet and use it to solve the problem.

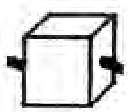
GLES 1.1.2; 2.1.3; 2.2.17; 2.2.18

27. Jane made a bread chain.
    There are 20 beads in her chain.
    Look for her pattern.
    How many  are in her bead chain?
    Tell how you know.



 beads cost 2¢ each.

 beads cost 5¢ each.

 beads cost 10¢ each.

How much will Jane spend to make her 20-bead chain?

GLEs 1.1.2; 1.1.4; 1.1.5

28. Count and write a number in each empty square.

1	2	3	4
5	6		
9			
13			

a. Describe a pattern going across ⟶.

____

____

b. Describe a pattern going down↓.

____

____

GLEs 1.1.2; 1.1.5

29. Fill in the blanks to extend the pattern.

0, 3, 6, 9, _____, _____, _____

Write the rule for the pattern. _______________________________

____

GLEs 1.1.4; 1.1.5; 2.1.7

Fill in the T-table.

Dogs	Legs
1	4
2	8
3	12
4	_____
_____	_____
_____	_____

Describe the rules, or patterns, in the T-table.

____

____

GLEs 1.1.2; 1.1.3; 1.1.4; 1.1.5

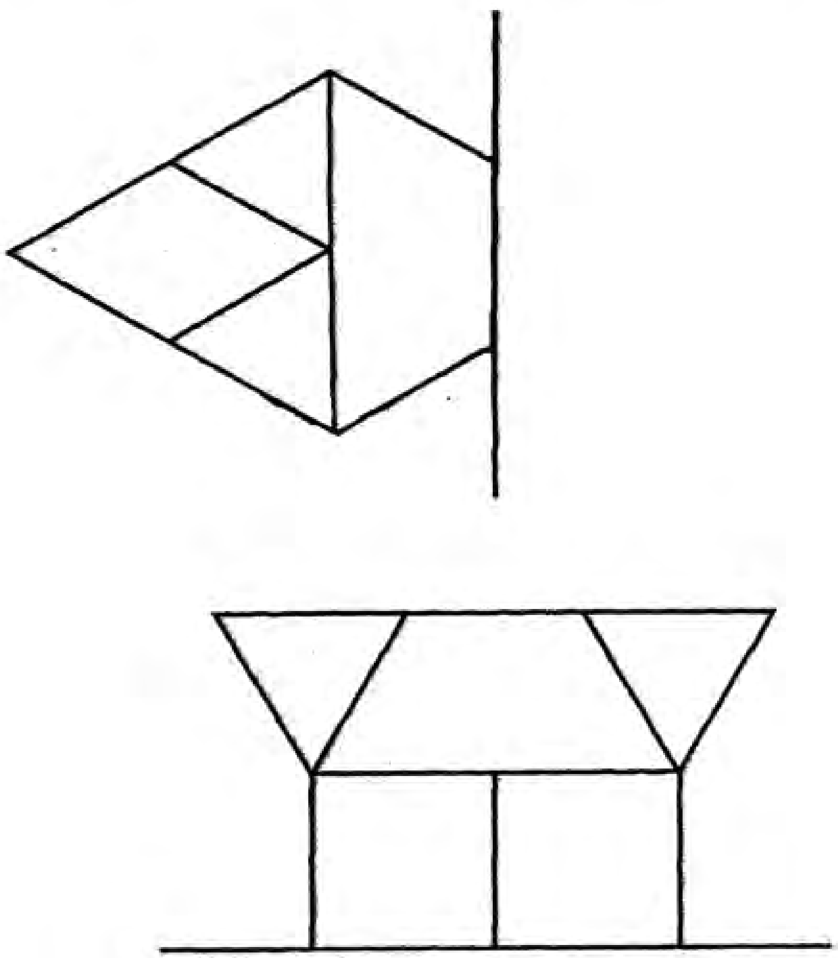
30. Look for the pattern. Fill in the blanks.

Use the rule to make up your own.

4	14	13
7	17	16
3	13	12
6	___	15
1	11	___
___	18	17
24	34	33
53	63	___
35	___	44
20	___	___

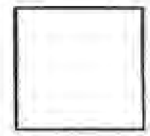
GLE 3.1.3

31. Cover the shapes with Pattern Blocks. Build the other half.
    Use the line of symmetry. Trace each shape. Color.

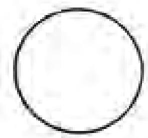


GLEs 3.1.1; 3.1.3

32. Draw a smaller square inside the square.

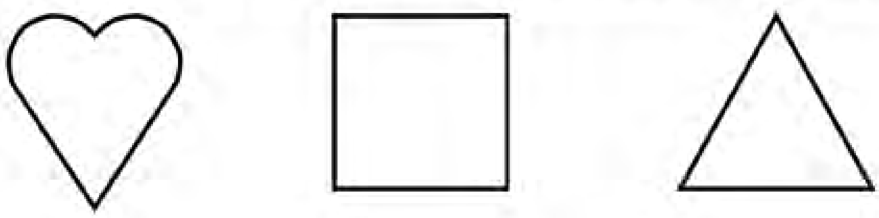


a. Draw a triangle inside the circle.

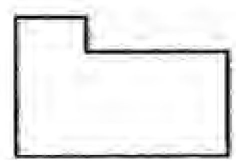


b. Draw a rectangle.

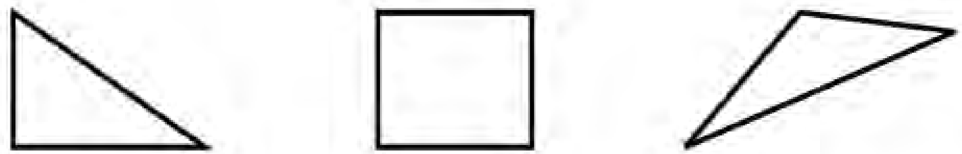
c. Draw one or more lines of symmetry inside each shape.



d. Draw a shape congruent to this one.



GLEs 3.1.1; 3.1.2

33. 

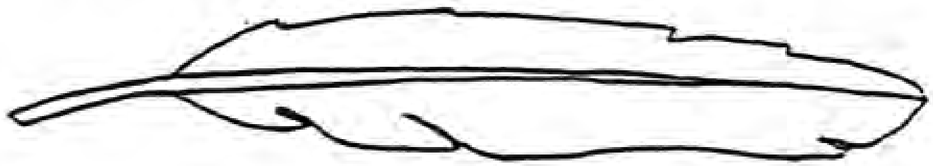
A B C

a. Andy says that Shapes A and C belong together. Why?

b. Brianna says that shapes A and B belong together. Explain why she also is correct.

GLEs 3.3.8; 3.3.9; 3.3.10

34.



If you measured the feather with centimeters and also measured it with inches, would the measurements be the same, or different?

Explain. ____

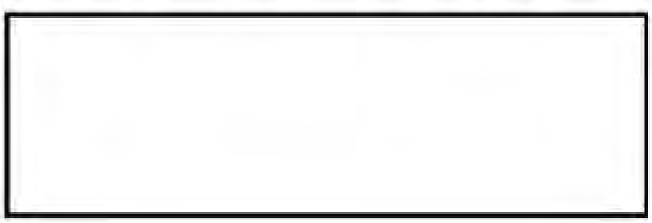
____

Estimate about how many beans long is the feather.  ____

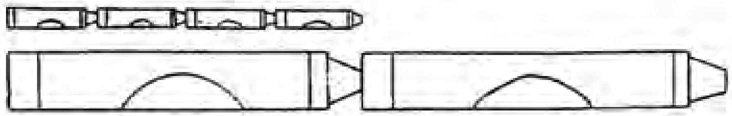
Tell how you made your estimate. ____

____

About how many beans would fit inside to cover the rectangle? ____



GLEs 3.3.8; 3.3.9

35. 

How many small crayons make one big crayon? ____________________

How many small crayons make two big crayons________________

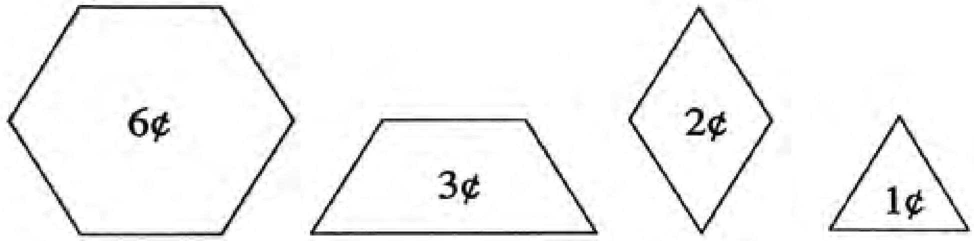
Explain how you found the answer.

Estimate how many small crayons will make three big crayons. __________

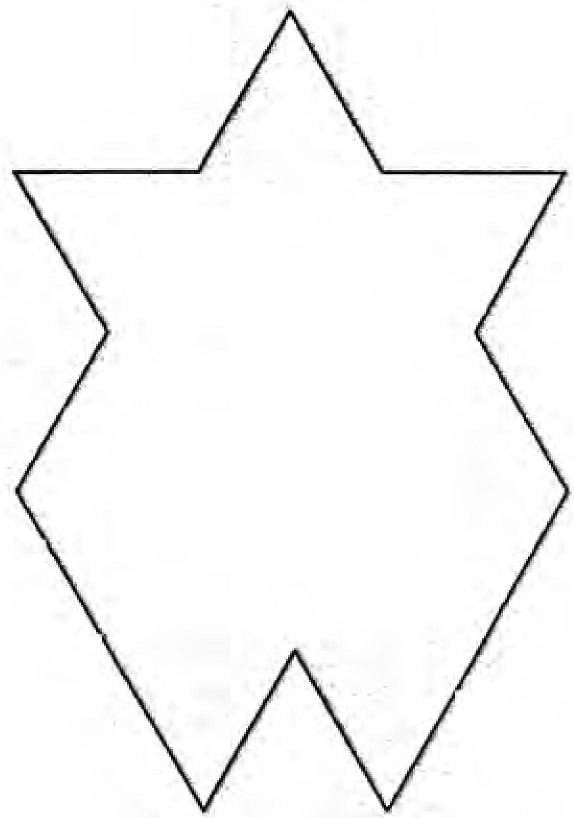
Estimate how many small crayons will make four big crayons. __________

GLEs 2.2.18; 2.2.19; 3.1.1; 3.2.4

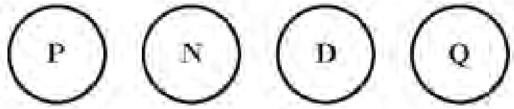
36.



Notice that each pattern block shape has a value. Explore filling this shape with pattern blocks.

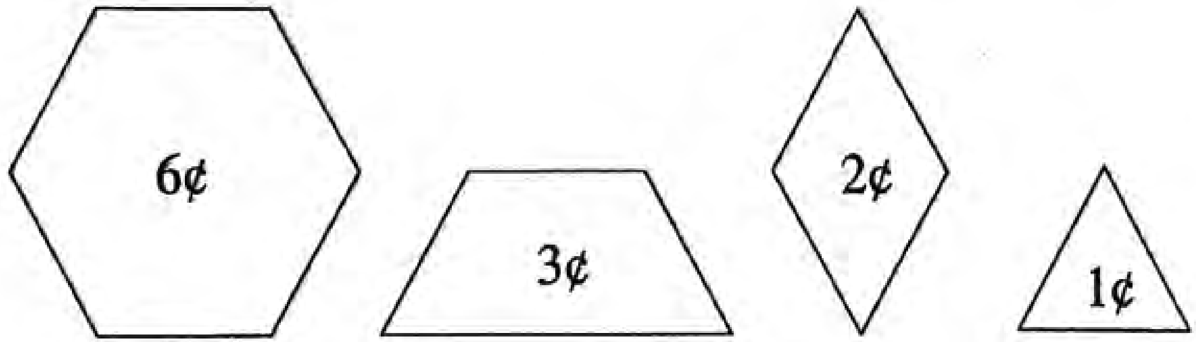


Now find out how much it costs to fill the design.
Show the set with the fewest coins that you would need to pay for the shape.
Use drawings like these coins to tell about the amount.



GLEs 3.1.1; 2.2.19; 3.1.3

37.



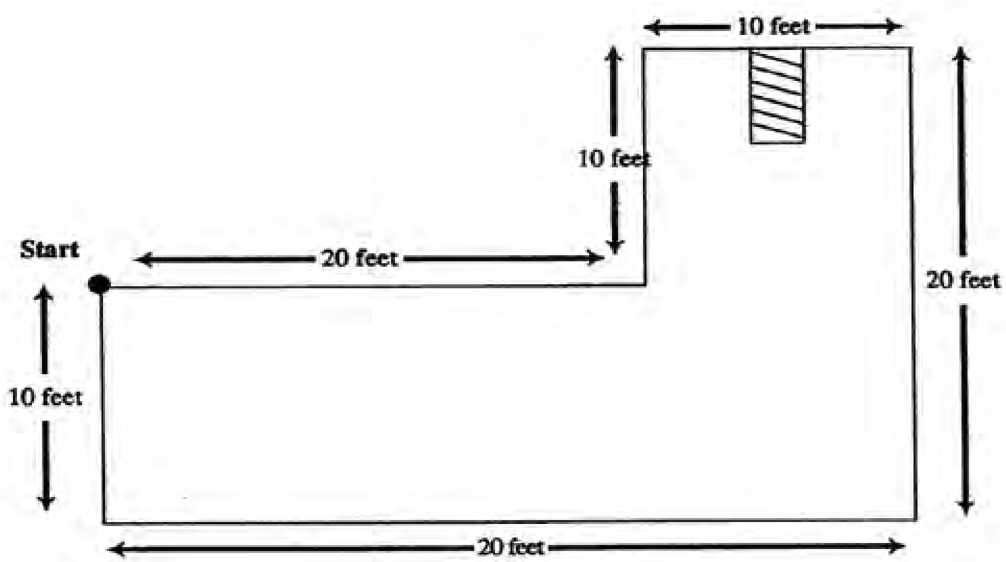
Design your own shape.
It must cost exactly 25¢. Use real pattern blocks to plan your design.
Then use the pattern blocks to record your design.

Tell how you would convince someone that your shape costs 25¢.________________________

____

GLEs 2.2.15; 3.3.8

38. Eldridge walked around the perimeter of the swimming and diving pool. How far did he walk?



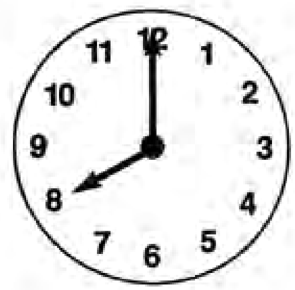
GLE 3.3.6

39. Match each clock face to the time.

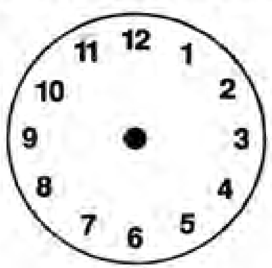
8:00

3:30

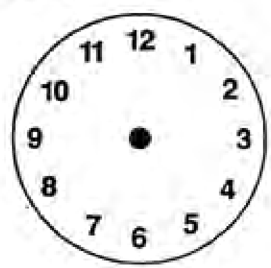
11:00



Draw on the clock face to show the time.



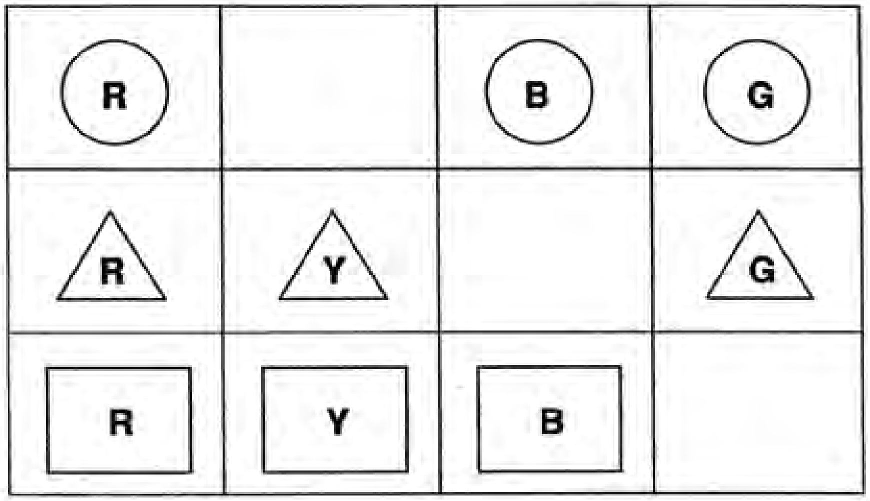
5:00



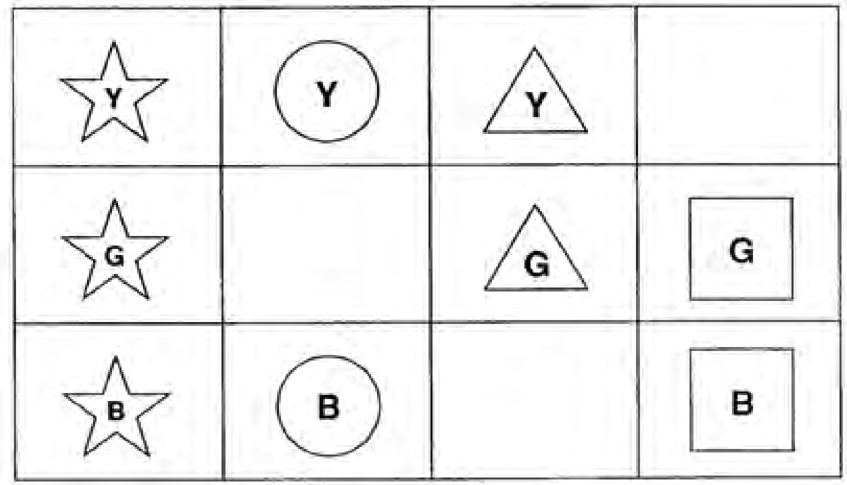
7:30

GLEs 3.1.3; 1.1.4

40. Draw the missing shapes and label them.



Draw the missing shapes and label them.



GLEs 4.1.2; 4.2.3

41. Colors of Jelly Beans in one bag.

Red	~~////~~ ////
Green	////
Pink	~~////~~ /
Yellow	~~////~~ ///

Tally Marks:	/ equals one jelly bean. ~~////~~ equals five jelly beans.

a. Use the data in the table to complete a bar graph below.

Red												
Green												
Pink												
Yellow												

Use the graph to answer the questions.

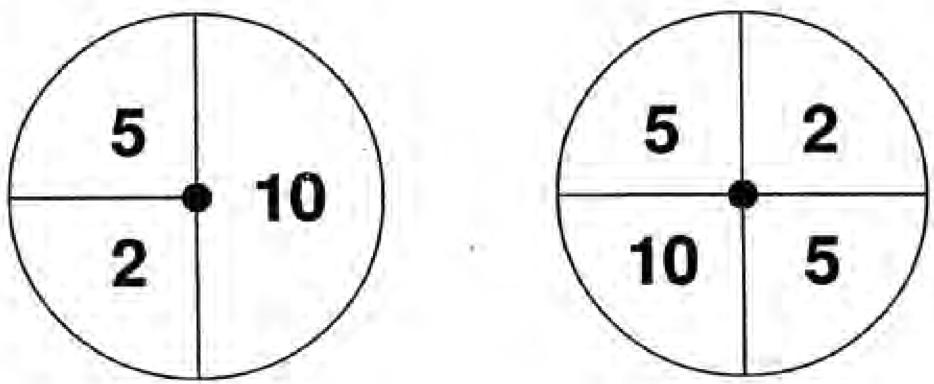
b. Which color is the most? ____________________ Which color is the least? ____________________

c. How many more pink than green jelly beans are in the bag? ____________

d. Write something else about the graph. ____

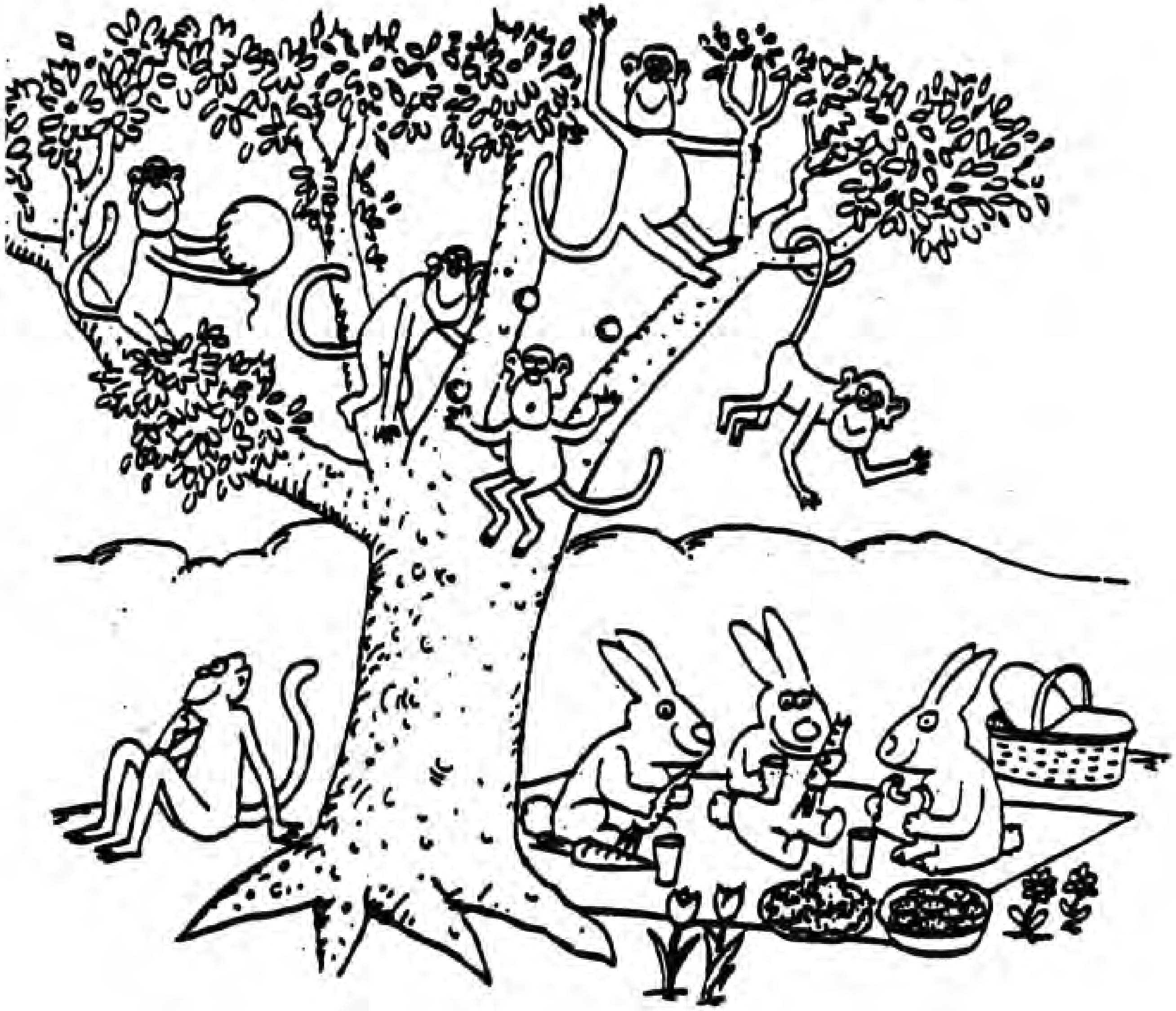
GLE 4.3.6

42. You have a choice of Spinner A or Spinner B.
To win, you must land on a 10.
Which spinner would you choose?
Explain why.



GLE 2.1.3

43. Use the picture below to answer the questions that follow.



a. Circle each monkey. Write how many there are. _______________

b. How many monkeys and bunnies are there? _______________

c. How many more monkeys than bunnies are there? _____________

d. How many bunny ears are there? Write a number sentence to show how you got your answer.

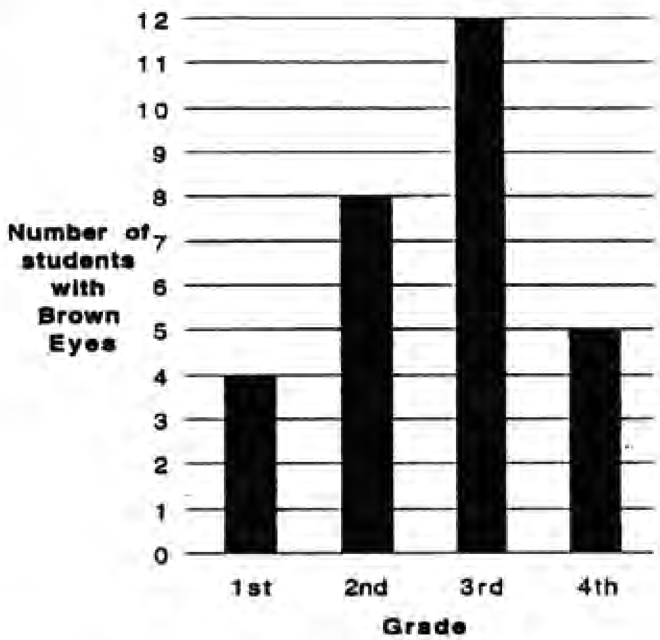
____

____

____

GLE 2.1.1; 4.2.3

44. Use the graph below to answer the following questions.



a. How many 1st graders have brown eyes? ____________________

b. What grade has the least number of students with brown eyes? ___

c. How many more 3rd graders have brown eyes than 2nd graders? ___

d. If the 1st and the 4th grades are combined, do they have more children with brown eyes than the 2nd grade? _______________

Write how you know. ____

____

e. Write another question that could be answered by the graph. ____________________

____

GLEs 1.1.2; 1.1.4

45. Write the missing number in the blank.

43, 53, _____, 73

a. How did you find the missing number? ______________________

____

b. Write the missing numbers in the blanks.

55, 50, 45, 40, _____, _____, _____

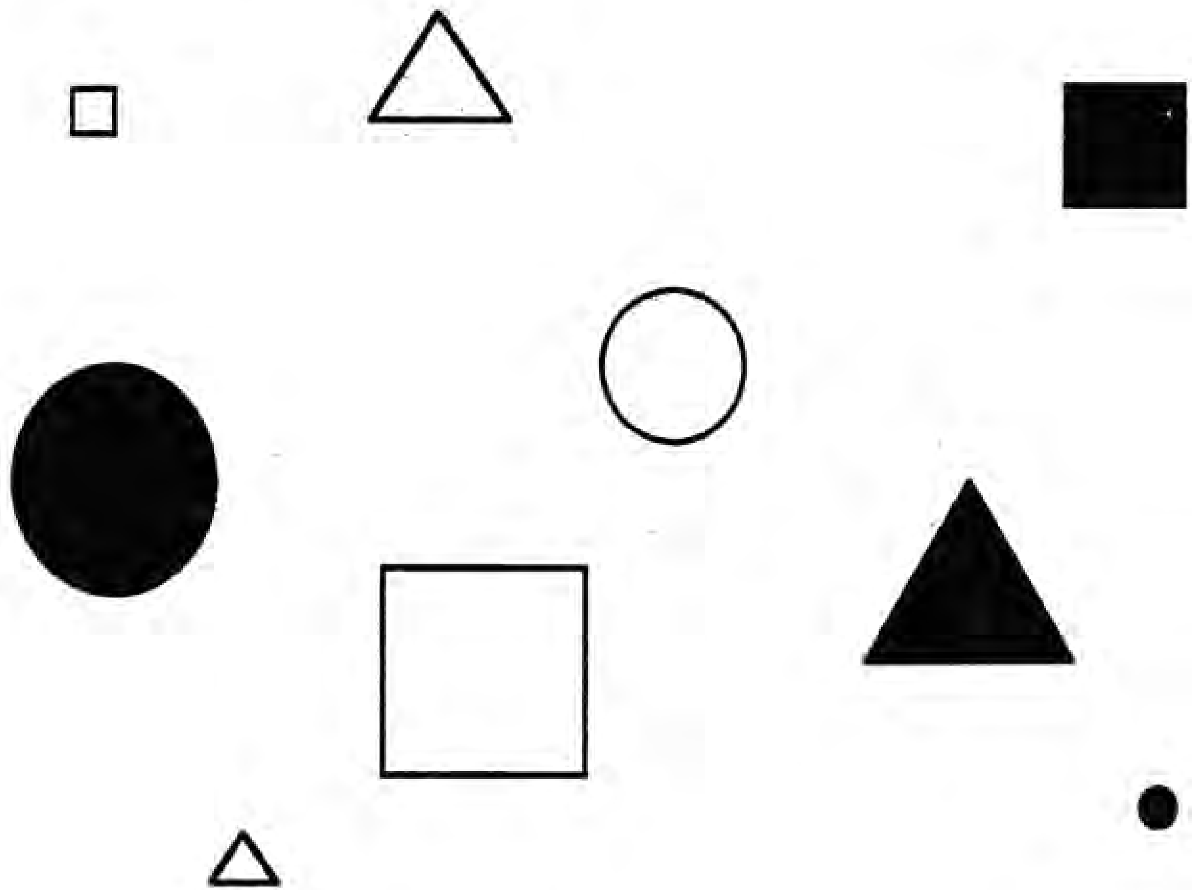
How did you find the missing numbers?______________________

____

GLEs 1.1.1; 3.1.1; 3.1.2

46. Look at the shapes.

a. Show how you would sort them into three groups.
   Write what the shapes in each group have in common.



GLE 1.1.2

47. Mac got a new plant.
    In April he counted 5 leaves.
    In May there were 10 leaves.
    In June he counted 15 leaves.
    In July there were 20 leaves.

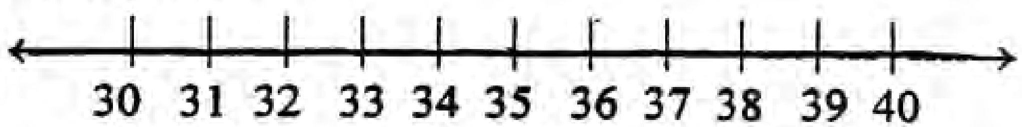
    a. How many leaves do you think there were in August? ___________

    b. Why do you think that? ________________________________

    ____

GLEs 2.1.1; 2.2.17

48. Sandy picked 38 carrots. Did she pick about 30 or about 40 carrots?
    Write how you know.

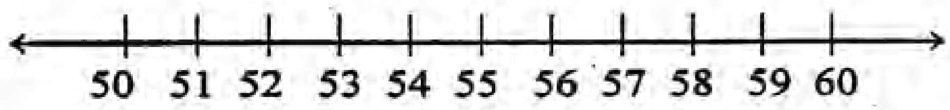


____

____

GLEs 2.1.1; 2.2.17

49. Larry picked 53 tomatoes. Did he pick about 50 or about 60 tomatoes? Write how you know.

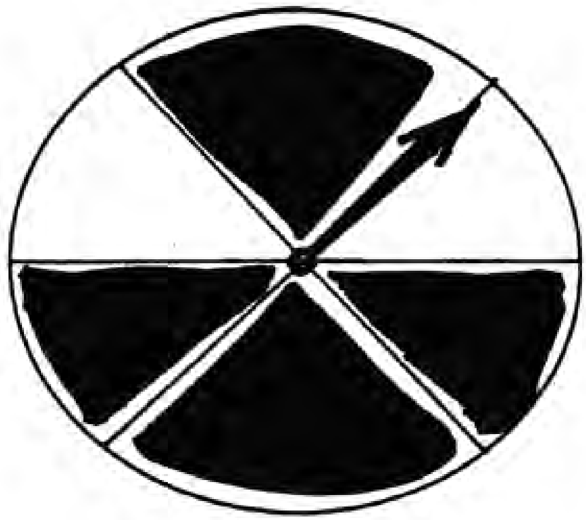


____

____

GLE 4.3.5

50. Suppose you spin the spinner 20 times and record the color, black or white, that comes up each time.



a. Which color do you think comes up most often, black or white?

____

b. Write how you decide. ____

____

GLEs 2.2.18; 2.2.19

51. Calvin needs 36¢. He already has 2 dimes and 1 penny. Put an "X" on each coin he could add to get to 36¢.

GLEs 2.2.15; 2.2.18; 2.2.19

52. You are the clerk at the school store.
Prices for the store are shown on the sign below.

School Store	
Pencils	5¢ each
Pens	8¢ each
Erasers	10¢ each

a. Complete the following order for a customer.

SCHOOL STORE ORDER FORM

Number	Item	Cost
1	Pencil	________¢
5	Pens	________¢
2	Erasers	________¢
	Total	________¢

b. Mike buys 1 pencil, 3 pens, and 1 eraser. How much does he spend? ____________________

____

c. Mike pays with 2 quarters. How much change should he get?

d. What coins could you give him to make the change? Put an “x” on the coins you would use.

e. Show two ways a friend of yours could spend exactly 30¢ in the store. What did your friend buy?

First Way ____

____

Second Way ____

____

f. Show two ways you could spend exactly 26¢ in the store. List what you would buy.

First Way ____

____

Second Way ____

____

g. The store also sells crayons. Your teacher sends you to the store to buy 5 boxes of crayons. What else do you need to know to find out how much 5 boxes will cost?

____

____

GLE 2.2.13

53.

ICED TEA

Dawn wanted to earn some money to buy a bathing suit. She made ice tea to sell. Her friend Carl came to buy some. Carl paid 10 cents for his first glass of ice tea and 5 cents for each glass of ice tea after that. Carl drank a total of 15 glasses of ice tea. How much money did Carl pay Dawn for all of the iced tea he drank? Show your work.

GLEs 2.1.4; 2.2.13

54. Eric and Sue have bunnies for pets. The veterinarian told them that each bunny should have one-fourth cup of water and 2 ½ carrots for dinner.

    Eric and Sue have a large barrel of water, but when they looked at the carrot bin they found only 15 carrots. They were able to feed all their pets. How many bunnies do they have?

GLEs 1.1.2; 2.2.15

55. My mother likes to keep track of how much my baby brother grows from one birthday to the next. He was 26 inches tall on his first birthday. On his second birthday Mom measured him and found he had grown 2 more inches from when he was measured on his first birthday. On his third birthday he had grown 1 inch. On his fourth birthday he had grown 2 more inches. If this continues how many inches will my baby brother have grown by his eighth birthday?

Curriculum Standards Connections

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS. Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 1.1. UNDERSTAND AND DESCRIBE PATTERNS AND FUNCTIONAL RELATIONSHIPS

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

1. **Sort, classify and order objects and numbers in more than one way and by one and two attributes and describe the rule used. Use attributes and describe the rule used. Use attributes such as size, shape, color, texture, orientation, position and use; and characteristics such as symmetry and congruence.**

2. **Recognize, extend and create repeating, growing, number; e.g., skip counting, odd/even, counting on by 10; and one and two attribute patterns. Describe the patterns and the rule used to make it.**

    - Construct geometric patterns and describe the core elements e.g., triangle, square, triangle in a math journal
    - Create patterns based on more than one attribute e.g., big and red, big and blue, small and red, etc.
    - Produce kinesthetic patterns for a partner to copy, follow, mirror or extend in gym or music class.

3. ***Replicate the pattern using a different representation e.g., letters to numbers ABBA to 1221.***

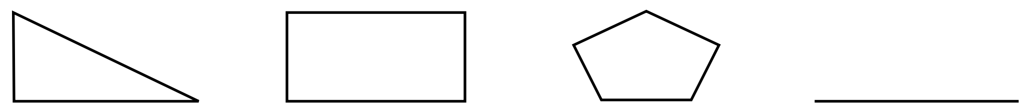
4. **Use patterns and the rules that describe the patterns to identify a missing object, objects with common or different attributes, and the complement of a set of objects. (See also GLE1.1.5)**

    - Present patterns with missing components to identify and share strategies for finding and writing solutions, e.g., 2, 4, _, 8, 10.

5. **Analyze and describe observable changes in patterns using language that describes number characteristics and qualitative characteristics such as attributes, orientation and position. (See also GLE 1.1.4.)**

- Give children varied opportunities to analyze patterns in function machines, rotating figures or shapes, and number. See below.

In	Out
26	29
47	50
118	121



COMPONENT STATEMENT: 1.2. REPRESENT AND ANALYZE QUANTITATIVE RELATIONSHIPS IN A VARIETY OF WAYS.

Grade-Level Expectations

6. **Model real-life situations that represent the addition and subtraction of whole numbers with objects, pictures, symbols and open sentences.**

- Have children act out situations such as: Liz has five oranges and Joanne has three apples. What would have to happen for Liz and Joanne to have an equal number of pieces of fruit? Possible responses include Liz could give Joanne an orange or Joanne could get two more apples or Liz could give oranges to two friends.

COMPONENT STATEMENT: 1.3. USE OPERATIONS, PROPERTIES AND ALGEBRAIC SYMBOLS TO DETERMINE EQUIVALENCE AND SOLVE PROBLEMS

Grade-Level Expectations

7. Demonstrate an understanding of equivalence or balance of sets using objects, models, diagrams, numbers, whole number relationships (operations) and the equals sign, e.g., 2 + 3 = 5 is the same as 5 = 2 + 3 and the same as 4 + 1 = 5. (See also GLE 1.2.6.)

SAMPLE INTEGRATED LESSON – PATTERN OBSERVATION OF SNOWFLAKES

Context: Water can be in the form of a solid, liquid or gas. The Wilson A. Bentley Science Center studies a solid form of water known as snowflakes. In science, we investigate observable properties of objects or materials. Mr. Bentley was one of the first people to closely observe the properties of snowflakes and found they had many shapes and patterns. He discovered patterns in snowflakes. Read and investigate the patterns that naturally occur in snowflakes.

GLEs: 1.1.2, 2.1.4, 2.2.8, 3.1.1, 3.1.2, 3.1.3

Time: Multiple instructional periods

Objective: Children will make predictions based on observations. Children will create and predict patterns formed when making paper snowflakes and recognize that snowflakes have reflective symmetry. Children will put together shapes that form repeating sequences or patterns. Children will create number patterns that match attributes of snowflakes (e.g., one snowflake has six sides, two snowflakes have 12 sides, etc.).

Materials: Pictures of snowflakes – there are printable images at the Wilson A. Bentley Web site (see electronic resources); string, 6-8 inches in length; paper cut in squares; pre-cut snowflakes.

For teachers: A Guide to Snowflakes: http://www.its.caltech.edu/~atomic/snowcrystals/class/class.htm

For teachers and students: Snow and Ice, http://britton.disted.camosun.bc.ca/snow/snowbook.pdf

Procedure:

1. Read aloud *Snowflake Bentley*.

2. Distribute pictures of snowflakes and ask questions such as:

   What shapes do you see?

   - Describe the shapes that you see in the snowflake.
   - Do any of the shapes repeat? Explain.
   - Describe any patterns that you see.

3. Hand out a piece of string to each pair of children. Have the children lay the string on a snowflake to show a line of reflective symmetry through the center of the snowflake. Ask questions such as:

    - Why did you place the string where you did?
    - Compare the two sides of your snowflake. How are they alike or different?
    - Do you see any patterns?

4. Distribute square pieces of thin paper. The children should make two folds and cut shapes from the folded and non-folded parts of the paper, being careful not to cut through the fold. Have the children make predictions about what will happen as they cut the paper, how many shapes they will see, and if any of the shapes will repeat in a pattern. They open the snowflakes to verify their predictions.

5. Give the children another piece of the square paper to fold to make a six-sided snowflake. As they make each fold, ask them what shape they will see. Discuss the shapes. Snowflake templates can be found at http://www.papersnowflakes.com. Use the basic shapes templates, including the hexagon.

6. Guide the children to cut shapes out of the paper to make a snowflake. Remind them to make sure not to cut completely along a side where there is a fold and cut out different shapes. They should keep the snowflake folded after cutting is complete and ask questions such as:

    - What shapes have you cut into your snowflake?
    - Do you think they will be the same shape when you unfold the paper? Why or why not?
    - Do you think you will see the shape one time or more than once? Why?

7. Have the children unfold two folds and ask questions such as:

    a. What happened to the shapes you cut along the fold?

    b. Is it the beginning of a pattern?

    c. Do you think the shape will repeat more? Why or why not?

d. Are you able to predict the pattern of the whole snowflake?

8. The children will then sketch what they think they will see when they unfold the snowflakes. They unfold one more fold and revise the snowflake sketches and then unfold the snowflakes completely. You can use Explore Learning Web site that electronically allows children to sketch snowflakes and then print them for cutting: http://www.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=45

9. Ask questions such as:

    - How is the snowflake like your drawing? How is the snowflake different from your drawing?
    - What shapes do you see?
    - Can you see a pattern?
    - Is there more than one pattern in the snowflake?
    - How is your snowflake like your partner's? How is it different from your partner's?

10. Direct the children to pick one pattern on the snowflake and tell what would be the next three shapes that you would see if the pattern continued. Compare your pattern to your neighbor's and discuss:

    - How do your snowflakes compare to what you expected? Explain the differences and similarities.
    - How quickly were you able to see a pattern in your snowflakes?
    - Can your neighbor continue the pattern in your snowflake for the next three shapes?
    - Write in your journal what you noticed or observed about patterns and shapes by cutting snowflakes.

❖ Possible Assessment Opportunities

❖ Divide students into groups of four. Hand out a pre-cut six-sided snowflake to each group. One member of the group cuts the snowflake in half. Collect the halves. Each group should find the match to its snowflake half. Discuss with the children how they knew that each of their snowflake halves were matches. Have the children describe the patterns that helped them identify their half.

Intervention: Allow the placement of the group's half on top of the other halves to locate a match.

Challenge: Provided with precut 12-sided snowflakes, have children identify the repeating pattern in the snowflake and identify the line of symmetry and explain how they know.

11. Using pictures of snowflakes from previous activities ask the children to explore ways to make number patterns that go with their collection of snowflakes (e.g., using six-sided snowflakes one snowflake has six sides, two snowflakes have 12 sides, etc.). Have the students explain how they developed their number pattern that matches their snowflake collection.

Note: There are a variety of number patterns that can be identified within snowflakes, the number of shapes is consistent with a snowflake. For example, a triangular crystal could have patterns of two columns on each side and children could identify a pattern of two, four, six, eight, 10, 12 and then explain how they identified the pattern.

Interdisciplinary Framework Connections				
Science	**English/Language Arts**	**Social Studies**	**Visual and Performing Arts**	**Physical Education**
AINQ.3 Make predictions based on observed patterns. **A.18** Describe differences in physical properties of solids and liquids.	**1.2a** Students will generate and respond to questions. **1.3d** Students will develop vocabulary through listening, speaking, reading and writing.	• Students will explain the patterns, distributions and relocations of people. • Students will explain ways in which humans use and interact with environments.	• Students will observe and describe the movement elements (action, space, dynamics) in a brief movement study. • Students will demonstrate the following partner skills: copying, leading and following, and mirroring.	• Work cooperatively and productively with partners or in small groups to complete assigned tasks.

Vocabulary: add, subtract, equal, odd, even, ratio, core element, repeat, mirror, sort, classify, extend, analyze, equity symbol, relationships, pattern, growing pattern, equivalence, properties

Resources:

Electronic Resources:

Wilson A. Bentley: http://snowflakebentley.com/index.htm

Cool Math for Kids http://www.coolmath4kids.com/

Internet 4 Classrooms http://www.internet4classrooms.com/skills_2nd.htm#math

Score Mathematics http://score.kings.k12.ca.us/number.sense.html

Math Forum http://mathforum.org/paths/fractions/e.fraclessons.html

Apples for the Teacher http://www.apples4theteacher.com/math.html

National Library of Virtual Manipulatives http://nlvm.usu.edu/en/nav/grade_g_1.html

Illuminations http://illuminations.nctm.org/

One-Difference Train – Goals 2000

Problem Solving – Goals 2000

Teacher References:

Algebra in the PreK-2 Curriculum? Teaching Children Mathematics NCTM Sept. 2005

Navigating through Algebra – Pre-k – 2, NCTM

Children's Literature:

The 329th Friend, by Marjorie Weinman-Sharmat

Snowflake Bentley, by Jacqueline Briggs Martin

Sam Johnson and the Blue Ribbon Quilt, by Lisa Campbell Ernst

The Doorbell Rang, by Pat Hutchins

A Remainder of One, by Elinor J. Pinczes

How Many Feet in the Bed?, by Diane Johnston Hamm

One Hundred Ways to Get to 100, by Jerry Pallotta

Two Ways to Count to Ten, by Ruby Dee

How the Second Grade Got $8,205.50, by Nathan Zenelman

Gator Pie, by Louise Mathews

Only One, by Marc Harshman

Arctic Fives Arrive, by Elinor J. Pinczes

One Less Fish, by Kim Tong

From One to One Hundred, by Terri Sloat

Two of Everything, by Lily Toy Hong

100 Days of Cool, by Stuart Murphy

One Hundred Hungry Ants, by Elinor J. Pinczes

Notes:

***NUMERICAL AND PROPORTIONAL REASONING*. Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.**

COMPONENT STATEMENT: 2.1. UNDERSTAND THAT A VARIETY OF NUMERICAL REPRESENTATIONS CAN BE USED TO DESCRIBE QUANTITATIVE RELATIONSHIPS

Grade-Level Expectations

1. **Locate, label, compare, and order whole numbers up to 1,000 using pictures, place value models, number lines, and benchmarks of 0, 10 and 100, including naming the number that is 10 or 100 more or less than a given number.**

   - Have children circle numbers on a hundreds chart as you give clues such as: Circle the number that means a dozen or two tens and five ones or the number of days in this month.

   - Arrange benchmarks by 10s to 100 along a number line. Give children cards with numbers to place on the number line. Repeat activity using number lines of 100-200, 400-500, 900-1,000. When children have progressed, use number lines from 0-1,000 with benchmarks of 100s. There should be numerous whole class and individual opportunities for these activities.

   - Use a meter stick or draw a line about 100 centimeters long and mark each end. Label equidistant tens (decimeters) on the line. Locate a point and mark it with an arrow. Have children identify the number indicated by the arrow and identify the number that is ten more and ten less. Repeat with hundreds when appropriate. (Can also be used for GLE 2.2.11.)

2. **Represent whole numbers up to 1,000 by modeling and writing numbers in expanded forms, e.g., 37 = (3 x 10) + (7 x 1), and regrouped forms, e.g., (2 x 10) + (17 x 1) = 37, and use the forms to support computational strategies.**

   - Count big groups of objects by putting 10 of each in a cup until only ones are left. Build that two-digit number in different ways using interlocking cubes. Write about the number of objects in sentences using different ways to describe the quantity.

Example: There were four tens and 16 ones of kidney beans in the cups. Jeff counted five tens and six ones kidney beans.

❖ **Possible Assessment Opportunities**

❖ Prepare bags of 20 to 99 objects to count, one for each child. The children count the objects by making groups of tens and ones. Record the amount as tens and ones, and then write the number in standard form. Trade bags and repeat.

Intervention: Begin with objects and have the child use 10-frame cards to organize the groups of 10.

Challenge: Use multiple bags of objects to record numbers greater than 100.

- Have children represent large whole numbers in three different ways: (1) Show the number made with base-10 blocks (2) written as hundreds, tens and ones, and (3) written with numerals and label each place value.

Intervention: Begin by building a two-digit number with Unifix or other interlocking cubes. Record the number using pictures, labeled as tens and ones and standard notation.

Challenge: Create a game to match different forms of a three-digit number.

3. **Represent multiplication and division (with factors of 1, 2, 5 and 10) using a variety of models and strategies such as arrays, pictures, skip counting, extending number patterns, and repeated addition and subtraction; describe the connection between multiplication and division.**

- Children can cover their desks and other familiar flat surfaces with many of the same small objects or index cards and use counting to determine area and introduce the concept of multiplication and division through rectangular arrays.

4. **Use a variety of models and familiar objects to compare, order and estimate parts of a whole using the unit fractions ½, ⅓, ¼.**

- Give children a collection of equal sized pieces of an object or model. Have them decide if the pieces are more than a whole, close to a whole or less than a whole. Have them justify their answers.

Intervention: Give the child halves or thirds. Make a model of a whole. Ask the child to compare the pieces with the model of the whole to determine if the amount is more than a whole, close to a whole, or less than a whole and explain why.

Challenge: Have the child choose groups of pieces (they may be different sized) that are close to: one half, two wholes or more. Explain how the pieces were chosen.

5. **Use a variety of models to represent and describe parts of groups as unit fractions ½, through ⅒.**

- Provide extensive opportunities for students to identify equal parts of objects, such as partitioned rectangles, paper plates, or oranges as unit fractions up to tenths. Ask questions such as:

  1. How many pieces or parts do we have?

  2. What is one of those pieces or parts called?

  3. How many of these pieces or parts does it take to make one whole?

6. **Estimate and determine ½, ⅓, ¼ of a small group of up to 20 objects, such as finding ½, ⅓, ¼ of 12 cookies.**

- Have the children represent a one- or two-digit number using interlocking cubes and determine if the cubes can be separated into two, three or four equal groups to make equal sized parts called ½, ⅓ or ¼.

7. **Describe ratios in terms of the linear patterns that develop from the relationships between quantities. For example: In a pattern of green, green, red blocks there are always two green blocks for one red block.**

COMPONENT STATEMENT: 2.2. USE NUMBERS AND THEIR PROPERTIES TO COMPUTE FLEXIBLY AND FLUENTLY AND TO REASONABLY ESTIMATE MEASURES AND QUANTITIES

Grade-Level Expectations *(Italics indicate links not evident in 2005 Framework)*

8. ***Count whole numbers to 1,000 and beyond.***

9. ***Count on by tens from a given amount, e.g., 17, 27, 37, etc.***

- Count groups of tens and singles, with singles up to nine. Expand to groups of 10 and singles more than nine to provide opportunities to move from counting by adding the singles one at a time to counting by making another group of tens.

- Have children build a number such as 23, with Unifix or interlocking cubes. Ask the children to add an additional 10 cubes, count them and record the number. Continue adding, counting and recording until the child can explain the pattern that happens when 10 is added to a number.

10. ***Read and write numerals up to 1,000.***

11. **Skip count by twos, fives, tens and hundreds to 1,000 and beyond. (See also GLE 2.1.1 and 1.1.2)**

- Skip count using human or paper number lines. As children count by ones, the target number is said with emphasis, and that child steps forward or that number is circled on the paper. Once every second, fifth or 10th number is identified, children can count using only the children who have stepped forward or the circled numbers.

- Use calculators to count by twos, fives, and tens and hundreds. Children should record the numbers from the display in a T-table and explain the patterns they see. These activities should make connections to multiplication clear. Example:

Key Stroke	Display
1	5
2	10
3	15

12. **Determine whether a set of objects has an odd or even number of items by pairing objects and creating arrays.**

13. **Create word problems and write and solve two- and three-digit number sentences that reflect contextual situations and real-world experiences involving addition and subtraction. Construct and solve open sentences, e.g., □ + 5 = 11. Solve the problems using a variety of methods including models, pictures, pencil and paper, estimation and mental computation, and describe the reasoning or strategies used.**

14. **Solve problems using addition and subtraction facts involving sums and differences to 20 with flexibility and fluency.**

- Use the hundreds chart and graphs to discover patterns in addition and subtraction facts.
- Use different colored objects to show the part-whole relationship (three yellow and four red equals seven).

❖ **Possible Assessment Opportunities**

❖ Have the children create as many ways as possible to construct a number using sums and differences. (16 is 8 + 8, 5 + 5 + 6, 6 + 6 + 4, 20 - 4, etc). Have children record the fact families they have created and explain why fact families are an efficient way to compute (16 = 8 + 8, 16 - 8 = 8, 9 + 7 = 16, 7 + 9 = 16, 16 - 9 = 7, 16 - 7 = 9, 16 = 12 + 4…)

Intervention: Begin by providing two-sided color counters equal to the sum, to use in finding the combinations (e.g., 15 red + 1 yellow, 14 red + 2 yellow).

Challenge: Ask the children to organize the different ways to determine if there is a pattern. Explore different numbers to see if the same patterns exist. Explain why or why not.

15. Add two-digit numbers with and without regrouping. Subtract two-digit numbers without regrouping and with regrouping using models.

16. Determine when an estimate for a problem involving two- and three-digit numbers is appropriate or when an exact answer is needed.

17. Use a variety of strategies to estimate solutions and to determine if a solution to a computation or word problem reflecting real-world experiences involving addition and subtraction of two- and three-digit whole numbers is reasonable.

18. Determine and compare the value of pennies, nickels, dimes, quarters and half dollars.

19. Count, compare and trade sets of pennies, dimes and dollars up to $10.00

SAMPLE INTEGRATED LESSON – AN APPLE A DAY

Context: Many schools in Connecticut receive apples from local farmers for their lunch programs. Jim loves Gala apples and has one for lunch as often as he can. This week the lunchroom only had Empire apples, which he does not like. He asked when the Gala apples would be available again. The cafeteria workers weren't sure but told him there were lots of other good varieties of apples he could try. Chris has noticed that most of the children eat apples during lunch. Help Chris find out how many kinds of apples are grown in Connecticut and when he might be able to have a particular kind of apple for lunch.

Grade-Level Expectations: 2.1.1, 2.2.8, 2.2.10, 2.2.13, 3.3.5, 4.1.2, 4.2.3

Time: Multiple instructional periods

Objectives: Children will be able to:

- identify and write two digit numbers,
- solve real-world problems using addition, and
- represent data in different forms

Materials: Access to computers, paper and pencil, 11 x 18 paper, markers, poster board, counters or connecting cubes, calculators

Procedure:

1. Read the story *Apple Picking Time* by Michelle Slawson.
2. Working in small groups, have the children find the different varieties of apples grown in Connecticut and when they are harvested. Use the following Web sites as sources of information for the children lists can be printed from each Web site and given to each group. http://www.ctapples.com/growrdir.pdf , Connecticut Apples: http://www.ctapples.com/ , Connecticut orchards list: http://www.allaboutapples.com/orchard/ct01.htm.
3. Children should record the information using any method they choose. Each group should share their findings with the class.
4. As a class, make a master list of the varieties of Connecticut apples, eliminating all duplicates, and determine the total number of apple varieties.

5. Discuss when the apples are harvested and have each group decide on a way to record and display that information.

6. When the groups have completed and shared their displays, refine the class master list to include when the varieties are available.

7. Each group should create an availability timeline that coincides with the months that school is in session.

❖ Possible Assessment Opportunities

- ❖ Working independently, each child should use the timeline, the information about the different varieties of apples and the number of students in the school to help the cafeteria manager make decisions about the number of each variety of apple to order and when. More than one variety may be ordered. Children may choose to write letters, produce graphs or create calendar posters.

Intervention: Make a picture timeline or line plot using pictures of the apple varieties harvested in two months such as August and September.

Challenge: Investigate the variety of apples grown and harvested in another state. Make a timeline for that state's harvest. Compare the two timelines to describe the similarities and differences and possible reasons for the variations.

Using the Web site All About Apples (http://www.allaboutapples.com/) estimate and then determine how many apple varieties are on this list http://www.allaboutapples.com/varieties/index.htm. Explain to the class how you figured out the actual number of apple varieties.

Interdisciplinary Connections			
Science	**English/Language Arts**	**Social Studies**	**Visual and Performing Arts**
A INQ 5 Seek information in books, magazines and pictures. **A INQ 9** Count, order and sort objects by their properties.	• Students interpret, analyze and evaluate text in order to extend understanding and appreciation. • Students prepare, publish and/or present work appropriate to audience, purpose, and task.	• Explain ways humans use and interact with the environment. • Define scarcity and abundance.	**Visual Arts** • Use the elements of art and principles of design to communicate ideas.

Vocabulary: same, equal, digit, odd, even, compare, skip counting, grouping, regroup, trade, 10-frame, place value, hundreds, tens, ones, singles, a ten, a hundred, more than, less than, 10 more, 10 less, hundred more, hundred less, close to, closer to, about , almost, referent, shorter, longer, taller, inch, ruler, centimeter, meter stick, unit, part-whole, add, subtract, sum, difference, fraction, equivalent, unit fraction, fractional part, reasonable, estimate, basic fact, multiplication, array, division, divide, split, equal sized groups, half hour, quarter hour, timeline

Resources:

Electronic Resources:

Apples and More: http://www.urbanext.uiuc.edu/apples/index.html

Michigan Apples: http://www.michiganapples.com/index.asp?Loc=2&Loc2=5

Best Apples: http://www.bestapples.com/varieties/index.shtml

Electronic Abacus http://illuminations.nctm.org/ActivityDetail.aspx?ID=8

Ten Frame http://illuminations.nctm.org/ActivityDetail.aspx?ID=75

Comparing Connecting Cubes http://illuminations.nctm.org/LessonDetail.aspx?id=U41

In On the Ground Floor http://www.creativille.org/groundfloor/index.htm

A counting lesson for two digit numbers http://www.sasked.gov.sk.ca/docs/elemath/gr2lessp.html

Different Ways – Goals 2000

Going to the Fair – Goals 2000

Amazing Equations – Goals 2000

How Many Blocks – Goals 2000

In Only a Minute – Goals 2000

How Much Money – Goals 2000

Teacher References:

Research Ideas for the Classroom; Early Childhood Mathematics, edited by Robert J. Jenson

Elementary and Middle School Mathematics, Teaching Developmentally, by John Van de Walle, 4th and 5th editions

Children's Mathematics: Cognitively Guided Instruction, by T. P. Carpenter, E. Fennema, M. L. Franke, L. Levi, and S. Empson

Problem-Solving Lessons, Grades 1-6, by Marilyn Burns

Children's Literature:

Annie's One to Ten, by Annie Owen

One Watermelon Seed, by Celia Barker Lottridge

Twelve Ways to Get to Eleven, by Eve Merriam

Six Dinner Sid, by Inga Moore

Domino Addition, by Lynette Long, Ph.D.

The King's Commissioners, by Aileen Friedman

A Chair for My Mother, by Vera B. Williams

The Coin Counting Book, by Rozanne Lanczak

Math Potatoes, by Greg Tang

Annno's Counting House, by Mitsumasa Anno

The Doorbell Rang, by Pat Hutchins

Each Orange Had 8 Slices, by Paul Giganti

My Little Sister Ate One Hare, by Bill Grossman

Ten for Dinner, by Jo Ellen Bogart

100th Day Worries, by Margery Cuyler

My First 1,2,3 Book, by Sebastian Conrad

One Tortoise, Ten Wallabies: A Wildlife Counting Book, by Jakki Wood

Classroom Materials: items from science or social studies in groups from 10 to 200, collections, base-ten blocks, inter connecting blocks, pattern blocks, coins, calendars, hundreds chart, number lines, number cards, small cups or containers, place value mats, place value charts, small 10-frame cards

Notes:

GEOMETRY AND MEASUREMENT. Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 3.1. USE PROPERTIES AND CHARACTERISTICS OF TWO- AND THREE-DIMENSIONAL SHAPES AND GEOMETRIC THEOREMS TO DESCRIBE RELATIONSHIPS, COMMUNICATE IDEAS AND SOLVE PROBLEMS.

Grade-Level Expectations

1. **Identify, describe and draw polygons (triangles, quadrilaterals including trapezoids and rhombuses, pentagons, and hexagons), solids, and other familiar two- and three- dimensional objects in the environment. (See also GLE 3.1.3.)**

   - Place several familiar objects (e. g., ball, pencil, etc.) on a table. Have children view the objects for a limited time. Cover. Play "20 Questions," with the teacher choosing an object and the children asking geometry questions, (e.g., Does the figure have six faces?), to identify the object.

   - Provide pieces of rope to small groups of two to three children to create polygons. Have the children verbally describe the polygon they created to another group of children and ask that group to name the shape. Repeat until all groups have had a chance to create and explain a variety of polygons.

   - Have the children draw a polygon and write the name on a page in their math journals. The children should then find pictures of objects that closely resemble the polygons they have drawn and named, and paste the pictures on the appropriate page of the journal. Children should explain the reason for pasting the picture on that page in writing. Magazines can be used to find pictures, such as stop signs that are octagons or rectangular candy bars.

2. **Compare and sort familiar polygons, solids, and other two- and three- dimensional objects in the environment. (See also GLE 3.1.3.)**

- Have the children sort a set of pattern blocks, storage containers or geometric solids and explain the reason for the sort. For example: I separated the sphere from all the other solids because the sphere is round and the other shapes have straight, flat sides. Ask the children to find more than one way to sort the figures.

3. **Construct polygons, solids and other two- and three-dimensional objects using a variety of materials and create two-dimensional shapes and designs with one or more lines of reflective symmetry (lines that divide the shape or design into two congruent parts). (See also GLE 3.1.2.)**

   - Have children work in pairs with a set of building materials, e.g., small pieces of pipe cleaner inserted in the ends of the straws, to create three dimensional objects or solids.

   - Have children look for examples of congruent figures in the environment. Have children copy shapes on geoboards and then subdivide the shapes into two symmetrical pieces or congruent parts if possible. Children can then sort shapes and objects by whether they have symmetry and/or congruence.

   - Children can explore letters of the alphabet and numerals to find lines of symmetry. They can fold paper in half and cut out symmetrical designs or identify symmetry in wallpaper or gift wrap designs.

COMPONENT STATEMENT: 3.2. USE SPATIAL REASONING, LOCATION AND GEOMETRIC RELATIONSHIPS TO SOLVE PROBLEMS

Grade-Level Expectations

4. **Investigate and predict the result of putting together and taking apart two- and three-dimensional shapes in the environment, e.g., use objects to find other shapes that can be made from three triangles or a rectangle and a triangle.**

   - Children can investigate which pattern block shapes can be formed from the equilateral triangles, recording their results using pictures or words in a chart.

   - Give the children an outline of an irregular shape, which can be constructed from pattern block or tangram templates, and have them fill in the outline using actual pattern block or tangram pieces.

- Have the children look at the world around them for examples of three-dimensional structures in which they can see familiar solids such as rectangular prisms and cylinders.

❖ Possible Assessment Opportunities

❖ Provide children with hexagon, trapezoid, blue rhombus and triangle pattern blocks and have them create hexagons and trapezoids by using the other shapes.

Ask questions such as:

1. Can you use the triangles to make a hexagon?
2. What other shapes could you use to make the hexagon?
3. Can you make the red trapezoid with any of the other shapes?"

Intervention: Provide hexagon and trapezoid templates for the child to fill, with internal lines drawn if necessary.

Challenge: Have the children draw and color the shapes on triangular grid paper and discuss how the various shapes are related

- Give children the opportunity to play a geometry game that is set up and played like Battleship in pairs. Make blank tic-tac-toe game boards for each child. One child secretly places four different pattern blocks in four different squares on her game board. Using direction and position words the child guides her partner to place pattern block pieces in the corresponding squares on his game board. The children check to see if the partner has placed all the pattern blocks in the correct location and direction and then the children switch roles.

~ *COMPONENT STATEMENT: 3.3. DEVELOP AND APPLY UNITS, SYSTEMS, FORMULAS AND APPROPRIATE TOOLS TO ESTIMATE AND MEASURE.*

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

5. ***Know the months of the year in order and locate dates, days, weeks and months on a calendar. Use the information to write and solve problems involving calendars.***

   - The children can write and solve problems such as:

     1. What was yesterday's date?
     2. October 31st is on what day of the week is on this year?
     3. What is the date of the third Monday of this month?

   - Read aloud *When This Box Is Full* by Patricia Lillie, a story about a little boy who places items in a box for each month of the year. After the story is read, have the children work in small groups of five to six children to brainstorm what they do for each month of the year. Each child should write and illustrate what they do for each month on 4 x 6 index cards. Place the cards in the center of the work area so that the children can organize the cards in by month.

6. ***Solve problems involving telling time, including estimating and measuring the length of time needed to complete a task, to the half-hour using analog and digital clocks.***

   - The children create a journal entry describing their day at school. Stamp a clock face on the journal page and write a time underneath that has been written on the board. Each child should draw hands on the clock face to show the time correctly. When the actual time of day on the classroom clock matches the time on the journal page, students record what they are doing in pictures and words next to the correct clock face.

   - Have the children conduct experiments such as the following, using timers: How many times can you bounce a ball in three minutes? How many times can you clap your hands before the sand runs out of the timer? How many times can you blink your eyes before the second hand goes all the way around the clock?

- After establishing a referent such as 10 seconds, 30 seconds or 1 minute, have children estimate the length of time it takes to complete a task such as read pages or passages in a book, write a sentence or walk to the lunchroom.

7. **Use measurement tools such as thermometers to measure temperature, basic rulers to measure length to the nearest half-inch or centimeter, and balance scales to measure weight/mass in grams. (See also GLE 3.3.8.)**

8. **Use nonstandard referents and standard benchmarks to estimate and measure the following (ee also GLEs 3.3.7, 3.3.9 and 3.3.10.):**

   - **length (to the nearest inch, half-inch, foot, yard, centimeter or meter)**

     - Have the children discover common referents in everyday objects by comparing them with measuring tools, such as small paper clip is about one gram, width of a finger about 1 centimeter, height from the floor to the knob on the door about 1 meter.

     - Read and discuss with the children *How Big Is a Foot?* by Rolf Myllar. The children use their own feet to measure the width or length of the hallway and compare their results. Finally, they measure the hallway using meter sticks and discuss the difference in their results.

     - Conduct a classroom hunt where the children locate items that are about the size of a centimeter, foot, meter, gram, etc. Have the children explain how they estimated that the object was equivalent to the measurement.

   - **area (in square inches)**

     - Give the children numerous opportunities to estimate the number of square tiles or Unifix cubes that it will take to cover different sized rectangles such as books, writing paper or construction paper.

   - **capacity (in liters and cups)**

     - Provide a collection of labeled containers. Mark one container as the target and have the children sort the rest of the collection into those that hold more than, less than or about the same amount as the target container. Provide an organizer for the children to record their results. Next, have the children verify their choices by providing a filler, such as rice or beans. Avoid giving explicit instructions or directions, but later discuss the children's ideas and actions for proving which containers were more, less or about the same as the target container.

    - Give each group of three to four children a measuring cup and several containers of different sizes, plain white paper, some uncooked rice, and 1-inch graph paper. Each group should determine the number of cups of rice that fit in each container and then record the results on the graph paper in a bar graph. After completing the graphs, the class agrees on how to arrange the containers in order from largest to smallest.

- **weight (in grams)**
    - Provide a variety of experiences weighing objects. Use balances to compare weights and understand equality, such as find out how many pennies balance a small familiar object.
    - Use balances or scales with gram weight to assign a numerical value to the weight of an object.

- **temperature**
    - Have the children estimate the temperature and check the estimates by reading the temperature on a thermometer and recording the results.
    - As part of the morning routine, the children check each of two thermometers, one Fahrenheit and one Celsius, and make daily recordings of the outside temperature. They record the temperatures in a chart and look for interesting patterns.

- **volume (using water or sand).**
    - Use two identical sheets of paper 8 ½ x 11. Roll one sheet into a short cylinder and the other into a tall cylinder. Set them both on a flat surface and ask the children, does one hold more than the other. Place the taller one inside the shorter one. Fill the taller one with sand and then remove it form the shorter cylinder. Which holds more?

9. **Describe the strategy used to determine an estimate and determine if the estimate is reasonable. (See also GLEs 3.3.7 and 3.3.8.)**

10. ***Describe the relationships between centimeter and meter and among inch, foot and yard.*** **(See also GLE 3.3.8.)**

SAMPLE INTEGRATED LESSON – OLYMPIC GAMES

Context: The physical education teacher in your school wants to hold Olympic Games. He needs officials to help to measure the performance of the Olympians. The measurements will be used to award the gold, silver, and bronze and other medals.

Grade-Level Expectations: 3.3.7, 3.3.8, 4.1.2, 4.2.3

Time: Multiple instructional periods during the general and physical education classes

Objective: The children will demonstrate the use of units, systems, and processes of measurement and organization of data.

Materials: Gym equipment. The classroom and the physical education teacher design events for all ability levels. Events should also include activities from other cultures that have a measurement component.

Procedure:

1. Share information with the students about the Olympic activities that require the use of measurement.
2. Have the physical education teacher describe your school's Olympic events.
3. The children need to determine an appropriate measuring tool for the event (e.g., stop watches or timers, yardsticks or tape measures, measuring cups to measure water transported in a relay race.)
4. There also needs to be a master time keeper for the events who will signal when participants must switch events.
5. The children need to decide on a way to record all the data.
6. For each event, each child will write an estimate of how he thinks he will perform and then record the actual results.
7. The children will display all the data for each event in a table to determine the medalists in the events.

Interdisciplinary Framework Connections			
Science	**English/Language Arts**	**Social Studies**	**Healthy and Balanced Living**
A.INQ.2 Use senses and simple measuring tools to collect data. **A.INQ.7** Use standard tools to measure and describe physical properties such as weight, length and temperature.	• Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.). • Use oral language with clarity and voice to communicate a message. • Determine purpose and choose an appropriate written, oral or visual format. • Publish and/or present final products in a myriad of ways, including the use of the arts and technology. • Use appropriate language as related to audience.	• Understand elements of culture.	**Standard 9** Demonstrate competency in motor skills and movement patterns needed to perform a variety of physical activities **Standard 11** Participate regularly in physical activity **Standard 13** Exhibit responsible personal and social behavior that respects self and others in physical activity settings **Standard 14** Value physical activity for health, enjoyment, challenge, self-expression and/or social interaction

Vocabulary: measure, minutes, hours, days, week, month, calendar, clock, digital, analog, data, length, area, weight, capacity, volume, estimate, ruler, thermometer, scale, inches, centimeters, foot, tally marks, the months of the year

Resources:

Electronic Resources:

Tour of Measurement: http://www.mathforum.org

Can You Measure Up? http://artsedge.kennedy-center.org/content/3801

The Shape of Sand: http://web.archive.org/web/20041019125446/www.galaxy.net/~k12/structure/sand.shtml

Measuring Our Classroom – Goals 2000

Two- and Three- Dimensional Riddles – Goals 2000

Is It 15? – Goals 2000

Teacher References:

NCTM Measurement Standards K-2

Engaging Young Children in Mathematics, by Douglas H. Clements

Adding It Up, by National Research Council

Elementary and Middle School Mathematics, by John Van De Walle

Dumpling Soup: Exploring Kitchens, Cultures, and Mathematics, by N.L. Smith "Teaching Children Mathematics" 1999 Vol.6

Children's Literature:

How Big is A Foot?, by Rolf Myller

Inch by Inch, by Leo Lionni

Super Sand Castle Saturday, by Stuart Murphy

A Drop of Water, by Walter Wick

Cubes, Cones, Cylinders, and Spheres, by Tana Hoban

Great Graph Contest, by Loreen Leedy

Clocks and More Clocks, by Pat Hutchins

Is the Blue Whale the Biggest Thing? by Robert E. Wells

Notes:

***WORKING WITH DATA: PROBABILITY AND STATISTICS*. Data can be analyzed to make informed decision using a variety of strategies, tools and technologies.**

COMPONENT STATEMENT: 4.1. COLLECT, ORGANIZE AND DISPLAY DATA USING APPROPRIATE STATISTICAL AND GRAPHICAL METHODS.

Grade-Level Expectations

1. **Pose questions that can be used to guide data collection, organization and representation.**

    - Children can pose questions based on real life experiences to determine the favorite books, movies, snacks or bedtime of classmates, schoolmates or adults.

2. **Collect and systematically organize and represent the data that answer the questions using lists, charts and tables, tallies, glyphs (coded pictures) picture graphs, and bar graphs.**

    - Provide opportunities to measure, sort, gather and analyze data about objects from their natural environment.

    Ask questions such as:

        - What question could we ask to learn something about each other (e.g., the foods we like, shoe sizes, types of pets)?
        - How do you measure a particular attribute?
        - Can you find more than one way to measure and chart the data about the identified attribute (e.g., tally marks, counting, weighing)?
        - What would be your estimate of the results of the data collection?

- Sort tasks by required completion time and objects by size or weight then record the results of the sort.
- Create vertical and horizontal bar and picture graphs with children. Have children discuss whether a bar or picture graph provides a better representation of the data collected.

COMPONENT STATEMENT: 4.2. ANALYZE DATA SETS TO FORM HYPOTHESES AND MAKE PREDICATIONS

Grade-Level Expectations

3. Describe data that have been organized and make comparisons using terms such as largest, smallest, most often, or least often. (See also GLE 3.1.3.)

- Provide children with published graphs, from sources such as children's magazines, social studies and science materials. Have children analyze the information in the graph and ask each other questions that can be answered with the information in the graph.

4. Determine patterns and make predictions from data displayed in tables and graphs. (See also GLE 4.2.3.)

- Give each child an individual box of raisins. Use at least two different brands of raisins. Have children estimate the number of raisins in each box before counting, and then compare the actual counts to their estimates. Lead the class in the discussion and creation of a graph using the raisin boxes. Are all boxes of raisins created equal? Which brand should your family purchase?
- Have children examine data in the class attendance chart, weather chart or calendar to describe any noticeable patterns and make predictions.
- Have the children collect data for eye color in the class and create a bar graph. The children will also collect and organize the data for hair color in the class. Find a buddy class and have those children collect the same data from that class and organize the data into two new graphs. Have the children compare the graphs for eye color and hair color to determine any patterns and to make predictions about eye color and hair color in the second grade.

- If most children in the class have the same eye or hair color, data can be collected and organized about different information such as the total number of siblings, the number of older or younger siblings, aunts, uncles, cousins or pets. Predictions should then be made about other classes, schools.

❖ **Possible Assessment Opportunities**

❖ Provide opportunities for the children to graph and analyze data that is important to them and discuss what information the graph conveys about the topic chosen. Examples of questions the children might generate are: What ice cream flavors are favorites? How many birthdays are in each month? What hot lunches are most popular?

Intervention: Keep the children's question simple and connected to their life experience and have them collect data from a specific number of respondents.

Challenge: Investigate if children in other communities or countries have similar interests and responses. Display the information in alternate ways.

COMPONENT STATEMENT: 4.3. UNDERSTAND AND APPLY BASIC CONCEPTS OF PROBABILITY

Grade-Level Expectations

5. Describe and explain the likelihood of the occurrence of various events. State possibilities, make predictions and test the predictions in practical situations.

- Have the children discuss the likelihood of events such as:
  - It will rain tomorrow.
  - George will go to bed late tonight.
  - I am going on vacation tomorrow.

- Have the children describe or make up events that are likely and unlikely to occur and justify their thinking.

6. **Conduct simple probability investigations involving activities of chance and games with number cubes and spinners; record, graph and describe the results of the investigations.**

   - Create a spinner that is one-half yellow, one-fourth red, and one-fourth blue. Have the children predict which color would be landed on most frequently and why. Working in pairs, each child should spin the spinner ten times and use tally marks to record the results. Class discussion should focus on comparison of the predictions and actual results. Ask questions such as:

     - How did your prediction compare with your results?

     - Explain why your prediction was correct or incorrect.

     - How do the results for yellow compare with the results for blue? How do the results for red compare with blue and why?

   - Children predict how often heads and tales come up when a coin is tossed 10 times. Have two children toss a coin 10 times each. Record the results with tallies for the number of heads and tails. How do the number of heads and tails compare? Recruit three more volunteers and then five more to repeat the process. Discuss the results after each group has completed the tosses. Combine the tallies and compare the volunteers' results with individual predictions.

SAMPLE INTEGRATED LESSON – HEALTHY HABITS

Context: The school nurse needs to tell the principal about the eating habits in each class. You need to complete a graph that will show how much of each of the food groups you and your classmates are eating.

Grade-Level Expectations: 1.1.1, 2.2.8, 2.2.9, 3.3.5, 4.1.1, 4.1.2, 4.1.3

Time: multiple instructional periods

Objective: Children will use problem solving, data collection and measuring skills to analyze eating habits and to prepare healthy snacks for the class.

Materials: A variety of foods, measuring tools and kitchen supplies

Procedure:

1. Review the basic food groups and classify snacks students eat in those food groups.
2. Discuss healthy eating habits
3. The children can evaluate their eating habits by completing the nutrition tracker from the electronic resource, *Nutrition Explorations* http://www.nutritionexplorations.org./

- ❖ **Possible Assessment Opportunities**

  - ❖ Have the children complete a bar graph representing the amount of food they eat in the various food groups from the nutrition tracker and explain how the graph is representative of that data.

  Intervention: Focus on the three main food groups and/or provide parts of the graph.

  Challenge: Research how the eating habits of your class compare to those of another class in your school by comparing the graphs you created.

  Extension: Children from different cultures may eat different types of foods.

Pose this question: Can we have a healthy snack time that might be enjoyed by people from different countries?

Lead the discussion with questions such as:

- How can we answer the question?
- What do we need to do to plan this special snack time?

Continue the guided discovery. Identify the different types of foods and make picture graphs to represent the types of foods and the cultures or countries they are from. Plan the special snack and create a schedule with the class planning for, preparing and serving the special snack. Include opportunities for students to make some of the snacks that require weighing and measuring to complete the recipe.

<table>
<tr><th colspan="4">Interdisciplinary Framework Connections</th></tr>
<tr><th>Science</th><th>English/Language Arts</th><th>Social Studies</th><th>Visual and Performing Arts</th></tr>
<tr>
<td>A.INQ.2 Use senses and simple measuring tools to collect data.

A.INQ.7 Use standard tools to measure and describe physical properties such as weight, length and temperature.

A.INQ.8. Use nonstandard measures to estimate and compare the sizes of objects.

A.INQ.10 Represent information in bar graphs.

A.19. Describe the life cycles of flowering plants as they grow from seeds, proceed through maturation and produce new seeds.

A.23 Identify the sources of common foods and classify them by their basic food groups.

A.24 Describe how people in different cultures use different food sources to meet their nutritional needs.</td>
<td>• Organize information in proper sequence to use in a summary and/or retelling.

• Generate and respond to questions.

• Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.).

• Use oral language with clarity and voice to communicate a message.

• Determine purpose and choose an appropriate written, oral or visual format.

• Publish and/or present final products in a myriad of ways, including the use of the arts and technology.

• Use appropriate language as related to audience.</td>
<td>Humans and Environment Interaction

• Create timelines that sequence events and peoples, using days, weeks, months, years, decades and centuries; demonstrate a familiarity with peoples, events and places from a broad spectrum of human experience through selected study from historical periods and from the various regions (e.g., East Asia, Europe, the Americas, Africa, South Asia, etc).</td>
<td>Art

• Use different media techniques and processes to communicate ideas, feelings, experiences and stories.

• Use elements of art and principles of design to communicate ideas.

• Select and use subject matter symbols and ideas to communicate meaning.</td>
</tr>
</table>

Vocabulary: measure, data, length, area, weight, graph, chart, table, picture graph, bar graph, estimate, scale, inches, centimeters, foot, tally marks, chance, likelihood, predict

Resources:

Electronic Resources:

Eye to Eye: http://illuminations.nctm.org/LessonDetail.aspx?ID=L169

Dealing with Data: http://illuminations.nctm.org/LessonDetail.aspx?id=L297

Nutrition Explorations: http://www.nutritionexplorations.org

What's the Weather? http://illuminations.nctm.org/LessonDetail.aspx?ID=L196

Teacher References:

NCTM Measurement Standards K-2

Engaging Young Children in Mathematics, by Douglas H. Clements

Adding It Up, by National Research Council

Elementary and Middle School Mathematics, by John Van De Walle

Dumpling Soup: Exploring Kitchens, Cultures, and Mathematics, by N.L. Smith "Teaching Children Mathematics" 1999 Vol.6

Making Sense of Data, in the *Addenda Series,* by Mary Lindquist.

Children's Literature:

The Mouse Who Owned the Sun, by Sally Derby

A Drop of Water, by Walter Wick

Probability, by Charles F. Linn

Jump, Frog, Jump!, by Robert Kalan

Is the Blue Whale the Biggest Thing? by Robert E. Wells

Cloudy with a Chance of Meatballs, by Judi Barrett

Notes:

Grade 3

CONTENTS

The Learner at This Level

THE THIRD-GRADE CHILD:

- Is full of energy and imagination, which need to be given direction and focus.
- Learns best when work is designed in bite-size pieces.
- Needs to experience “incremental success” in schoolwork, in gradually increasing quantities and levels of complexity, to remain motivated.
- Enjoys working cooperatively and is most productive in groups.
- Needs lots of physical activity.
- Has a rapidly expanding vocabulary.

Source: *Yardsticks; Children in the Classroom Ages 4-14* by Chip Woods Pages 83-92

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS

- Develops varied representations for a single quantity.
- Looks for patterns in numbers and operations to facilitate estimation.
- Solves problems using patterns.
- Generates “If . . . then . . .” statements to formulate rules.

NUMERICAL AND PROPORTIONAL REASONING

- Understands that some ways of representing a problem are more helpful than others are.
- Explores, applies and shares a variety of computational strategies.
- Uses all four operations in problem solving, through models, arrays partitioning and fair shares.
- Links concrete models to written algorithms.
- Efficiently uses basic addition and subtraction facts.
- Develops fraction number sense through measuring, weighing, comparing models, and some paper and pencil tasks.

GEOMETRY AND MEASUREMENT

- Uses models and drawings to compare geometric figures and relationships.
- Identifies the attributes of two- and three-dimensional shapes.
- Uses nonstandard measures and standard measurement instruments.
- Uses benchmarks to make estimates in measurement.

WORKING WITH DATA: PROBABILITY AND STATISTICS

- Uses a variety of methods to collect and record data, including measuring devices, printed resources and tallies.
- Identifies and extends patterns and sequences in charts, graphs and tables.
- Discusses data, communicates conclusions and makes predictions and inferences.
- Interprets data by connecting it to prior knowledge.
- Generates new questions from displayed data.

Mathematics Background for Teachers

MATHEMATICS BACKGROUND FOR GRADE 3 TEACHERS

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS

Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

Central Understanding: Relationships can be generalized and represented through rules.

Background: Relationships are illustrated by different representations such as language, tables or equations. The understanding of relationships relies on a strong foundation of numeric and geometric concepts. Language allows us to formalize these relationships. The exploration of patterns that are also functions, allows for flexible and fluent thinking and the formation of rules about numbers, quantities and relationships. Work with functions begins with meaningful situations within a context and uses proficiency with arithmetic to explore patterns and build generalizations.

NUMERICAL AND PROPORTIONAL REASONING

Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

Central Understanding: Relationships between numbers and operations are discovered and learned in contextual situations

Background: The inquisitive nature of children fosters the development of different strategies for performing operations. Children initially solve multiplication and division problems by directly modeling the action and relations in the problems. The change to more efficient ways for solving these problems develops as children see the connections between different operations. Common algorithms are useful but do not demonstrate math concepts clearly. Estimation is a strategy, not a wild guess, which demonstrates a deeper understanding of the concepts of number and operations. Numerous experiences with multiple representations lead to the ability to make generalizations about number and operations and to a deeper knowledge of mathematical ideas.

MATHEMATICS BACKGROUND FOR GRADE 3 TEACHERS

GEOMETRY AND MEASUREMENT

Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

Central Understanding: Objects and geometric shapes and figures can be described and categorized based upon measurement and classification of specific attributes.

Background: Children at this age are usually firmly at Van Hiele Level 0 of geometric thought, and developing the capability to analyze shapes at Van Hiele Level 1. It is important to consider the child's level of geometric thought when examining geometric shapes and properties and investigating their position on space. Extensive opportunities to explore, construct and measure must be provided for all children. The ability to measure using standard tools will also be developed to a higher level of sophistication, given these opportunities.

WORKING WITH DATA: PROBABILITY AND STATISTICS

Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

Central Understanding: Decisions are made based upon relationships determined from data sets.

Background: Objects or data can be organized or categorized in collections or sets. Information about objects or sets of data can be represented and interpreted in different graphic ways. The method of representation used is governed by the type of information or data under consideration. Numbers or values that describe the characteristics of a selected group or population can be represented statistically. Generalizations, which support decision making, can be made from graphic and statistical representations.

Correlated Grade-Level Expectations

Click here to access correlated grade-level expectations for Grade 3 on the State Department of Education Web site.

Sequenced Grade-Level Expectations

GRADE 3 SEQUENCED GLES

Grade-Level Expectations	Fall	Winter	CMT	Spring
ALGEBRAIC REASONING				
1.1 Understand and describe patterns and functional relationships.				
1. Sort, classify and order a group of objects and numbers in more than one way and explain the reason or describe the rule used.				
2. Create and construct numerical and spatial patterns and sequences that repeat and grow.				
3. Analyze, describe and extend repeating and growing patterns and sequences, including those found in real-world contexts, by constructing and using tables, graphs and charts.				
1.2 Represent and analyze quantitative relationships in a variety of ways.				
4. Describe mathematical relationships and situations involving computation of whole numbers (addition, subtraction, multiplication and division) using words, symbols, open number sentences and equations e.g., $56 + \Delta = 100$ and $3 \times 5 = 9 + 6$.	Addition and subtraction			Multiplication and division
1.3 Use operations, properties and algebraic symbols to determine equivalence and solve problems.				
5. Demonstrate understanding of equivalence as a balanced relationship of quantities by using the equals sign to relate two quantities that are equivalent and the inequality symbols, < and >, to relate two quantities that are not equivalent, e.g. $23 \times 5 > 23 \times 2$.				
6. Solve problems and demonstrate an understanding of equivalence using the equals sign in number sentences that reflect the commutative and associative properties of addition and multiplication of whole numbers, e.g. $3 \times 5 = 5 \times 3$.				
NUMERICAL AND PROPORTIONAL REASONING				
2.1 Understand that a variety of numerical representations can be used to describe quantitative relationships.				
1. Locate, label, compare, and order whole numbers up to 10,000 using place value models, number lines and number patterns (including multiples of 100 and 1000).				
2. Identify the number that is 100 and 1000 more or less than a given number up to 10,000 using place value models, pictures and number lines.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
3. Round three- and four-digit numbers to the nearest hundred and thousand using place value models, number lines and number patterns.				
4. Represent three- and four-digit numbers up to 10,000 in expanded forms e.g., 5472 = (5x1000) + (4x100) + (7x10) + (2x1), and regrouped forms e.g., 5472 = (4x1000) + (14x100) + (6x10) + (12x1). Use the forms to support computational strategies.				
5. Represent fractions with like and unlike denominators of 2, 3, 4, 5, 6 and 8 using a variety of materials; label the fractional parts using words and fraction symbols.				
6. Locate, label and estimate fractions with like and unlike denominators of 2, 3, 4, 5, 6 and 8 by constructing and using models, pictures and number lines.				
7. Determine equivalence, compare and order fractions through the construction and use of models, pictures and number lines with like and unlike denominators of 2, 3, 4, 5, 6 and 8, including identifying a whole object or a whole set of objects as a fraction with the same numerator and denominator.				
8. Use models, number patterns and counting and grouping of objects, to find equal parts of a set of objects and identify amounts such as ⅔ of 12 is 8.				
9. Describe quantitative relationships using ratios and identify patterns with equivalent ratios such as 3 out of 6 crayons are red or 4 out of 8 crayons are red and are the same as 1 out of 2 crayons is red.				
2.2 Use numbers and their properties to compute flexibly and fluently and to reasonably estimate measures and quantities.				
10. Recall the multiplication and division facts for 1, 2, 3, 4, 5 and 10.				
11. Write multiplication and division story problems to match a given multiplication or division number sentence and vice versa; solve the problems and justify the solutions.				
12. Solve problems involving addition and subtraction of two- and three-digit whole numbers and money amounts up to $100.00 with and without regrouping, using a variety of strategies, including models.				
13. Create and solve addition and subtraction word problems by using place value patterns and algebraic properties (commutative and associative for addition).				

Grade-Level Expectations	Fall	Winter	CMT	Spring
14. Solve problems involving the multiplication and division of two- and three-digit numbers by one digit (2, 3, 4, 5 or 10) with models, arrays and pictures of sets.				
15. Determine when an estimate for a problem involving two- and three-digit numbers is appropriate or when an exact answer is needed.				
16. Use a variety of estimation strategies to determine and justify the reasonableness of an answer to a computation or word problem involving addition and subtraction of two- and three-digit whole numbers and money amounts up to $100.00.				
17. Determine when a strategy will result in an over estimate or an underestimate in problems involving two- and three-digit numbers.				
18. Determine and compare the value of sets of coins and write the values using decimal notation, e.g., two quarters = 50 cents or $0.50 (50 of 100 cents in a dollar) and is less than 2 quarters, 2 dimes and one nickel or $0.75.				
19. Determine, compare and write the value of money amounts up to $100.00 and identify equivalent ways to represent a given amount of money, including combinations of pennies, nickels, dimes, quarters and half dollars (e.g., $0.25 can be five nickels, two dimes and 1 nickel, or one quarter).				
GEOMETRY AND MEASUREMENT				
3.1 Use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.				
1. Identify, describe, construct and draw two- dimensional shapes such as quadrilaterals (including parallelograms), pentagons, and hexagons.				
2. Identify, describe, construct and represent three-dimensional figures such as cubes, spheres, cylinders, cones, pyramids, prisms.				
3. Compare and classify polygons and solids and determine congruence by using attributes such as the number and length of sides, faces and edges, and the number and kinds of angles (acute, right and obtuse).				
3.2 Use spatial reasoning, location and geometric relationships to solve problems.				
4. Create two-dimensional figures with one or more lines of reflective symmetry.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
5. Draw and interpret simple maps using shapes or pictures on a coordinate grid.				
6. Investigate ways to tile or tessellate a shape or region using a variety of polygons.				
3.3 Develop and apply units, systems, formulas and appropriate tools to estimate and measure.				
7. Use calendar and clocks to plan and sequence events and identify events and times as occurring in the a.m. and p.m.				
8. Solve problems involving telling time to the nearest quarter hour, five minutes and minute using analog and digital clocks.				
9. Develop an understanding and describe the relationships between appropriate units of measure through concrete experiences (ounces and pounds; gram and kilograms; inches, feet and yards; meters and kilometers; cups, pints and quarts; and milliliters and liters).				
10. Estimate and measure using nonstandard units and appropriate customary and metric tools and units: • length and perimeter to the nearest ¼ inch or ½ centimeter, • area in square inches or square centimeters, • capacity in cups, pints, quarts, milliliters or liters, • weight in ounces, pounds, and grams *[mass is weighed in grams]* • temperature to the nearest degree, and • volume using inch cubes and centimeter cubes.	length	area		
11. Describe and use estimation strategies that can identify a reasonable answer to a measurement problem when an estimate is appropriate.				
WORKING WITH DATA				
4.1 Collect, organize and display data using appropriate statistical and graphical methods.				
1. Pose questions that can be used to guide data collection, organization, and representation.				
2. Collect and organize the data that answer the questions using diagrams, charts, tables, lists, pictographs, bar graphs and line plots.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
4.2 Analyze data sets to form hypotheses and make predictions				
3. Analyze data that have been collected and organized, to draw and defend conclusions based on the data.				
4. Describe an event or element as typical based upon the range, median and mode of a set of data.				
4.3 Understand and apply basic concepts of probability				
5. Experiment to test predictions and determine probability in practical situations such as investigating the fairness of games using a variety of spinners and dice.				
6. Describe the probability of an outcome as ___ out of ___ (e.g., 3 out of 5).				
7. Investigate combinations using models.				

Correlated GOALS 2000
Criterion Referenced Test

GRADE 3 CORRELATED GOALS 2000 CRT

The Goals 2000 Mathematics Curriculum was written as a companion to the 1998 Mathematics Framework. The Goals 2000 resources cited in this 2008 Model for Mathematics Curriculum are aligned to the 2005 Mathematics Curriculum Framework, 2007 Curriculum Standards and the fourth generation Connecticut Mastery Test.

The Grade 3 Criterion Referenced Test Part A from the Goals 2000 Mathematics Curriculum is aligned to the Grade 3 sequenced GLEs and can be used for pre- and post-assessment.

Please use the link below to access the electronic version of the complete document, which includes other activities, such as opportunities for open-ended and challenge experiences that must be examined for alignment prior to use.

http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=321084

Grade 3 Mathematics CRT

Coding indicates related 2007 grade-level expectations

GLE 1.1.2 Complete the following pattern: 36 30 __ 18 12 __

GLE 2.1.4 Which means the same as 700 + 4?

a. 70,004

b. 7,004

c. 704

d. 740

GLE 2.1.4 Which means the same as 680?

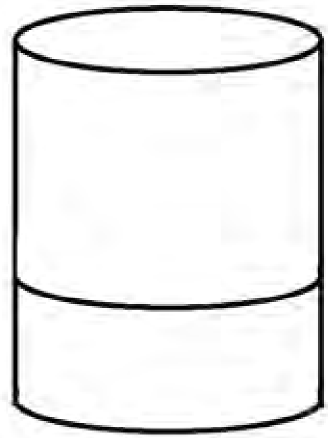
a. 600 + 800

b. 6 + 8 + 0

c. 68 + 0

d. 600 + 80

GLE 2.1.5 About how full is the glass?
About:



a. 1/2
b. 3/4
c. 1/4
d. 4/1

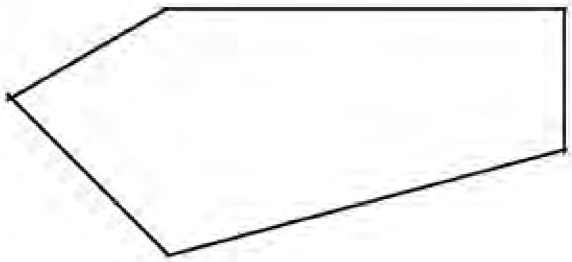
GLE 2.1.3 Our library has 740 books on bats. This number is CLOSEST to:

a. 800
b. 600
c. 700
d. 500

GLE 2.2.17 Cathy and her friend sold 48 boxes of girl scout cookies. ABOUT how many boxes of cookies is that?

a. A little more than 40
b. A little less than 50
c. A little more than 50
d. A little less than 40

GLE 3.3.10 Measure each side of the shape to the nearest centimeter with your ruler. What is the perimeter of the shape? ______________________________



GLE 3.3.8 It is now 9:30. What time will it be in 2 hours?

a. 10:45

b. 11:30

c. 11:45

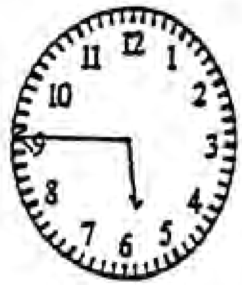
d. 12:00

GLE 3.3.8 Robert set his alarm clock so that he could wake up early. The alarm went off at the time shown on the clock. What time did the alarm ring?

a. 6:45

b. 5:45

c. 5:15



GLE 3.3.8 If your brother looked at the clock and said, "It's quarter to six, we're going to be late" What time would the clock show?

a. 5:45

b. 6:15

c. 6:45

d. 6:30

GLE 3.3.7 Mary overheard her cousin telling her mom she would come to visit on the second Monday in April. What date will that be?

a. April 18

b. April 11

c. April 19

d. April 25

APRIL						
S	**M**	**T**	**W**	**T**	**F**	**S**
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

GLE 3.3.7 Use the above calendar. If your cousin arrives on the second Monday and stays 8 days, what is the date she will leave?

a. April 26

b. April 12

c. April 19

d. April 25

GLE 2.1.4 Which means the same as 395?

a. 3 hundreds and 8 tens and 5 ones

b. 3 hundreds and 7 tens and 5 ones

c. 3 hundreds and 8 tens and 15 ones

d. 3 hundreds and 5 tens and 15 ones

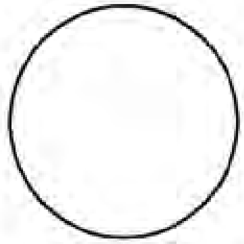
GLE 2.1.4 Which means the same as 6 tens and 16 ones?

a. 616
b. 6010
c. 66
d. 76

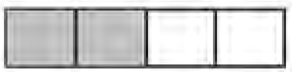
GLE 2.1.5 What fraction of the group of colored markers is shaded?

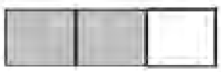
a. 2/6
b. 4/6
c. 2/4
d. 5/6

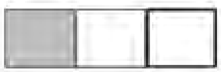
GLE 2.1.6 Shade in 1/4 of the circle.

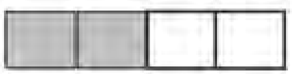


GLE 2.1.6 Which picture shows 2/3 shaded?

a. 

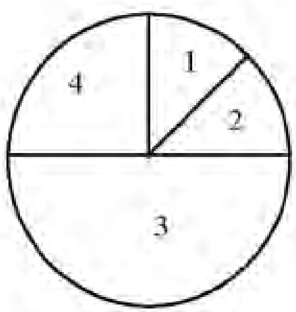
b. 

c. 

d. 

GLE 4.3.5 The game which Jack and Tom are playing uses a spinner like the one shown below. Which number will be landed on MOST often during their game? Explain.

a. 1
b. 2
c. 3
d. 4



GLE 2.2.18 Connie bought her sister a sticker book. It cost $1.06. Here is what Connie got for change.

How much change did Connie get? ____________________

GLE 2.2.12 John's dad bought him 12 tickets at the school carnival. He wants to know how many rides he can go on. What does he need to know to find out how many rides he can go on?

GLE 3.3.9 What is a REASONABLE height for a kitchen table?

a. 3 feet
b. 3 inches
c. 3 miles
d. 3 yards

GLE 3.3.9 What is a REASONABLE weight of a student in Grade 4?

a. 70 tons
b. 70 ounces
c. 70 pounds

GLE 3.3.9 Which of the following would most likely be the length of a tube of toothpaste?

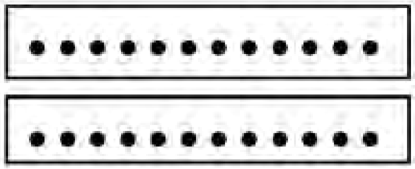
a. 5 inches
b. 5 feet
c. 20 inches
d. 20 feet

GLE 3.3.9 What is a REASONABLE weight (or mass) of a small button?

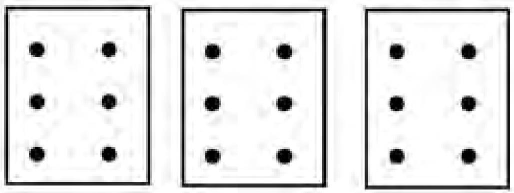
a. 2 kilograms
b. 2 grams
c. 2 liters
d. 2 milliliters

GLE 2.2.11 Which picture goes with the number sentence 18 ÷ 3? Write a story problem to match.

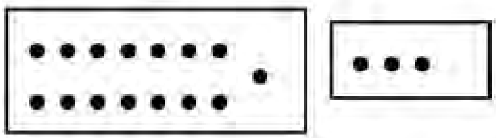
a.



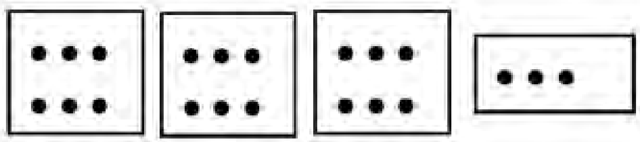
b.



c.

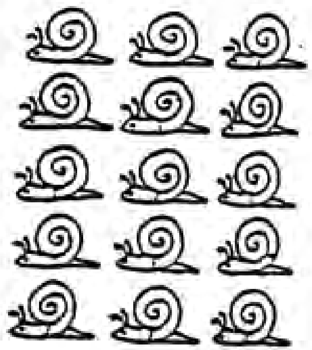


d.



GLE 2.2.11 Which number sentence goes with this picture? Write a problem that can be solved using the picture.

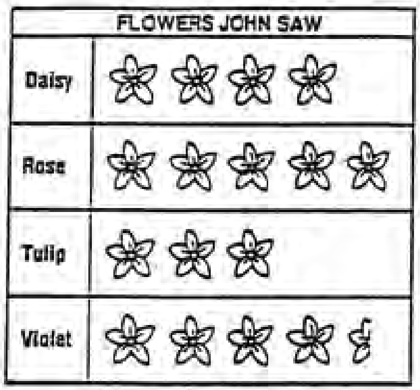
a. 15 ÷ 3 =5
b. 5 x 3 = 15
c. 15 x 1 = 15
d. 3 + 5 = 8



GLE 2.2.11 Juan was getting ready to play a game using marbles. He has 24 marbles and wants to share them with his 3 friends. Which fact could he use to find how any marbles each friend will get?

a. 24 ÷ 4
b. 24 – 4
c. 4 ÷ 24
d. 4 x 24

GLE 4.2.3 Rodrigo and John made graphs of flowers they saw on their walk. Use the graph to answer the questions below.



Each  stands for 4 flowers

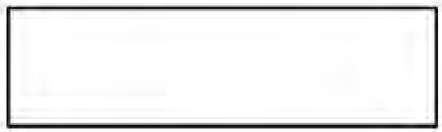
GLE 4.2.3 How many tulips did John see?

a. 10 tulips
b. 3 tulips
c. 12 tulips
d. 4 tulips

GLE 4.2.3 How many daisies did John see? Explain your reasoning.

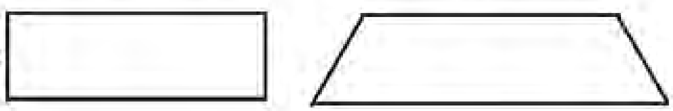
a. 4
b. 5
c. 16
d. 10

GLE 3.2.4 Draw a line of symmetry through the rectangle.

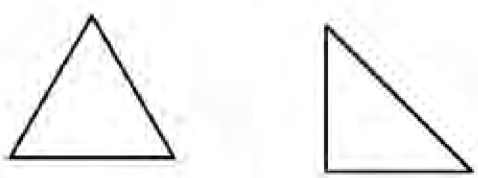


GLE 3.1.1 Draw a 5 sided polygon.

GLE 3.1.3 How are the following shapes alike?

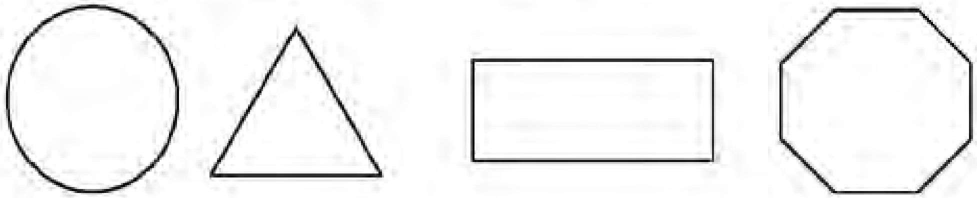
a.


____

b.


____

GLE 3.1.1 Which of these shapes are polygons? Explain how you know.



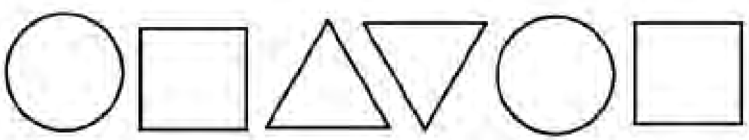
GLE 3.1.1 Draw the following.

a. a square ____________________

b. a trapezoid ____________________

c. a hexagon ____________________

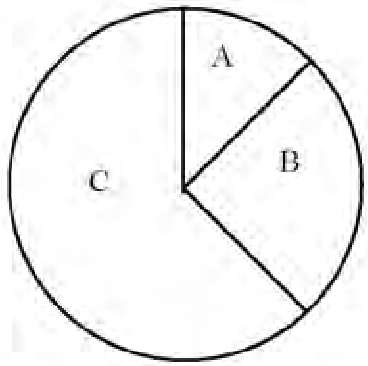
GLE 1.1.2 What 2 shapes are next in this sequence? Write a sentence that explains how you decided what to draw.

 __________ __________

GLE 1.1.2 Fill in the table.

Golf balls	3	6	9	12
cost	$5	$10	$15	

GLE 4.3.5 Players drop counters onto this game board. A player scores a point each time a counter is completely inside the space with his or her letter.



a. Is it a fair game? Explain. ______________________________

____

____

b. Which player will probably have the highest score?

____

____

GLE 1.1.3 Which number belongs in the blank space?

Start	End
20	16
16	12
12	______
8	4

What is the Rule? ____

GLE 2.2.16 Lisa bought 37 bananas and Mary bought 44 apples. About how many pieces of fruit did they buy together? Which number sentence gives the most **REASONABLE** estimate?

a. 40 + 50
b. 40 + 40
c. 30 + 40
d. 30 + 50

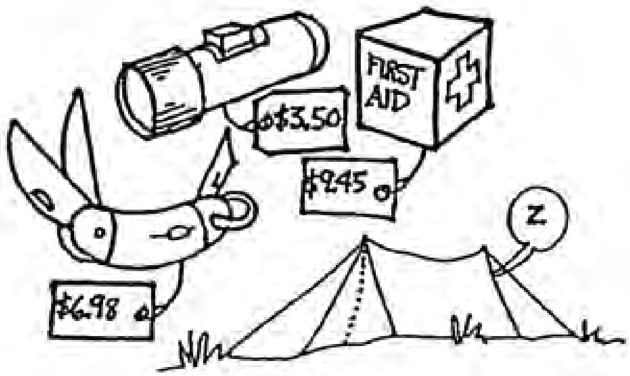
Explain why your answer is reasonable.

____

____

____

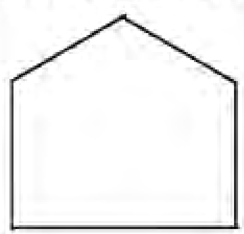
GLE 2.2.12 **Mr. Will Derness bought one first aid kit, one jackknife, and three flashlights. What was the total cost?** ______________



GLE 3.1.1 How many angles and sides does this figure have?

a. ______________ **angles**

b. ______________ **sides**



c. What name can we use to describe this shape? ______________

GLE 3.1.1 Draw a polygon that has 4 sides. Make 2 sides longer than the other 2 sides.

GLE 2.2.15 Sarah has 83 basketball cards in her collection. About how many cards does she have? Which would be the best estimate and why?

a. 85
b. 95
c. 80
d. 90

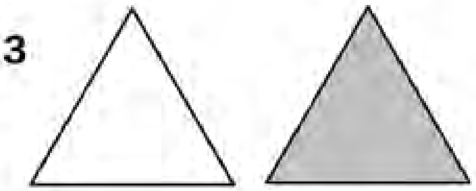
GLE 3.3.7 An airplane that was due to land at 10:40 was 20 minutes late.

What time did the plane land? ________________

GLE 3.3.8 I drove my car from Maine to New York. I left at 10:00 a.m. I arrived in New York at 5:00 p.m.

How many hours was I driving? ______________

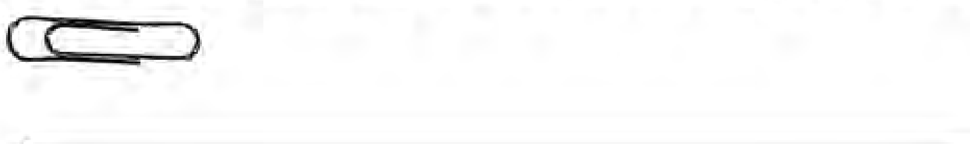
GLE 3.1.3



How are these two figures the same?

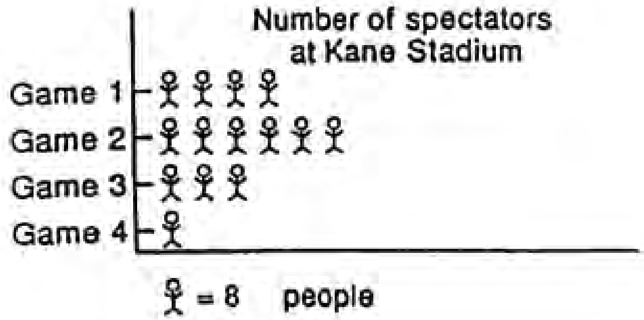
a. size and shape
b. size only
c. shape and coloring
d. shape only

GLE 3.3.10 If this paper clip is two inches long, ABOUT how long is the line?



GLE 4.3.2 Use the pictograph below to answer the question.
How many spectators were at Game 3?

a.
b. 8
c. 3
d. 24
e. 32

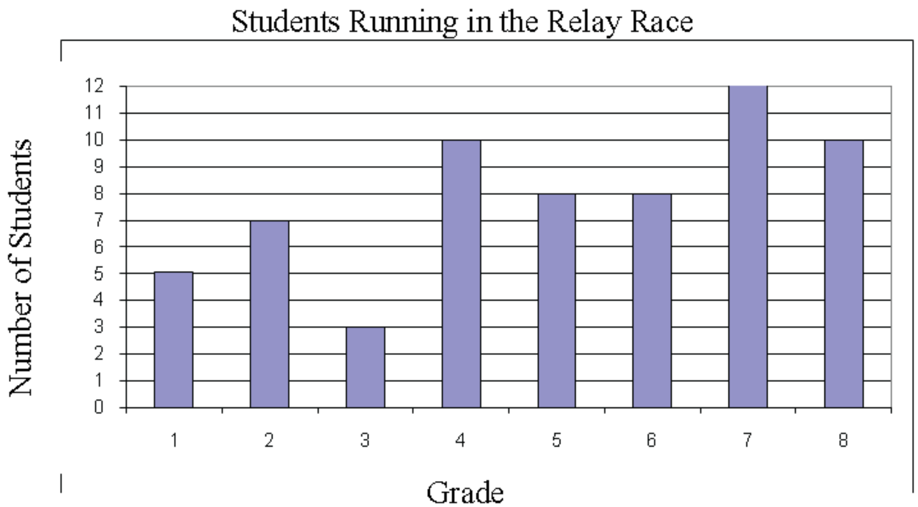


GLE 4.2.3 Use the table to answer this question: How many napkins will you need for 6 people?

PLANNING A PICNIC

Supplies	4 People	6 People	8 People
Bags of Chips	5	7	9
Cookies	8	12	16
Drinks	6	8	10
Napkins	7	9	11
Sandwiches	4	6	8

GLE 4.2.3 Use the graph to answer the questions below.



How many more sixth graders than third graders ran in the relay race?

____

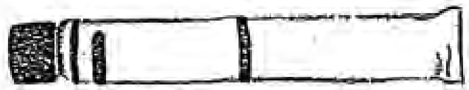
GLE 4.1.1 Write 2 more questions this graph could answer for you?

____

____

____

GLE 3.3.10 Use your ruler to measure the toothpaste tube to the nearest inch.



____

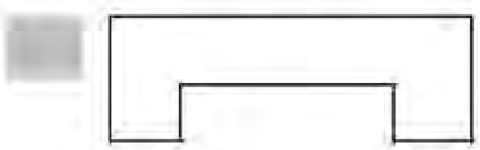
GLE 3.3.10 Measure the pen to the nearest centimeter.

____

GLE 3.3.10 Use a ruler to draw a line 3 inches long.

GLE 3.3.10 Use a ruler to draw a line 9 centimeters long.

GLE 3.3.11 About how many shaded squares will fit in the shape?

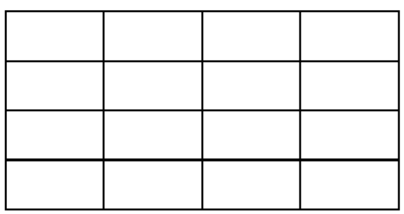


____

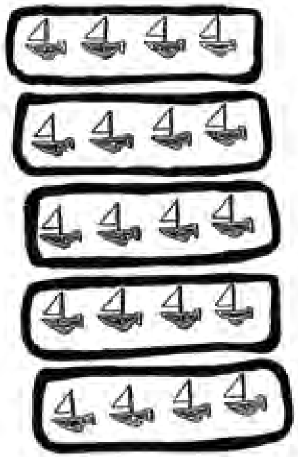
GLE 2.2.11 Write a story problem that could be solved using this number sentence: 5 x 6 = 30

GLE 2.2.11 Abel put his butterfly collection in the case shown. If each square holds 1 butterfly, which fact can be used to find the number of butterflies the case will hold when full?

a. 4 x 4 =
b. 4 ÷ 4 =
c. 4 – 4 =
d. 4 + 4 =



GLE 2.2.11 Write a division sentence for this picture. ____________



GLE 2.2.12 Joe rode his bicycle 28 miles one day. He rode 12 miles the next day. About how many more miles did ride the first day?

a. 10
b. 20
c. 30
d. 40

GLE 2.2.12 At the pet store, there are 15 kinds of fresh water fish, 26 kinds of salt water fish, and 18 kinds of birds. How many kinds of fish are there at the pet store?__________

GLE 2.2.16 Susan made $15.00 delivering newspapers. She spent $11.45 on a birthday present. ABOUT how much does she have left?

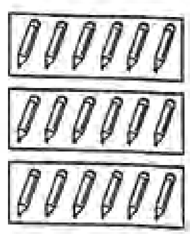
a. A little more then $2.00
b. A little more than $3.00
c. A little less than $4.00
d. A little less than $5.00

GLE 2.2.16 Cleo and Roger rented videotapes for $15.00 and spent $38.00 to buy cassette tapes. Which statement shows the most REASONABLE estimate for what they spent?

a. $10 + $40
b. $10 + $30
c. $20 + $30
d. $20 + $40

GLE 2.2.11 Mrs. Penny divided 18 colored markers equally among three students. Which expression could be used to find the number of markers each student received?

a. 18 + 3
b. 3 ÷ 18
c. 18 ÷ 3
d. 18 x 3



GLE 2.2.10 Complete each fact family.

2 x 5 = 10	4 x 3 = 12
5 x 2 = 10	12 ÷ 3 = 4
10 ÷ 5 = 2	3 x 4 = 12
______________	______________

GLE 2.2.10 Write the fact family for 2, 4, and 8

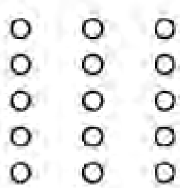
a. ______________________

b. ______________________

c. ______________________

d. ______________________

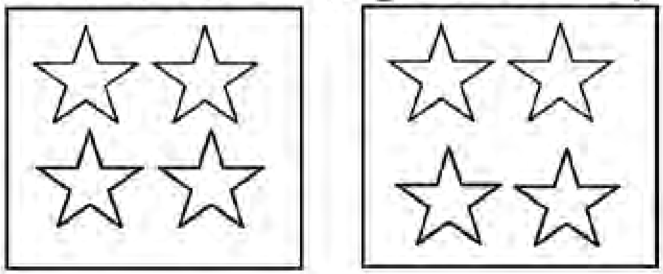
GLE 2.2.11 Write a multiplication sentence for this picture.



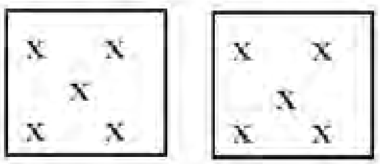
____

GLE 2.2.11 Which number sentence goes with this picture?

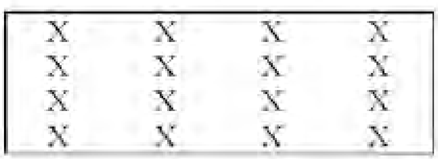
a. $8 \div 2$
b. $4 \div 2$
c. 8×2
d. $2 + 4$



GLE2.2.10 Write a division sentence for this picture. ____________________



GLE2.2.10 Write a multiplication sentence for this picture. ____________________



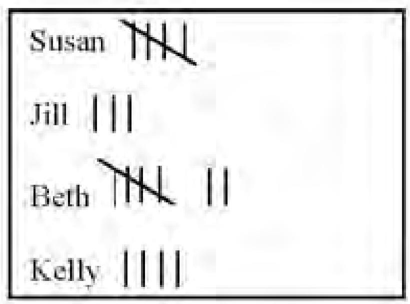
GLE 2.2.14 There were 45 soccer players in a league. 28 new players joined the league. To find out how many players are in the league, you should:

a. Divide 45 by 28
b. Subtract 28 from 45
c. Multiply 28 by 45
d. Add 28 to 45

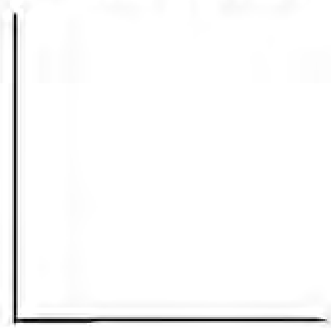
GLE 2.2.12 A paint store ordered an extra 125 cans of paint for a sale. On Monday, they sold 31 cans of paint. On Tuesday, 53 cans of paint were sold. How many more cans of paint were sold on Tuesday than on Monday? Show your work.

a. 72
b. 22
c. 84
d. 209

GLE 4.1.2 Boxes of cookies sold.

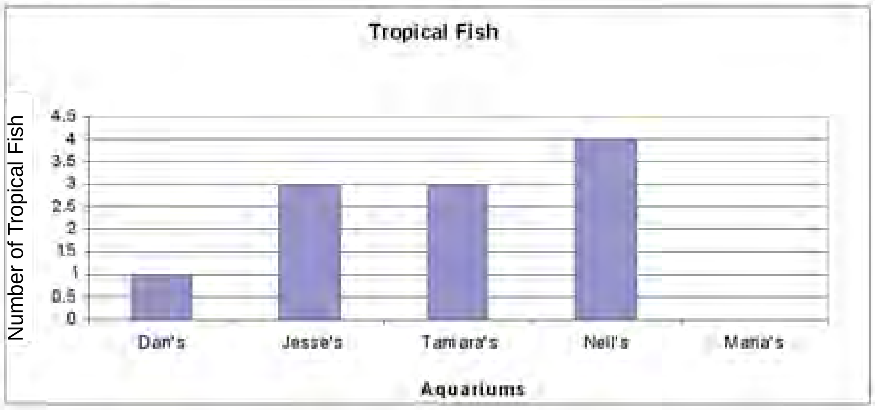


Use the data above to create a graph that shows the amount of cookies sold.



GLE 2.1.2 On Sunday, the bagel shop sold 372 bagels before noon, and 100 more bagels after noon. How many bagels did the bagel shop sell on Sunday? Show your work.

GLE 4.2.3 The graph below show how many tropical fish are in Dan's, Jesse's, Tamara's, Neil's and Maria's aquariums.



a. One of Neil's fish died. How many fish does he have now? ________

b. Who has the most fish? ________________

c. Who do you think has the largest aquarium? Explain.

____

____

GLE 2.2.12 Sue went to the store with $6.00. She wants to buy all these items. Show your work.

a. How much will it cost her? ________________

b. Will she have enough money? ______________

GLE 2.2.12 The phone store has 25 different phones. 16 phones are black. How many phones are not black? _________________

Curriculum Standards Connections

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS. Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 1.1. UNDERSTAND AND DESCRIBE PATTERNS AND FUNCTIONAL RELATIONSHIPS.

Grade-Level Expectations

1. **Sort, classify and order a group of objects and numbers in more than one way and explain the reason or describe the rule used.**

2. **Create and construct numerical and spatial patterns and sequences that repeat and grow. (See also attached Growing Patterns lesson.)**

   - Translate repeating patterns from one medium to another (e.g., keys to pattern blocks).
   - Use centimeter grid paper to explore changes in growing patterns (e.g., make steps.)
   - Extend repeating patterns using numbers, various materials or drawings including orientations (e.g., changing smiles on smiley faces, or repositioning single shapes.) △ ▷ ▽
   - Demonstrate repeating and growing patterns through physical movements (e.g., repeating: the steps in a dance; growing: clap once, clap twice, clap four times)
   - Examine numeric patterns and identify the next number or the missing elements. (e.g. 1, 2, _, 8)

3. **Analyze, describe and extend repeating and growing patterns and sequences, including those found in real-world contexts, by constructing and using tables, graphs and charts. (See also attached Growing Patterns lesson.)**

- Investigate growing patterns (1, 3, 5, 7) and create a table to record and extend the pattern. 
- Start with a number on a hundreds chart and discuss the difference between that number and the one above it, below it, and to each side. Ask questions such as:
  1. What stays the same?
  2. What changes?
  3. Describe any patterns you notice.
- Use sections of a hundreds chart with missing numbers to be identified. Ask children to share the thinking used to identify the missing numbers. Example: Begin with a 2x2 rectangle from the chart 21, 22, __, 32 and then, over time, increase the size of the rectangles, have more missing numbers or give a section of the chart that is not a rectangle.

COMPONENT STATEMENT: 1.2. REPRESENT AND ANALYZE QUANTITATIVE RELATIONSHIPS IN A VARIETY OF WAYS.

Grade-Level Expectations

4. **Describe mathematical relationships and situations involving computation of whole numbers (addition, subtraction, multiplication and division) using words, symbols, open number sentences and equations e.g., $56 + \Delta = 100$ and $3 \times 5 = 9 + 6$.**

- Explore and describe skip counting and multiplication patterns found by using hundreds charts.
- Use constant keys on calculators to: (a) create multiplication tables (b) predict and then verify the next number in a growing pattern.

❖ **Possible Assessment Opportunity**

❖ Have the children explore different operations to reach a target number and describe the patterns they noticed in a journal.

Intervention: Begin with addition and subtraction.

Challenge: Include multiplication and find the least number of steps needed to reach the target number.

COMPONENT STATEMENT: 1.3. USE OPERATIONS, PROPERTIES AND ALGEBRAIC SYMBOLS TO DETERMINE EQUIVALENCE AND SOLVE PROBLEMS.

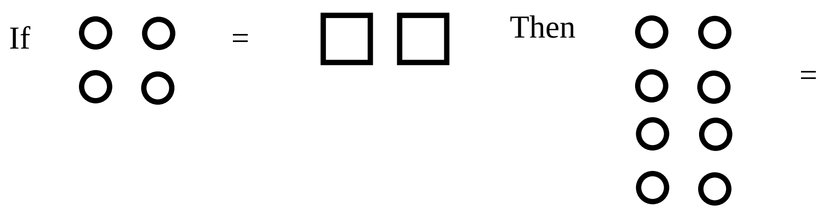
Grade-Level Expectations

5. Demonstrate understanding of equivalence as a balanced relationship of quantities by using the equals sign to relate two quantities that are equivalent and the inequality symbols, < and >, to relate two quantities that are not equivalent. (23 x 5 > 23 x 2)

- Have the children record different number combinations that will yield the same sum [e.g., 3 + 3 = 6, 5 + 1 = 6, or 1 + 5 = 6, 2 + 4 = 6, or 4 + 2 = 6, etc. or 2 + 1 + 3 is equal to 2 + (1 + 3) is equal to 6] and explain why another combination is not equivalent to the same sum (e.g., 2 + 5 = 7 or 8 + 7 > 6 + 6).
- Activities with a balance scale and counters or paper clips on an equal arm balance can also be used to demonstrate this concept.
- Investigate a variety of numeric patterns that demonstrate ratios (e.g., one orange has eight segments; two oranges have 16 segments, etc.)

❖ <u>**Possible Assessment Opportunity**</u>

❖ Have the children create a table to identify patterns or simple ratios that show equivalence in a given problem such as:



Intervention: Provide a graphic organizer (table) with a few numbers inserted as cues. Have the children predict how the pattern will extend on the table and then test to check the prediction.

Challenge: If there are three wheels on a tricycle and two wheels on a bicycle what is the total number of bicycles and tricycles you would need to have an equal number of wheels for both bicycles and tricycles?

6. Solve problems and demonstrate an understanding of equivalence using the equals sign in number sentences that reflect the commutative and associative properties of addition and multiplication of whole numbers, e.g. 3 x 5 = 5 x 3.

SAMPLE INTEGRATED LESSON — GROWING PATTERNS (A MULTI-DAY LESSON)

Adapted from a lesson prepared by Grace M. Burton for NCTM Illuminations.

Objective:

Students will:

- create growing patterns
- describe growing patterns
- analyze how growing patterns are created
- find number patterns in Pascal's triangle

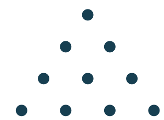
Grade-Level Expectations: 1.1.3, 1.2.4

Time: Multiple days

Procedure: Open the following link to complete the lesson: http://illuminations.nctm.org/LessonDetail.aspx?ID=L304. For lesson materials, click the following links:

- http://mathforum.org/workshops/usi/pascal/images/blank.comb.gif
- http://mathforum.org/workshops/usi/pascal/images/fill.comb.gif.

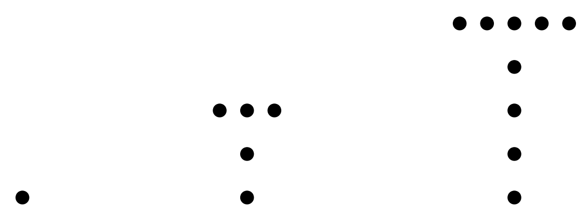
1. Explain that students will be exploring patterns that grow according to a rule. Display the “bowling pin” pattern (which is a “counting-on” pattern):



2. Then ask, “What will come next in this pattern?” (Students may find this question easier to answer if they use cubes on a blank grid or copy the pattern onto paper.) When students give the correct answer [a row of five dots], ask them to explain how they got that answer. Repeat with several more rows. Then ask the students to state the rule that they would use to add more figures to the pattern. Encourage alternate expressions of the rule. (This activity requires higher-order thinking and involves solving numerical problems.)

3. Make a “corner pattern” by making a right angle with three dots, then one with five dots, then one with seven dots. What will come next in this growing pattern? Then what? How do you know? Have you seen this pattern before? (It is a list of the odd numbers.)

4. Next display the pattern below, and ask students what they might call the pattern (a T pattern). Ask questions such as: How many dots are in the first figure of the T growing pattern? How many dots will be in the fourth figure? In the fifth? How do you know? What is the rule? How would you demonstrate that you have found the rule? (Each figure contains four dots more than the previous figure.) How long could we continue this pattern? (Forever.)



5. Then repeat the steps used in the counting-on pattern above with the new pattern below. (The next three figures will contain 13, 17, and 21 dots.) Ask several students to state the rule that they would use to add more figures to the pattern. (Each time, two dots are added to each part of the previous figure.) Then ask them to add more rows to the table below.

Figure	Dots
1	1
2	5
3	9

6. Next introduce the students to Pascal's triangle by using the first 6 rows of the triangle. Use the worksheets on the links listed on the previous page or open Exploring Pascal's Triangle. Ask for volunteers to name any patterns that they see. Ask questions such as: Here is a row from Pascal's triangle (1 4 6 4 1), what would be the row after that? How do you know? What is the sum of this row? What is the sum of the first four rows (1, 2, 4, 8)? Do you notice a pattern in the sum of the rows? (Each row's sum is double the previous sum.) Do you notice any other patterns in the triangle?

7. To conclude the lesson, have the students make patterns that grow and exchange them with a friend to extend. At the end of the class, ask for volunteers to share their growing patterns and their rules. Ask questions such as: What was the rule for one of the patterns that you made? Did anyone else make a different pattern with that rule?

Interdisciplinary Framework Connections			
Science	**English/Language Arts**	**Visual and Performing Arts**	**Physical Education**
B INQ.1 Make observations and ask questions about objects, organisms and the environment. **B INQ.10** Use mathematics to analyze, interpret and present data.	• Use content vocabulary appropriately and accurately. • Develop a critical stance and cite evidence to support the stance.	• Demonstrate non–locomotor movements (such as bend, twist, stretch, sway, swing). • Demonstrate eight basic locomotor movements. • Demonstrate accuracy in moving to a musical beat and responding to change in tempo. • Identify and demonstrate basic dynamic contrasts (slow/quick, gentle/strong).	• Explore and adapt fundamental movement skills to meet a variety of challenges. • Interact with peers while participating in group activities.

Vocabulary: function, rule, equal, not equal, ratio, trends, , flip, rotate, slide, construct, pattern, function, relationship, sort, classify, sequence, analyze, equivalence, inequalities, CMT Web site - http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/math/cmtgrade3.pdf

Resources:

Electronic Resources:

National Library of Virtual Manipulatives http://nlvm.usu.edu/en/nav/grade_g_1.html

Math Forum http://mathforum.org/

Interactive Resources http://www.globalclassroom.org/ecell00/javamath.html

Mirror Tool http://illuminations.nctm.org/ActivityDetail.aspx?ID=24

Star Child http://starchild.gsfc.nasa.gov/docs/StarChild/

Illuminations http://illuminations.nctm.org/

3-D Patterns – Goals 2000 -

Color Combinations – Goals 2000

Teacher References:

Navigating through Algebra – Grades 3-5 NCTM

Children's Literature:

Right in Your Own Backyard, by Time Life for Children

Two of Everything, by Lily Toy Hong

A Cloak for a Dreamer, by Aileen Friedman

The Nature and Science of Patterns, by Jane Burton

Sam Johnson and the Blue Ribbon Quilt, by Lisa Campbell Ernst

The Coin Counting Book, by Rozanne Lanczak Williams

Only One, by Marc Harshman

Equal Shmequal, by Virginia Kroll

The King's Chessboard, by David Birch

Mrs. Fitz's Flamingos, by Kevin McCloskey

How Much, How Many, How Far, How Heavy, How Long, How Tall...is 1000? by Helen Nolan

The April Rabbits, by David Cleveland

Notes:

***NUMERICAL AND PROPORTIONAL REASONING*. Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.**

COMPONENT STATEMENT: 2.1. UNDERSTAND THAT A VARIETY OF NUMERICAL REPRESENTATIONS CAN BE USED TO DESCRIBE QUANTITATIVE RELATIONSHIPS

Grade-Level Expectations

1. **Locate, label, compare and order whole numbers up to 10,000 using place value models, number lines and number patterns (including multiples of 100 and 1,000).**

   - Build upon children's existing sense of number and number patterns. Reinforce the fact that it takes 10 units, or ones, to make a ten, and that it takes 10 tens to make 100, and 10 hundreds to make 1000, and so on. Have children demonstrate with place value models for numbers up to 1000 and explain their thinking orally and in writing.

   - Give children nonconsecutive three-digit numbers on index cards. (Extend this activity to four- and five-digit numbers as soon as children are ready). Have the children line up in order of their numbers. Ask questions such as:

     1. Is this the only way to line up? Why or Why not?

     2. Name a number that comes between "Joe's number" and "Susie's number." Explain how you know that to be true.

     3. Have the children place all of their numbers in order (least to greatest or greatest to least) on a number line across a board or on a line made of string. Ask each child to pick one of the numbers as a favorite and write or illustrate as much as she can about the number in terms of place value (each digit) and its proximity to the nearest 100 or 1000.

     4. Ask a child to use printed number lines or number charts (use hundreds chart as a model) to count by tens, hundreds or thousands up to a target number and explain how to get to the number by adding or taking away ones, tens and/or

hundreds to get to the target. Ex: For target number 6,453, star with 5,950 and count by 50's-6,000, 6,050, 6,100, 6,150… to get to 6,453, then describe the target number position in relation to 5,000 and 6,000 when counting by hundreds on a number line (the number is closer to 6,500 than to 6,400).

2. Identify the number that is 100 and 1,000 more or less than a given number up to 10,000 using place value models, pictures and number lines.

- Give children nonconsecutive three- or four-digit numbers on index cards. Have the children:

1. Name a number that is 10 more or less than ______ 100 more or less than _______ 1,000 more or less than_____.
2. Identify the number which is closest to ______?
3. Use a string line and place cards with each of the hundreds (or thousands) on the line and have the children place their numbers in the appropriate location on the number line.

❖ **Possible Assessment Opportunities**

❖ Play "I'm thinking of a number" and have children hold up their answers using digit cards or on slates.

Give clues such as:

1. I'm thinking of a three-digit number that is between 300 and 400.
2. My number has a digit in the tens place that is twice the digit in the ones place. What could my number be? Some possibilities are 342, 363 or 384.
3. My number is a multiple of 2. What could my number be?
4. If I were to place my number on a number line, it would be closer to 300 than to 400. What could my number be?

Explain to your neighbor how you know that your answer is correct.

Intervention: Preteach for the game by modeling, explaining and recording strategies to get to the written two-digit number. Ask the child to explain the process. Move to three- and four-digit numbers when the child is ready.

Challenge: Have children think of target numbers to the extent of their capabilities and develop clues for others to figure out the number.

3. **Round three- and four-digit numbers to the nearest hundred and thousand using place value models, number lines and number patterns. (See GLEs 2.1.1 and 2.1.2.)**

4. **Represent three- and four-digit numbers up to 10,000 in expanded forms 5472 = (5 x 1000) + (4 x 100) + (7 x 10) + (2 x 1) and regrouped forms e.g., 5472 = (4 x 1000) + (14 x 100) + (6 x 10) + (12 x 1). Use the forms to support computational strategies.**

- Use a place-value chart and base-ten materials to represent a number in standard form and develop number names. Record the number using pictures and numbers in expanded and standard notation.

- Ask students to identify how they are using place value when computing. Ex: 72 - 69 means that 72 must be regrouped as 60 + 12, or 6 tens and 12 ones in order to perform the indicated operation.

❖ Possible Assessment Opportunities

❖ Provide each child with a three- or four-digit number and ask them to find a variety of ways to represent that number. Models and pictures as well as numbers should be encouraged.

Intervention: Ask children to build a two-digit number using models or pictures before moving to three digits and then on to four digits. Have children describe the number while composing and decomposing with models.

Challenge: Expect a greater variety of representations (e.g., expanded notation, multiples, or a fractional part of another number). Have the children explain when these representations would be useful.

5. **Represent fractions with like and unlike denominators of 2, 3, 4, 5, 6 and 8 using a variety of materials; label the fractional parts using words and fraction symbols.**

- Give students multiple opportunities to use a variety of material such as pattern blocks ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$), paper squares, paper strips, spinners or fraction circles to represent fractions and frame discussions.

- Identify times over the course of a week when fractions were used at home, school, shopping, etc. Write story problems that describe and illustrate how the fractions were use at home, school, etc.

6. **Locate, label and estimate fractions with like and unlike denominators of 2, 3, 4, 5, 6 and 8 by constructing and using models, pictures and number lines.**

   - Create models of fractions, such as fraction bars, to show a whole and parts of the whole. Guide the children in writing the appropriate fraction names on each piece. Encourage the children to manipulate the pieces to explore how the fractional pieces make a whole.

   - Label missing unit fractions on a given number line marked in halves, or thirds, or fourths

   - Compare fraction strips or bars (two or three at a time) that have been divided into halves, thirds, fourths, fifths, sixths and eighths to determine the size of each unit fraction and the relative placement of each on a number line, bar or strip that represents a whole.

7. **Determine equivalence, compare and order fractions through the construction and use of models, pictures and number lines with like and unlike denominators of 2, 3, 4, 5, 6 and 8, including identifying a whole object or a whole set of objects as a fraction with the same numerator and denominator.**

   - Construct models such as fraction bars or fraction squares (e.g., use different colors of 6 x 6 squares of construction paper divided into equal pieces of 2, 3, 4, 5, 6, 8 and label each pieces with the appropriate fraction). Use the models to identify equivalent fractions and to compare and order fractions.

   - Find fractional parts of sets. Give groups of children small sets of objects and discuss how they would split them in half. Discuss the relationship between fractions and division such as ½ of 8 is 4 or $^{4}/_{8}$, and the corresponding division problem 8 ÷ 2. Continue the process with other common fractions.

8. **Use models, number patterns and counting and grouping to find equal parts of a set of objects and identify amounts such as ⅔ of 12 is 8.** 

   - Have children use objects, pictures and models to complete statements such as: If ⅓ of 6 is 2, then ⅔ of 6 is __. ⅓ of 12 would be__ if ⅔ of 12 equals 8.

9. **Describe quantitative relationships using ratios and identify patterns with equivalent rations such as 3 out of 6 crayons**

are red or 4 out of 8 crayons are red and are the same as 1 out of 2 crayons is red.

❖ **Possible Assessment Opportunities**

- ❖ Use hexagon, trapezoid, blue rhombus and triangle pattern blocks to show different ways to equal one whole,
- ❖ Using the hexagon as one whole, ask children to find different ways to make the same design in fractional parts using hexagons, blue rhombuses, green triangles and red trapezoids. The children should record the various solutions as number sentences using fraction notation or the first letter of the color of the blocks used. (This can also be done on a computer)

Intervention: Provide appropriate terminology in a bank (¼ and one-fourth, ½ and one-half). Place pattern blocks directly on top of a shape template to record the pieces used to cover the hexagon..

Challenge: Create other fraction pattern block puzzles that have values greater than one (such as a hexagon, trapezoid and triangle clown, hexagon and trapezoid fish, or "peanut shape" made from two hexagons side by side). Encourage other children to solve the puzzles and record the appropriate fractions using drawings, fraction symbols and number sentences.

OR, use Fraction Concept lessons from the National Library of Virtual Manipulatives:

http://enlvm.usu.edu/ma/classes/__shared/emready@fraction_concepts/info/lessonplan.html

COMPONENT STATEMENT: 2.2. USE NUMBERS AND THEIR PROPERTIES TO COMPUTE FLEXIBLY AND FLUENTLY AND TO REASONABLY ESTIMATE MEASURES AND QUANTITIES

Grade-Level Expectations

10. Recall the multiplication and division facts for 1, 2, 3, 4, 5 and 10.

- Use pictures of objects to develop the understanding of multiplication and divisions (e.g., the wings of butterflies, a group of stoplights, legs on chairs or tables, wheels on a tricycle, fingers on hands). Have children write story problems and complete number sentences such as: 3 groups of 5 and 3 X 5 = 15, or repeated addition 5+ 5+ 5 = 15.

- Create arrays with color tiles to represent multiplication and division facts. Replicate the arrays on graph paper, record corresponding number sentences and state the facts.

- Give children multiplication charts and have them shade in the multiples of 2, 3, 4, 5 and 10 using different colors. Discuss how the patterns are developing in the chart, record the corresponding number sentences, and state all the facts they have found.

❖ **Possible Assessment Opportunities**

❖ Writing Prompt: Write a letter to a new student in our class who does not know multiplication. Explain what you understand about multiplication and the best ways to learn and use multiplication. You can use diagrams to help to show what you mean. You must write in complete sentences.

Intervention: Provide a word bank of key words (e.g., repeating, arrays, addition, groups, etc.).

Challenge: Explain how multiplication is related to division.

- Provide sets of objects for groups of children to divide and share equally. Ask questions such as:

1. What happens if we can't divide the set up equally among the group members?
2. What do you notice about the number of people in the group and whether you can divide the set of objects equally?
3. Write about what happens when you divide a set of objects among a group of children.

11. Write multiplication and division story problems to match a given multiplication or division number sentence and vice versa; solve the problems and justify the solutions.

12. Solve problems involving addition and subtraction of two- and three-digit whole numbers and money amounts up to $100.00 with and without regrouping, using a variety of strategies, including models.

- Supply children with base-ten materials to discover three-digit addition and subtraction with regrouping using given number sentences (e.g., 646 + 175 = __).

- Using a number line that children have created, choose two children and ask them to add their numbers together (using any strategies) and determine where the sum will be placed on the number line. Ask questions such as:

  1. How did you get the sum?

  2. How did you know where to place the sum on the number line?

  3. Can anyone share why they think the sum is in the correct or incorrect place?

  4. What would happen to the sum if we change the digit in the tens place to__?

     - What would the new number be?

     - Where would we place the new number on our line and why?

13. Create and solve addition and subtraction word problems by using place value patterns and algebraic properties (commutative and associative for addition).

- Give children opportunities throughout the year to use contextual situations to compute flexibly.

  Ex: Gil is proud that he rode his bicycle 30 miles today, especially when he heard that yesterday Gail had ridden her bicycle 7 miles and Abe had ridden 28 miles on his bicycle. Barbara wanted to know how many miles her three friends had ridden all together. She thought 30 + 7 + 28 could be added in different ways: 30 + 28 + 7 or 30 + 20 + 15 or 37 +28 or 50 + 15.

14. Solve problems involving the multiplication and division of two- and three-digit numbers by one digit (2, 3, 4, 5 or 10) with models, arrays and pictures of sets.

- Match illustrations and models of multiplication and division problems to the appropriate number sentences

15. Determine when an estimate for a problem involving two- and three-digit numbers is appropriate or when an exact answer is needed

16. Use a variety of estimation strategies to determine and justify the reasonableness of an answer to a computation or word problem involving addition and subtraction of two- and three-digit whole numbers and money amounts up to $100.00.

- Using a number line the children have created, ask each child to pick a number and work in pairs to estimate what number their sum would be close to on the number line. Ask questions such as:

  1. How do you know your estimate is reasonable?
  2. Check your estimate to determine if it is reasonable, an overestimate or an underestimate.
  3. What do you need to think about when estimating?

❖ **Possible Assessment Opportunities**

❖ Create a grocery store with priced empty packages. Provide a target amount the children have to spend.

Version 1- Have children "shop" in pairs. Challenge the children to see which pair can get closest to the target amount in the shortest amount of time. Allow children to choose various strategies to determine the accuracy of the estimated purchase.

Version 2 – Have the children shop by choosing at least four items and then make an estimate on how much they spent. Find out if their estimate was reasonable and calculate the real cost. Have the children explain in writing how they arrived at their estimate.

Intervention: Provide number lines or hundreds charts to help facilitate estimation. Orally explain each step of estimation during the process.

Challenge: Describe the estimation strategies used for the two different shopping trips compare and determine the efficiency of each

❖ **Possible Assessment Opportunities**

❖ Furnish simple number sentences for addition or subtraction and have the children write story problems for the number sentences

Intervention: Analyze the components of addition and subtraction story problems with the children. Discuss how they are written and the necessary components. Provide a graphic organizer showing two sentences and a line ending with a question mark. Add some key words if necessary and gradually reduce the given words as ability increases.

Challenge: Write a story problem for a multiple step number sentence (e.g., 12 + 9 – 2).

17. Determine when a strategy will result in an over- or and under-estimate in problems involving two- and three-digit numbers.

18. Determine and compare the value of sets of coins, and write the values using decimal notation, i.e. 2 quarters = 50¢ or $0.50 (fifty of 100 cents in a dollar) and is less than 2 quarters, 2 dimes and a nickel or $0.75.

19. Determine, compare and write the value of money amounts up to $100.00 and identify equivalent ways to represent a given amount of money, including combinations of pennies, nickels, dimes, quarters and half dollars (e.g., $0.25 can be five nickels, two dimes and 1 nickel, or one quarter).

- Given various amounts of coins, the children identify the amount, compare amounts and write the value of coins using cent and decimal notation.

❖ **Possible Assessment Opportunities**

❖ Write down a specific amount of money, less than one dollar. Have the children list all the ways to make that amount of money.

Intervention: Use real money and, if adding or counting on is difficult, provide support such as a hundreds chart.

Challenge: Find out how much money was spent if you paid with a dollar and received a specific amount as change. Explain how you found your answer.

SAMPLE INTEGRATED LESSON – EDWARD'S EXCELLENT EATERY

Context: Jessica wants to order some food in a restaurant. The menu for the restaurant is as follows:

Edward's Excellent Eatery

ENTREES	**PRICE**
Pasta with sauce	$ 6.00
Baked fish	$ 9.00
Chicken	$ 7.00
Top sirloin	$ 8.00
DRINKS	
Small soda	$ 1.00
Large soda	$ 2.00
Iced tea	$ 2.00
Milk	$ 1.00
DESSERTS	
Jell-O	$ 1.00
Chocolate cake	$ 3.00
Pie	$ 2.00
Pie and ice cream	$ 4.00

Objectives: Children will be able to add, subtract and multiply money amounts.

Children will estimate a sum.

Children will justify the purchase of their items.

Grade-Level Expectations: 1.2.4, 1.3.5, 1.3.6, 2.2.12, 2.2.15, 2.2.16,

Time: One to two instructional periods

Materials: paper, pencil, menu, and calculator

Procedure:

1. Jessica must only order one entree, at least two drinks and no more than three desserts.
2. Jessica can spend no more than $20.00 for the food.
3. Use estimation to decide what items you could possibly use to create meals for under $20.00
4. List three different meals that Jessica could order for herself.
5. Determine the total cost for each meal using multiplication, addition and subtraction. Show all your work.
6. Were your estimates reasonable? Explain why.
7. If any of the meals cost more than $20.00, make other choices because the Edward's Excellent Eatery won't let Jessica buy things when she doesn't have enough money.
8. Figure out how much change you will get from the $20.00.
9. Recheck your work with a calculator. How accurate were you? What could you do to improve your work?

Interdisciplinary Framework Connections		
English/Language Arts	**Social Studies**	**Information and Technology**
• Use content vocabulary appropriately and accurately (math, music, science, social studies) • Use strategies to generate and develop ideas for speaking, writing and visual activities. • Publish and/or present final products in a myriad of ways, including the use of the arts and technology.	• Recognize that money is an exchange and that different countries use different currencies.	• Use content-specific technology tools and software

Vocabulary: arrays, grouping, place value, hundred more, hundred less, close to, closer to, about , almost, referent, shorter, longer, taller, visual organizer, unit, part-whole, whole, numerator, denominator, mixed number, measurement model, fractional parts, fractional value, product, partitioning, quotient, divisor, multiple, decimal, decimal notation, regroup, commutative property, associative property, compare, round, estimate, reasonable, approximate. See CMT Handbook on website: http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/math/cmtgrade3.pdf for additional vocabulary.

Resources:

Electronic Resources:

Making Connections with the Vedic square (ENC):

http://my.goenc.com/classroom/documents/?doc_type=doc&doc_id=2770&file_name=index.asp

Rectangle multiplication (Grades 3-5) (ENC): http://nlvm.usu.edu/en/nav/frames_asid_192_g_2_t_1.html

The Product Game (NCTM): http://illuminations.nctm.org/LessonDetail.aspx?id=U100

Visual Fractions: http://www.visualfractions.com/

Fun with Fractions: http://illuminations.nctm.org/LessonDetail.aspx?id=U113

Bear's Breakfast – Goals 2000

Fraction Posters – Goals 2000

Picturing 123 – Goals 2000

Estimate Needed – Goals 2000

Hot Dog Buns – Goals 2000

Picturing Multiplication – Goals 2000

Teacher References:

Recycle Integrated Learning Experience 2 http://www.mcps.k12.md.us/curriculum/socialstd/grade3/Recycle_3_2.html

A Deeper Look at Elementary Mathematics http://my.goenc.com/classroom/documents/?doc_type=doc&doc_id=2868&file_name=index.asp

Teaching Student-Centered Mathematics, Grades 3 – 5 by J. A. Van de Walle and L. H. Lovin

Adding it up: Helping Children Learn Mathematics, by National Research Council

Children's Literature:

Welcome To Garbage Can, by Sandy Grimsley

Math Potatoes, by Greg Tang

More than One, by Tana Hoban

Counting On Frank, by Rod Clement

The Best of Times, by Greg Tang

Fraction Action, by Loreen Leedy

The Doorbell Rang, by Pat Hutchins

Trash, by Charlotte Wilcox

Each Orange Had 8 Slices, by Paul Giganti

Moira's Birthday, by Robert Munsch

Six Dinner Sid, by Inga Moore

Roman Numerals I to MM, by Arthur Geisert

Amanda Bean's Amazing Dream, by Cindy Neuschwander

How Much Is A Million? by David Schwartz

The 329th Friend, by Marjorie Sharmat

Bunches and Bunches of Bunnies, by Louise Matthews

Notes:

GEOMETRY AND MEASUREMENT. Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 3.1. USE PROPERTIES AND CHARACTERISTICS OF TWO- AND THREE-DIMENSIONAL SHAPES AND GEOMETRIC THEOREMS TO DESCRIBE RELATIONSHIPS, COMMUNICATE IDEAS AND SOLVE PROBLEMS.

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

1. **Identify, describe, construct and draw two-dimensional shapes such as quadrilaterals (including parallelograms), pentagons and hexagons.**

   - Select a shape of the day and have the children find that shape throughout the school and record where they located the shape and describe the object that included or actually was the shape of the day.
   - Have the children use flexible straws to make regular polygons by placing the short end of the flexible straw into the long end. (This will ensure that all sides will be of equal length and each interior angle the same approximate measure). Discuss the attributes of the shapes.
   - Prepare "Who Am I" riddles for the children to solve, such as: "I am a polygon; I have four sides of equal length, but the four angles are not of equal measure. Who am I?" Have students make up riddles and share them with each other.

2. **Identify, describe, construct and represent three-dimensional figures such as cubes, spheres, cylinders, cones, pyramids, prisms.**

   - Have children use 10 cubes to build a three-dimensional shape and draw the shape on graph paper showing how it would look from the front, back, side, top, and bottom. Have students try to match each other's drawings with the appropriate structures.

3. **Compare and classify polygons and solids and determine congruence by using attributes such as the number and length**

of sides, faces, and edges, and the number and kinds of angles (acute, right and obtuse).

- The children can look around their homes for objects that have the different types of angles-acute, obtuse and right-within the object and record and describe their observations. Have the children classify the objects by angles on a graphic organizer.

❖ **Possible Assessment Opportunities**

❖ Classify polygons according to attributes. Polygons are two-dimensional objects, not solids. Polygons are classified and described by the number of sides, the kind of angles, and the length of the sides.

Intervention: Begin with triangles and quadrilaterals that can be manipulated. Have children classify by the number of sides, types of angles (right or not right), and congruence.

Challenge: Use a variety of polygons, including those with irregular and concave shapes. Identify and classify the polygons, then write definitions for each group based on the similarities of the attributes.

4. ***Create two-dimensional figures with one or more lines of reflective symmetry.***

- Have the children create symmetrical patterns using grid paper, geoboards and computer programs.

COMPONENT STATEMENT: 3.2. USE SPATIAL REASONING, LOCATION AND GEOMETRIC RELATIONSHIPS TO SOLVE PROBLEMS.

Grade-Level Expectations

5. **Draw and interpret simple maps using shapes or pictures on a coordinate grid.**

- Place various objects in different locations on a large grid (marked by masking tape) on the floor or playground. Have the children describe how to move from one object to another based on location, position and direction, using appropriate terminology.

- Provide a collection of pictures or stickers that the children will arrange on an x,y (quadrant 1 only) according to directions such as, place the picture of the flower next to the picture of the clown. The picture of the cat will be 2 places to the right of the clown. Stamps can also be used for this activity.

- Share with the children symbols and shapes from other cultures that are used in bead work, fabric, or clothing. Have children create a design on a coordinate grid that could be used on clothing or fabric.

6. **Investigate ways to tile or tessellate a shape or region using a variety of polygons.**

   - Have children work to cover a design using pattern blocks. Begin with students covering a square with square tiles, cover a pattern block hexagon; create a pattern block design and attempt to tessellate

   - Have children create a design using 2 or more pattern blocks that can cover a piece of paper or a pre-drawn design by tessellating (repeating the design completely covering the region without open space or overlaps.

COMPONENT STATEMENT: 3.3. DEVELOP AND APPLY UNITS, SYSTEMS, FORMULAS AND APPROPRIATE TOOLS TO ESTIMATE AND MEASURE.

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

7. **Use calendar and clocks to plan and sequence events and identify events and times as occurring in the a.m. and p.m.**

8. **Solve problems involving telling time to the nearest quarter hour, five minutes and minute using analog and digital clocks.**

   - Construct analog clocks together while discussing the parts, beginning with the numbers and the marks in between each.

   - Have children count by fives as they move around the clock (and practice the multiplication facts 1-12).

   - Children can make picture timelines (full hour marks) describing a typical day.

   - As direct instruction, provide each child with a demonstration clock with both analog and digital representations to identify time by the hour; quarter hour and minute.

9. ***Develop an understanding and describe the relationships between appropriate units of measure through concrete experiences. (ounces and pounds; gram and kilograms; inches, feet and yards; meters and kilometers; cups, pints and quarts; and milliliters and liters.)***

- Students investigate how many cups in a pint, how many pints in a quart, and how many quarts in a gallon by filling various sizes of containers with water (e.g. use cups to fill pint containers, cups to fill pints, pints to fill quarts, etc).
- Balance scale/ two-pan balance to determine grams and kilograms
- Platform Scale to investigate and determine ounces in a pound

10. **Estimate and measure using nonstandard units and appropriate customary and metric tools and units:**

- **length to the nearest ¼ inch or ½ centimeter**
    - Give students different measuring tools, such as a 12-inch ruler, 10-centimeter strip or centimeter ruler, measuring tape, yardstick, and meter stick. Have students measure various objects around the classroom, including tables, windows, and the width of the room. Discuss with the students which tools and units are easier to use for measuring the different objects.
- **area in square inches or square centimeters**
    - Using square units (color tiles) create one rectangle of 36 square units. Have the children create other rectangles that will have an area of 36 square units.
    - Hold up various pentomino shapes and ask the children for estimates of the area. Give the children the pentominoes and one square unit. Have the children measure the area and record the results on grid paper.
    - Provide a collection of rectangular and square shapes and have the children measure to find the area.
- **capacity in cups, pints, quarts, milliliters or liters**
    - Make comparisons of the units by filling measuring tools with water and transferring the water to another size tool and see what happens.
    - The children should place the units in order from smallest to largest.

- Have the children measure out water or ingredients for an activity.

- **weight in ounces, pounds, and grams *[mass is weighed in grams]***

  - Have the children estimate the weight of various objects in grams and then use a balance scale to check the accuracy of their measurements.

- **temperature to the nearest degree**

  - The children estimate the temperature in various parts of the school, on various days over an extended period of the school year. Using thermometers record temperatures from different locations in the school, for example the cafeteria and the gym. Have the children create a bar graph from the data and analyze and describe the results for the principal who needs information on whether these parts of the school are properly heated or cooled.

- **volume using inch cubes and centimeter cubes**

  - Have children use cubes to fill rectangular boxes of various sizes as they explore the concept of volume.

  - Read *The Hundred Penny Box*. Have the children explore the concept of volume by building a paper box that will hold 100 pennies. Provide the children with inch cubes to use to estimate the volume of the box. Have the children discuss the strategies that they used to build their boxes.

11. Describe and use estimation strategies that can identify a reasonable answer to a measurement problem when an estimate is appropriate.

- Make stations with a variety of everyday objects for the students to measure within the same measurement system. Allow students to rotate between and among the stations, then discuss how the units within the systems compare with each another.

- Ask the students to bring in an assortment of “junk” to school (clean and safe throwaway objects: cardboard paper towel tube, empty jug, food box, old mitten, etc.). Gather measuring tools for finding length and weight and make the tools available to the students. Discuss various techniques for estimating and measuring standard items with unusual shapes and then estimate the measurement of the item. Have the students record the estimates and measurements in chart form. Be sure to use both the standard and metric systems.

- Weigh one item and then estimate the weights and masses of other items. Have the children describe how they used the “benchmark reference” to estimate the weight of the other objects.

SAMPLE INTEGRATED LESSON – PAINTING WALLS

Context: The kindergarten teacher has asked you to help her by painting some of the walls in the classroom dollhouse. The walls are different sizes and you first need to figure out the area of the wall you will be painting so that you can plan you time because the larger wall will take that person longer than the smaller wall. The dimensions of the walls are 10 x 4 cm, 8 x 5 cm, 9 x 3 cm, and 8 x 4 cm.

Objective: The children will be able to use a variety of strategies to determine and compare area.

Grade Level Expectations: 3.3.9, 3.3.10, 3.3.11, 2.2.10, 2.2.11

Time: One to two instructional periods

Materials: centimeter cubes, centimeter grid paper, rulers

Procedure:

1. Estimate the area for each wall.
2. Describe how you will find the area of the walls using the provided materials.
3. Use the materials and determine the area of each wall. Explain how your estimate compares with the actual area that you determined.
4. The art teacher can help you decide how to use the principles of color to paint the walls so that they coordinate with the existing colors in the house.
5. Choose the colors for the walls.

- ❖ **Possible Assessment Opportunities**
  - ❖ Write to your teacher and explain which walls it will take you longer to paint and why. Include the reasons for the paint color choices.

Intervention: Provide an advance organizer of key questions as prompts to be answered in the writing about the mathematics.

Challenge: Determine how much paint will be needed to cover the walls.

Interdisciplinary Framework Connections			
Science	**English/Lang. Arts**	**Social Studies**	**Visual & Performing Arts**
B.INQ.4 Employ simple equipment and measuring tools to gather data and extend the senses. **B.INQ.5** Use data to construct reasonable explanations. **B.INQ.8** Analyze, critique and communicate investigations using words, graphs and drawings.	• Generate and respond to questions. • Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.). • Use oral language with clarity, voice and fluency to communicate a message. • Determine purpose, point of view and audience and choose an appropriate written, oral or visual format. • Publish and/or present final products in a myriad of ways, including the use of the arts and technology.	• Create timelines that sequence events and peoples, using days, weeks, months, years, decades and centuries. • Locate the events, people and places they have studied in time and place (e.g., on a timeline and map) relative to their own location. • Exhibit curiosity and pose questions about the past when presented with artifacts, records or other evidence of the past.	• Use different media techniques and processes to communicate ideas, feelings, experiences and stories. • Use elements of art and principles of design to communicate ideas. • Select and use subject matter symbols and ideas to communicate meaning. • Identify connections between the visual arts and other disciplines.

Vocabulary: measure, minutes, hours, days, week, month, calendar, clock, digital, analog, data, length, area, capacity, volume, mass, graph, chart, table, pictograph, bar graph, estimate, ruler, thermometer, scale, inches, centimeters, foot, tally marks, polygon, survey, line graph, axis, horizontal, vertical, diagonal, key, range, mode, temperature, parallel, perpendicular, angle, acute angle, obtuse angle, right angle, reasonable, collect, analyze, organize, lists, diagrams, line plot. Also see page 44 of the Grade 3 CMT Math Handbook: http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/math/cmtgrade3.pdf.

Resources:

Electronic Resources:

Math Steps, Identifying and Classifying Polygons: http://www.eduplace.com/math/mathsteps/3/a/3.polygons.ideas.html

Inch by Inch: http://mathforum.org/paths/measurement/inchbyinch.html

Shapes at Work: http://www.sciencenetlinks.com/Lessons.cfm?DocID=130

Using Standard and Nonstandard Units – Goals 2000

Making Shapes – Goals 2000

Science Fair – Goals 2000

Teacher References:

NCTM Data Analysis Standards 3 - 5

Elementary and Middle School Mathematics, by John Van De Walle

Graphing and Computers in Grades 3-5: http://www.venturaes.com/graphing/

Adding It Up, by National Research Council

Family Math II, by Lawrence Hall of Science

Developing Graphing Comprehension, NCTM

Children's Literature:

People, by Peter Spier

A Drop of Water, by Walter Wick

The Wing on a Flea, by Ed Emberley

So You Want To Be President? by Judith St. George

Mapping Penny's World, by Loreen Leedy

Everybody Needs a Rock, by Byrd Baylor

Farmer Mack Measures His Pig, by Tony Johnston

Inch by Inch, by Leo Lionni

Measuring Penny, by Loreen Leedy

My Map Book, by Sara Fanelli

The Greedy Triangle, by Marilyn Burns

Nine O'Clock Lullaby, by Marilyn Singer

Tiger Math, by Ann Whitehead Nagda

A Cloak for a Dreamer, by Aileen Friedman

Shape Up, by David Adler

Chimp Math, by Ann Whitehead Nagda

Sam Johnson and the Blue Ribbon Quilt, by Lisa Campbell Ernst

How Tall, How Short, How Far Away, by David Adler

Notes:

***WORKING WITH DATA: PROBABILITY AND STATISTICS*. Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.**

COMPONENT STATEMENT: 4.1. COLLECT, ORGANIZE AND DISPLAY DATA USING APPROPRIATE STATISTICAL AND GRAPHICAL METHODS.

Grade-Level Expectations

1. **Pose questions that can be used to guide data collection, organization, and representation.**

2. **Collect and organize the data that answers the questions using diagrams, charts, tables, lists, pictographs, bar graphs and line plots.**

   - Draw and interpret picture graphs in which a symbol or picture represents more than one object, such as graphing the number of books each child reads using a star to represent two or three books each.

   - Design an investigation from a student generated question and focus on how data collection methods could affect the type of data collected, e.g., polling the school community to determine favorite animal, measuring the amount of time spent on homework, or how much money is spent on lunch in the cafeteria each day.

   - Following a survey of favorite TV shows of students in the entire third grade, groups of students develop their own pictographs using symbols of their choosing to represent multiple children.

   - Our Favorite Colors – Ask the children, “What is your favorite color?” and write their answers scattered on the board or chart paper. Ask questions such as:

     1. Can we interpret anything about the favorite color from the way the information is organized? Why or why not?

     2. Is this the best way to organize information?

3. How would you organize the information differently?

4. Have the children create their own methods, including a graph, for organizing the information.

- Collect and organize data from an experiment, such as recording and classifying observations or measurements, in response to a question posed. Observations could be of the characteristics of a collection of rocks.

- Read, interpret and construct bar graphs with consistent intervals greater than one. Graphs can be created that are representative of multiples as well as other equal intervals appropriate to the range of data being displayed. An extension of this activity is for the groups to work in pairs on the computer to enter the group's data, construct a graph, and explore how the graph changes as different scales and alternative forms are used. These children should report the results of their exploration to the class.

- Children can keep charts and graphs recording their improvements in health and fitness standards in preparation for the physical fitness assessment.

- Express the same information using charts, tables, line plots, picture graphs and bar graphs, e.g., create a bar graph from the information in a chart.

COMPONENT STATEMENT: 4.2. ANALYZE DATA SETS TO FORM HYPOTHESES AND MAKE PREDICTIONS

Grade-Level Expectations

3. Analyze data that have been collected and organized, to draw and defend conclusions based on the data.

❖ **Possible Assessment Opportunities**

❖ Using the information from the favorite color investigation, create a package of four colored pencils for the class. Write a journal entry telling what your colors would be in your package and why.

Intervention: Discuss how companies decide what color pencils to make and guide the child to look at the graph to determine the four favorite colors. Sentence starters can be provided for the journal entry.

Challenge: Develop a survey question on a favorite sport, candy, food, etc. Collect data from your classroom or students in your grade. Organize the data into a display and write a letter that could be sent to the company describing and interpreting your results.

❖ **Possible Assessment Opportunities**

❖ Support a conclusion or prediction orally and in writing, using information in a table or graph. Use the embedded science task "Soggy Paper" data collection and analysis.

Intervention: Provide the graph with all the component parts labeled.

Challenge: Provide graph without its component parts requiring the children to label the axes correctly, identify appropriate scale and create a title.

4. Describe an event or element as typical based upon the range, median and mode of a set of data.

- Before counting the number of raisins contained in individual boxes of raisins (use at least 2 different brands), ask the children to estimate the number of raisins in each box. Have the children count and record the raisins and compare the actual numbers to their estimates. Construct a class line plot to record the actual number of raisins and use the concepts of range, mean, median, and mode to discuss the situation.

COMPONENT STATEMENT: 4.3. UNDERSTAND AND APPLY BASIC CONCEPTS OF PROBABILITY

Grade-Level Expectations

5. Experiment to test predictions and determine probability in practical situations such as investigating the fairness of games using a variety of spinners and dice.

- Conduct simple probability experiments, record the results in a chart, table or graph, and use the results to draw conclusions about the likelihood of possible outcomes (e.g., the possible sums from tossing two dice or number cubes).

- Place 4 red and 6 blue color tiles in a bag. Have the children work in pairs to attempt to determine the total number and color of tiles in the bag. Each child should take one tile out of the bag, record the color by coloring one square of the graph paper with the appropriate color, and then replace the tile in the bag (repeat 10 times each). Once the pair has determined the tiles in their bag, have them make predictions about the probability of drawing a red tile out of the bag and test the prediction by pulling 10 more tiles each. The entire class can display their results on a classroom wall or board by making lines using their colored squares. Discuss the visual representation of the whole class results and how different pairs' results compare to the whole class.

6. **Describe the probability of an outcome as ____ out of ____ (e.g., 3 out of 5). See also GLE 3.2.5.**

   - Use appropriate language when discussing the experiments and activities in the previous GLE.

7. **Investigate combinations using models.**

   - Read to the children *A Three Hat Day* by Laura Geringer. Have the children use concrete objects (different colored beans, paper hats, or pattern blocks) to show different possible orders for wearing three different hats. The children can also investigate how many different ways there are to wear four different hats.

SAMPLE INTEGRATED LESSON – SEASONING OF THE PRESIDENTS (DATA ANALYSIS)

Context: The Smithsonian Institution is creating a new U.S. presidents display. Workers at the Smithsonian are looking for research about what season the presidents were born in and whether it makes them more likely to become president. Your task is to find out when all the presidents were born and to create a graph that will show whether the season a person is born will make the person more or less likely to be elected president.

Grade-Level Expectations:

Time: Multiple instructional periods

Objective: Children will create graphs based on historical events.

Materials: birth dates of U.S. presidents, colored pencils, graph paper, or computers with graphing programs or software installed

Procedure:

1. Review the seasons of the year and the dates when they start and end.
2. Cooperative groups should look at the list of all the birth dates of the presidents and place each president's name and birth date on a separate index card.
3. Each group sorts the index cards by season the birth date falls in.
4. Each group creates a graph that shows how many presidents were born in each season.
5. Each group must write a statement explaining how the data are displayed and what the graph shows about the seasons when U.S. presidents were born.
6. Based upon the findings, have a class discussion about whether classmates who were born in certain seasons are more likely than others to become president.

<table>
<tr><th colspan="4">Interdisciplinary Framework Connections</th></tr>
<tr><th>Science</th><th>English/Lang. Arts</th><th>Social Studies</th><th>Visual & Performing Arts</th></tr>
<tr>
<td>B.INQ.4 Employ simple equipment and measuring tools to gather data and extend the senses.

B.INQ.5 Use data to construct reasonable explanations.

B.INQ.8 Analyze, critique and communicate investigations using words, graphs and drawings.

B.INQ.10 Use mathematics to analyze, interpret and present data.

B.1 Sort and classify materials based on properties such as dissolving in water, sinking and floating, conducting heat, and attracting to magnets.

B.2 Describe the physical properties of rocks and relate them to their potential uses.</td>
<td>• Generate and respond to questions.

• Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.).

• Use oral language with clarity, voice and fluency to communicate a message.

• Determine purpose, point of view and audience and choose an appropriate written, oral or visual format.

• Use strategies to generate and develop ideas for speaking, writing and visual activities.

• Research information from multiple sources for a specific purpose.

• Examine sources of information and determine validity.

• Publish and/or present final products in a myriad of ways, including the use of the arts and technology.</td>
<td>• Locate the events, peoples and places they have studied in time and place (e.g., on a time line and map) relative to their own location;

• Place the history of their own families in the con-text of local, state, national and world history.

• Exhibit curiosity and pose questions about the past when presented with artifacts, records or other evidence of the past;

• Seek historical back-ground when confronted with problems and issues of the past, as well as of today’s world and their own lives;</td>
<td>• Use different media techniques and processes to communicate ideas, feelings, experiences and stories.

• Use elements of art and principles of design to communicate ideas.

• Select and use subject matter symbols and ideas to communicate meaning.</td>
</tr>
</table>

Vocabulary: measure, minutes, hours, days, week, month, calendar, clock, digital, analog, data, length, area, capacity, volume, mass, graph, chart, table, pictograph, bar graph, estimate, ruler, thermometer, scale, inches, centimeters, foot, tally marks, polygon, survey, line graph, axis, horizontal, vertical, , key, range, mode, reasonable, collect, analyze, organize, lists, diagrams, line plot, probability, trends, fairness. Also see p. 44 of the Grade 3 CMT Math Handbook: http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/math/cmtgrade3.pdf.

Resources:

Electronic Resources:

Categorical and Numerical Data: http://illuminations.nctm.org/LessonDetail.aspx?ID=U116

Exploring Data: http://mathforum.org/workshops/usi/dataproject/

Dealing with Data: http://illuminations.nctm.org/LessonDetail.aspx?ID=L1297

Making Shapes – Goals 2000

Science Fair – Goals 2000

Color Combinations – Goals 2000

Hot Dog Buns – Goals 2000

Teacher References:

NCTM Data Analysis Standards 3 - 5

Adding It Up, by National Research Council

Elementary and Middle School Mathematics, by John Van De Walle

Family Math II, by Lawrence Hall of Science

Graphing and Computers in Grades 3-5: http://www.venturaes.com/graphing/

Developing Graphing Comprehension, NCTM

Children's Literature:

So You Want To Be President? by Judith St. George

People, by Peter Spier

My Map Book, by Sara Fanelli

Pigs at Odds: Fun with Math and Games, by Amy Axelrod

Tiger Math, by Ann Whitehead Nagda

No Fair, by Carol Holtsmen

Everybody Needs a Rock, by Byrd Baylor

Great Graph Contest, by Loreen Leedy

Chimp Math, by Ann Whitehead Nagda

A Three Hat Day by Laura Geringer.

Notes:

Grade 4

CONTENTS

The Learner at This Level

THE FOURTH-GRADE CHILD:

- Learns better on her own than younger and older schoolmates as she gains mastery of basic skills.
- Is often anxious and complains about aches and pains.
- Has a growing sense of peer importance and solidarity.
- Likes to negotiate.
- Struggles with abstractions.
- Needs clear expectations, encouragement and positive language.

Source: *Yardsticks: Children in the Classroom Ages 4-14,* by Chip Woods, pages 95-103

ALGEBRAIC REASONING

- Recognizes a variety of patterns and trends.
- Uses growing patterns to explore functions.
- Discovers the relationship of equivalence on both sides of the equation.
- Explores the usefulness of algebraic reasoning to create generalizations.
- Likes rules and logic.
- Demonstrates the rule of a function, relationship or pattern.
- Expresses relationships using open sentences with one operation.
- Prepares for traditional algebraic expressions by utilizing horizontal equations.
- Applies inverse operations and explains the solution.
- Uses letters as variables not only as unknowns.
- Explores ratio and proportion.
- Creates simple formulas about area and perimeter of a rectangle.
- Describe changes in geometric designs or patterns.

NUMERICAL AND PROPORTIONAL REASONING

- Demonstrates four-digit place value by using models and pictures.
- Chooses compatible numbers based on place value or number pairs.
- Constructs strategies for flexible methods of computing, depending on the situation or the numbers.

- Uses regrouping for accurate computation.
- Identifies equivalent fractions using models and pictures.
- Uses the number line to represent both decimals and fractions in a geometric and visual manner.
- Discovers fractions and decimals are rational numbers.
- Efficiently uses multiplication and division facts.
- Models multiplication and division using objects, base-10 materials, or parts of a rectangle.
- Estimates in situations involving money.
- Creates story problems for all four operations.

GEOMETRY AND MEASUREMENT

- Employs appropriate units to measure the area of rectangular shapes.
- Recognizes the relationship between the area and perimeter of rectangles.
- Finds the area of more complex figures by dividing the figures into basic shapes.
- Uses models and drawings of shapes to construct and test hypothesis and to make generalizations about geometry.
- Develops formulas for measuring area and perimeter of geometric shapes.
- Identifies locations on a coordinate grid with ordered pairs.
- Measures attributes accurately with standard measures and tools.
- Determines when a precise measurement is appropriate.
- Iterates a unit of measure physically and/or mentally.
- Plans and schedule events using calendars and clocks.

WORKING WITH DATA

- Formulates questions for surveys and collects the information to make comparisons about groups.
- Collects data, including the use of measuring devices, printed or electronic resources, and surveys or samplings to answer questions.
- Sorts, re-sorts and organizes the same set of data or objects in multiple ways and records results on graphic organizers.
- Determines whether data are presented graphically in an adequate format for examining relationships.
- Discusses data, communicates conclusions, and makes predictions and inferences.
- Generates new questions from displayed data.
- Refines information from data by calculating mean, median, mode and range.

Mathematics Background for Teachers

MATHEMATICS BACKGROUND FOR GRADE 4 TEACHERS

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS

Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

Central Understanding: Equivalence is a relationship between members of one set and members of another set.

Background: Growing patterns are an example of functions and demonstrate how a change in one element of a set, or situation, creates a corresponding change in another set. A function occurs when a change in a variable of a set affects another variable in that set or a different set, a dependent relationship. Functions can be demonstrated in multiple ways: by describing the pattern, using a chart or table, using a graph, using symbolic notation in equations, and by using language to describe the equivalence in the relationship.

NUMERICAL AND PROPORTIONAL REASONING

Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

Central Understanding: Number relationships and properties of operations provide generalizations for efficient problem solving.

Background: Solving complex problem situations requires the understanding and use of strategies and their applications so that solutions can be expressed clearly and logically using appropriate mathematical notations. The ability to work with our number system, including rational numbers, requires flexible thinking that is built on understanding models, place value, properties of operations, and the fact that decimal notation is an extension of the base-10 system of whole numbers.

MATHEMATICS BACKGROUND FOR GRADE 4 TEACHERS

GEOMETRY AND MEASUREMENT

Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

Central Understanding: Geometric shapes and solids can be described through estimated and actual measurement. Generalizations can be used for efficient problem solving.

Background: Solving problems that involve estimation and measurement requires the selection of appropriate units, tools and strategies. Rational numbers (fractions and decimals) define customary and metric amounts to a finer degree of accuracy. The suitable unit or label is determined by the context of the situation. Tiling a plane through the use of transformations builds upon understanding of angle measurement and classification, symmetry and congruence and deepens understanding of two-dimensional space.

— NCTM *Focal Points*, pages 30-32

WORKING WITH DATA: PROBABILITY AND STATISTICS

Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

Central Understanding: Predictions can be made by analyzing information gathered from organized data.

Background: The reason for analyzing categorical and numerical data is to describe, summarize and compare information. Data are interpreted to validate predictions, develop meaning, create structure and define relationships. Different graphical representations and statistical measures of the same data influence conclusions drawn from analysis, interpretations and predictions. The maximum potential of data is reached when the display efficiently and clearly presents information for precise interpretation and generalization.

Correlated Grade-Level Expectations

Click here to access correlated grade-level expectations for Grade 4 on the State Department of Education Web site.

Sequenced Grade-Level Expectations

GRADE 4 SEQUENCED GLES

Grade-Level Expectations	Fall	Winter	CMT	Spring
ALGEBRAIC REASONING				
1.1 Understand and describe patterns and functional relationships.				
1. Extend and compare numerical and geometric sequences and classify patterns as growing or repeating. (e.g., 2, 4, 8, _, _ grows and the following sequence repeats.				
2. Develop and test generalizations based on observable patterns and relationships and describe the rules for number patterns using equations. (e.g., in this sequence 1, 6, 16, 36…, to get the next number the current number can be doubled and 4 added to the product)				
1.2 Represent and analyze quantitative relationships in a variety of ways.				
3. Describe mathematical relationships and situations, involving computation of whole numbers in all four operations, and ratios, using symbols, number sentences and equations. If = ΔΔΔ Then =______				
1.3 Use operations, properties and algebraic symbols to determine equivalence and solve problems.				
4. Represent possible values by using symbols (e.g., variables) to represent quantities in expressions and number sentences. Use number sentences (equations) to model and solve word problems.				
5. Solve problems and demonstrate an understanding of equivalence in mathematical situations that reflect the commutative and associative properties of addition and multiplication of whole numbers and the distributive property of multiplication over addition.	Commutative and associative			Distributive
NUMERICAL AND PROPORTIONAL REASONING				
2.1 Understand that a variety of numerical representations can be used to describe quantitative relationships.				
1. Locate, label, compare and order numbers up to *100,000* using place value models, number lines and number patterns (including multiples of *1,000 and 10,000).*				
2. Extend number patterns to determine 1,000 and 10,000 more and less than a given number in practical situations.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
3. Round whole numbers up to 100,000 using number patterns, number lines, diagrams and place value models.				
4. Write and describe equivalent representations of four- and five-digit whole numbers up to 100,000 and beyond, in expanded and regrouped forms. Use the forms to support computational strategies.				
5. Relate multiplication and division to number patterns and models of groups and rectangular arrays.				
6. Identify and define prime and composite numbers through the use of models including rectangular arrays, place value models and pictures.				
7. Construct and use number lines, pictures and models, including rulers, to determine and identify equivalent ratios and fractions.				
8. Locate, label and estimate *[round]* fractions with like and unlike denominators of 2, 3, 4, 5, 6, 8 and 10 by constructing and using models, pictures and number lines.				
9. Construct and use models, pictures and number lines, including rulers to compare and order fractional parts of a whole and mixed numbers with like and unlike denominators of 2, 3, 4, 5, 6 and 8 and 10.				
10. Construct and use models, pictures and number lines, including rulers, to identify wholes and parts of a whole (including a part of a group or groups) as simple fractions and mixed numbers.				
11. Use models to represent tenths and hundredths and record the representations using equivalent ratio, fraction and decimal notation ($^1/_{10}$, 0.1)				
12. Express a ratio or division problem as a fraction and describe the relationship between the divisor and the remainder written as a fraction. (e.g., When determining the number of groups of 3 in 14, we say 14 ÷ 3 = 4 with a remainder of 2 or 4 $\frac{2}{3}$).				
13. Solve practical problems involving simple ratios and proportions (e.g., determining distance on maps) by using models, pictures and number patterns.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
2.2 Use numbers and their properties to compute flexibly and fluently and to reasonably estimate measures and quantities.				
14. Develop and use a variety of computation strategies including place value concepts, number lines and the commutative and associative properties to add and subtract *three- and four*-digit numbers and money amounts up to $1,000.00.				
15. Solve contextual problems involving addition and subtraction of whole numbers using a variety of methods, including writing appropriate number sentences (equations) and explaining the strategies used.				
16. Create story problems to match a given number sentence (equation).				
17. Recall the multiplication and division facts 1 through 10.				
18. Write multiplication and division story problems, *involving basic facts and two- and three-digit by one-digit numbers*, to match a given number sentence and vice versa; solve the problems using strategies, including models and arrays and justify the solutions.				
19. Determine and explain in writing, when an estimate involving computation with three- and four-digit numbers and money amounts to $1,000, is appropriate and whether a particular estimation strategy is reasonable or will result in an overestimate or underestimate.				
20. Use models and pictures to add and subtract fractions with like and unlike denominators of 2, 3, 4, 5, 6, 8 and 10 and match number sentences or equations to the problems.				
21. Identify or write number sentences to solve simple problems involving fractions with like denominators, decimals (tenths) and mixed numbers.				
22. Write contextual problems involving the addition and subtraction of fractions and mixed numbers with like denominators and decimals (tenths); solve the problems and justify the solutions.				
23. Estimate a reasonable answer to simple problems involving fractions, mixed numbers and decimals (tenths).				
24. Write and solve multi-step contextual problems, including problems with extraneous information and explain how the answers were determined, orally and in writing.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
GEOMETRY AND MEASUREMENT				
3.1 Use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.				
1. Describe and represent polygons, solids, and other familiar two- and three- dimensional objects.				
2. Compare and classify polygons based on relationships such as parallel or perpendicular lines, symmetry and congruence.				
3. Make and test conjectures about polygons using geometric relationships such as symmetry and congruence.				
3.2 Use spatial reasoning, location and geometric relationships to solve problems.				
4. Draw and interpret simple maps with ordered pairs of numbers and/or letters in quadrant one of an *x*, *y* coordinate system and find possible paths between two points.				
5. Analyze geometric reflections (flips), rotations (turns), and translations (slides) of plane figures and describe the relationship to the original figure.				
3.3 Develop and apply units, systems, formulas and appropriate tools to estimate and measure.				
6. Use calendars and clocks to solve problems and schedule events involving elapsed time using months, weeks, days, hours and minutes.				
7. Write and solve problems involving the conversion of simple measures of time, e.g., minutes to hours, hours to days, and days to weeks and month).				
8. Use customary and metric tools and units and non-standard units to estimate, measure and solve problems involving length and perimeter to the nearest quarter-inch or half-centimeter, area, capacity, weight, temperature and volume.				
9. Use estimation strategies to predict reasonable answers to measurement problems explain the reasoning used orally and in writing.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
WORKING WITH DATA				
4.1 Collect, organize and display data using appropriate statistical and graphical methods.				
1. Pose questions and develop a plan to collect data using observations, surveys and experiments to answer the questions.				
2. Collect, organize and represent the data that answer the questions including the use of simple circle graphs and broken line graphs.				
4.2 Analyze data sets to form hypotheses and make predictions				
3. Discuss, make predictions and write about patterns and trends in categorical and numerical data that have been represented in a variety of ways.				
4. Determine the range, median, mode and mean of a set of data and describe characteristics of the data set as typical or average based upon those determinations.				
4.3 Understand and apply basic concepts of probability				
5. Conduct probability experiments and express the probability based on possible outcomes, e.g., 8 out of 10 tiles chosen were red.				
6. Determine and describe possible combinations, where order does not matter, e.g., when there is a choice of vanilla (V), chocolate (C) or strawberry (S) ice cream for a two scoop cone and two different scoops are desired, the possible combinations are CV, CS, or VS.				

Correlated GOALS 2000
Criterion Referenced Test

GRADE 4 CORRELATED GOALS 2000 CRT

The Goals 2000 Mathematics Curriculum was written as a companion to the 1998 Mathematics Framework. The Goals 2000 resources cited in this 2008 Model for Mathematics Curriculum are aligned to the 2005 Mathematics Curriculum Framework, 2007 Curriculum Standards and the fourth generation Connecticut Mastery Test.

The Grade 4 Criterion Referenced Test Part A from the Goals 2000 Mathematics Curriculum is aligned to the Grade 4 sequenced GLEs and can be used for pre- and post-assessment.

Please use the link below to access the electronic version of the complete document, which includes other activities, such as opportunities for open-ended and challenge experiences that must be examined for alignment prior to use.

http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=321084

Grade 4 Mathematics CRT

GLEs 2.2.14, 2.2.15

The refreshment stand at the local park has the following menu:

MENU	
Fish Plate	$3.99
Hamburger	$1.15
French Fries	$0.65
Onion Rings	$0.80
Milk	$0.45
Juice	$0.65

a. Julia wants a hamburger, french fries and a milk. She has $2.50. Does she have enough money to buy what she wants? YES OR NO ________________________

Show your work and explain how you know.

b. You are running the refreshment stand. Someone purchases two hamburgers, onion rings and two juices. He gives you a $5 bill. How much change should you give him? What coins could you give him?

______________________________ ____________________

Amount of Change Coins

c. Suppose you have $6 to spend at the refreshment stand. Make up an order of at least four items that comes close to the $6 without going over and tell how much you order will cost.

Your Order:

Total Cost: ______________

d. Betina has $3.60 of her allowance with her. She buys one order of french fries and one milk. How much of her allowance does she have left? Show your work and place your answer in the space below.

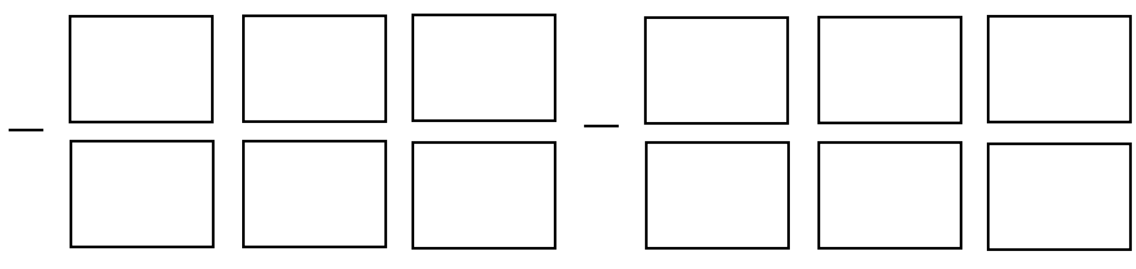
____

GLE 2.1.5

Draw a rectangular array that shows 4 x 5 and explain how you can find the product using addition.

GLE 2.2.14

Arrange the digits 4, 5, 6, 7, 8 and 9 in the boxes to get the smallest possible difference.



GLE 2.2.17

Write the following products or quotients:

a. 5 x 6 = _____

b. 3 x 8 = _____

c. 35 ÷ 7 = ____

d. 18 ÷ 3 = ____

GLEs 2.2.14, 2.2.18

Carol earns $4 an hour on weekdays and $6 an hour on Saturdays. Last month she worked 10 weekdays and 3 Saturdays. How much did Carol earn last month? Show your work and circle your final answer.

GLEs 2.2.14, 2.2.16

Write a story problem that can be solved using the number sentence:

$$345 - 217 = \boxed{}$$

GLEs 2.2.16, 2.2.17

Write a story problem that can be solved using the number sentence:

$$5 \times 7 = \boxed{}$$

GLEs 2.2.16, 2.2.17

Write a story problem that can be solved using the number sentence:

$36 \div 9 = \boxed{}$

____

____

____

GLE 2.2.15

Write a number sentence that could be used to solve each of the following problems.

a. Tim has $24.50. Robin has $37.25. How much do the two students have all together?

____

b. Charles earns $4 per hour. How much does he make if he works 14 hours?

____

GLE 2.1.12

c. A class of 25 students wins $50. If the money is shared equally, how much will each student get?

____

GLEs 2.2.14, 2.2.19

Sam went to the city with $144.87. When he returned, he had $36.39. Explain how you could estimate how much money he spent in the city?

____

____

____

GLE 2.2.19

Emeka's school has 431 students. His sister's school has 286 students. Explain how you could estimate the total number of students in the two schools.

a. ____

____

____

b. Will the strategy you used to estimate the total number of students in the two schools result in an over estimate or an underestimate?

____

GLE 2.1.1

Consider the number 12, 357.

a. Write the number that is 10 greater ______________

b. Write the number that is 10 less _________________

c. Write the number that is 100 greater _____________

d. Write the number that is 100 less ________________

e. Write the number that is 1,000 greater ____________

f. Write the number that is 1,000 less _______________

GLE 2.1.1

Use only the digits 9 6 8 1 and 3 without repeating any digit to:

a. Write a 2-digit number as close as possible to 60. ___

b. Write a 3-digit number as close as possible to 400.___

c. Write a 4-digit number as close as possible to 2,000 _

GLE 2.1.7

A window in Donna’s house is made up of 6 small panes of glass. While playing baseball, she accidentally broke 2 of the panes.

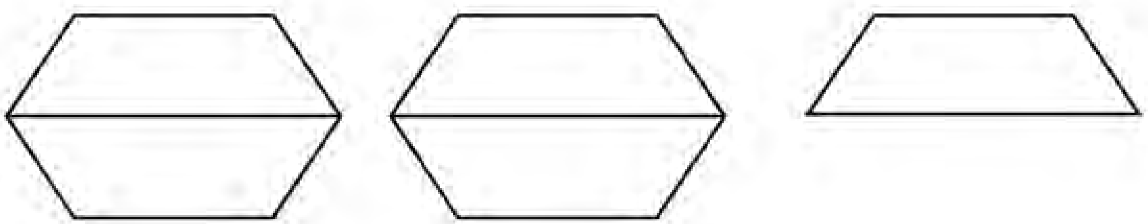
a. Draw a picture to show what fraction of the panes were broken.

b. Write an equivalent fraction that also describes what fraction of the panes were broken.

____

GLE 2.1.10

In the space below draw two different pictures that represent 3/4.



GLE 2.1.10

Dolores said the blocks pictured above can be described as 5/2.

a. Ricky describes the same blocks using a mixed number. What mixed number could Ricky have used to describe the blocks?

b. Tanisha used words to describe the blocks. What did she write?

GLE 2.1.9

Consider the following seven fractions:

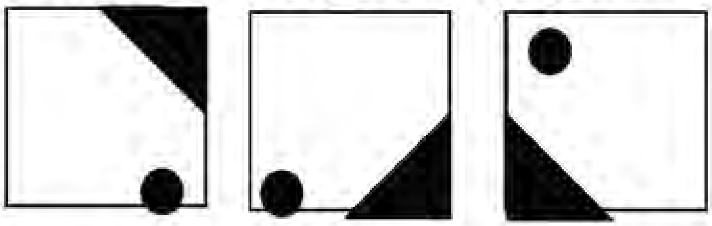
6/12 7/8 2/5 1/8 2/3 3/4 5/6

Sort the fractions into the correct column in the table below.

Close to 0	Close to 1/2	Close to 1

GLE 1.1.1

Draw the next figure in the pattern.

 __________

GLE 1.1.2

Fill in the blanks to complete a pattern. Then describe the pattern you used.

a. 11, 13, 15, ____, ___ , 21, ___

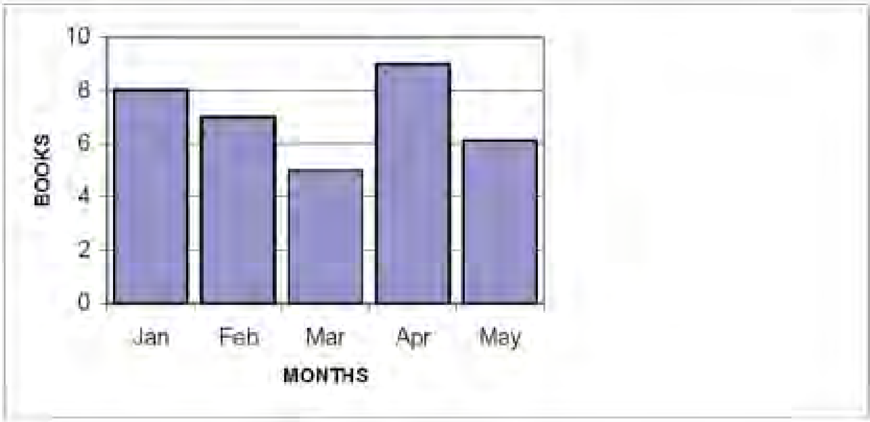
pattern: ______________________________________

b. 33 ___, ___, ___ , 21,18, 15

pattern: ______________________________________

GLE 4.2.4

The graph below shows how many books Rosa read during 5 months. Use the graph to answer the following questions.



During which month did Rosa read the fewest books? ____________

a. How many books did she read during this month? _______________

b. Find two months during which she read a total of 13 books.
Name the months. _____________ ________________

d. What is the total number of books Rosa read during these 5 months?

____

e. What is the average number of books Rosa read during these 5 months?

____

f. Write another question you can answer using the data in the graph.

____

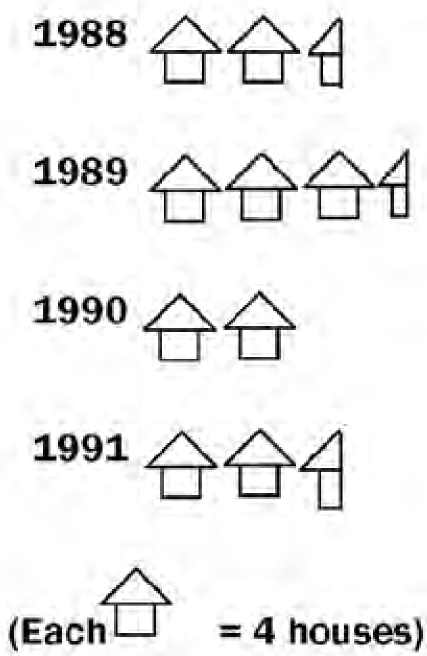
____

____

GLE 4.2.3

The graph below shows how many new houses were built in Westmont during four years. Use the graph to answer the following questions.

New Houses in Westmont



a. About how many houses were built in 1989? ____

b. Explain what you had to do to figure out your answer.

c. About how many houses do you think were built in 1993? _____

d. Explain what you had to do to figure out your answer.

e. About what was the total number of houses built in the four years

____

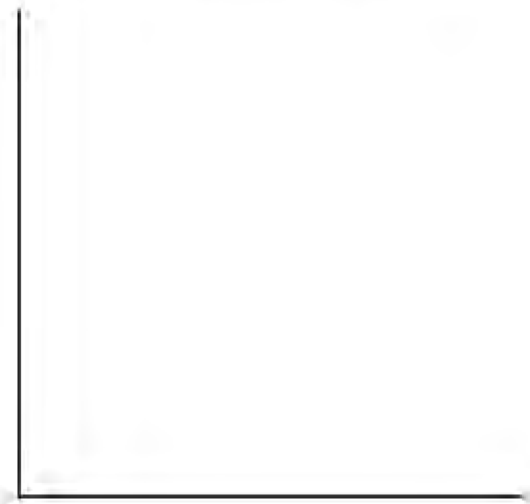
f. Explain how you arrived at your estimate.

GLE 4.1.2

Construct a bar graph that shows the data in the table.

Students per grade

Grade	Number of students
3	156
4	187
5	114
6	92



GLE 4.2.3

Look at the five graphs on the next page. Each graph shows something about a classroom of fourth graders.

a. Which of the five graphs do you think shows:

- The number of cavities that the 4th graders have? ___
- The ages of the fourth graders' mothers? __________
- The heights of the 4th graders, in inches? __________
- The number of people in the 4th graders' families? __

b. Explain why you think the graph you picked for the heights of the 4th graders in inches is the one correct graph.

____

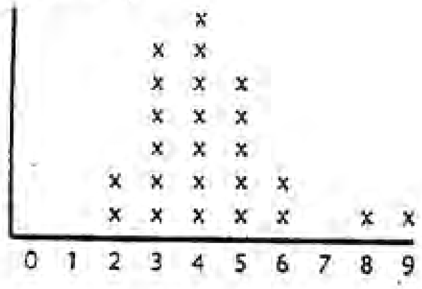
____

____

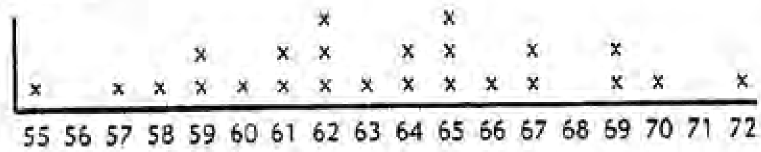
c. Why do you think the other graphs do not show the 4th grader's heights?

____

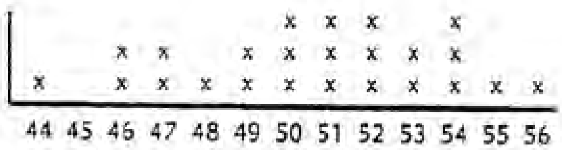
Graph 1



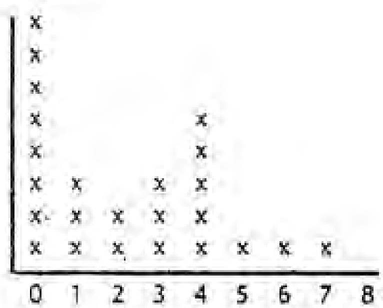
Graph 2



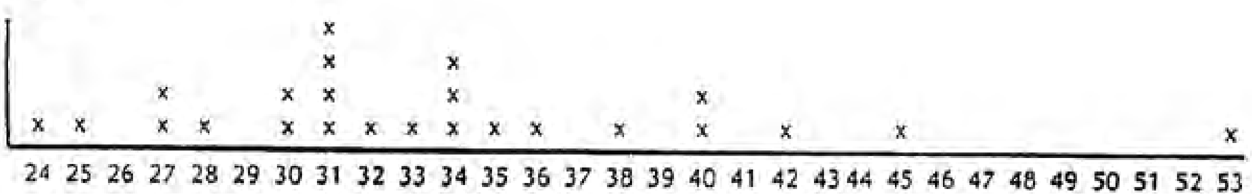
Graph 3



Graph 4

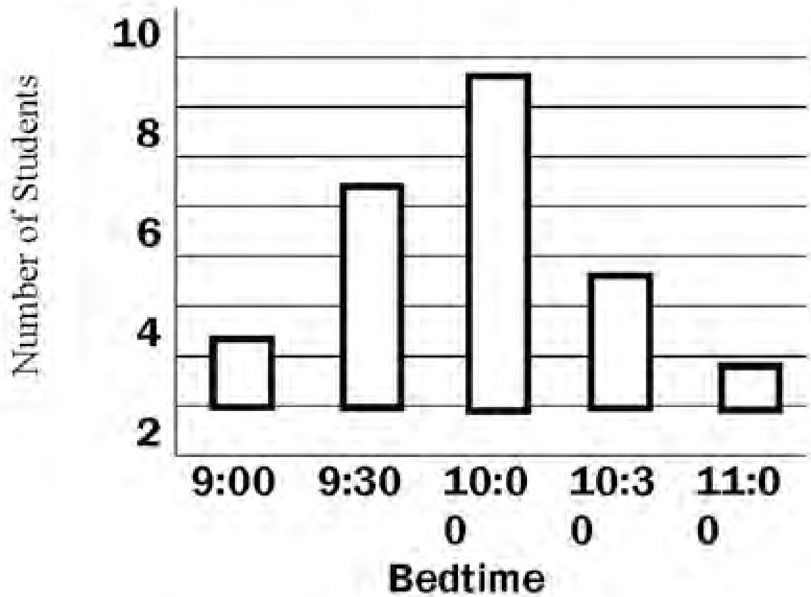


Graph 5



GLE 4.2.3

Here's a graph that shows the time that the 24 students in Ms. Ricardo's class went to bed last night. Write three conclusions that can be made about when the students went to bed last night based on the graph.



1. ______________________________

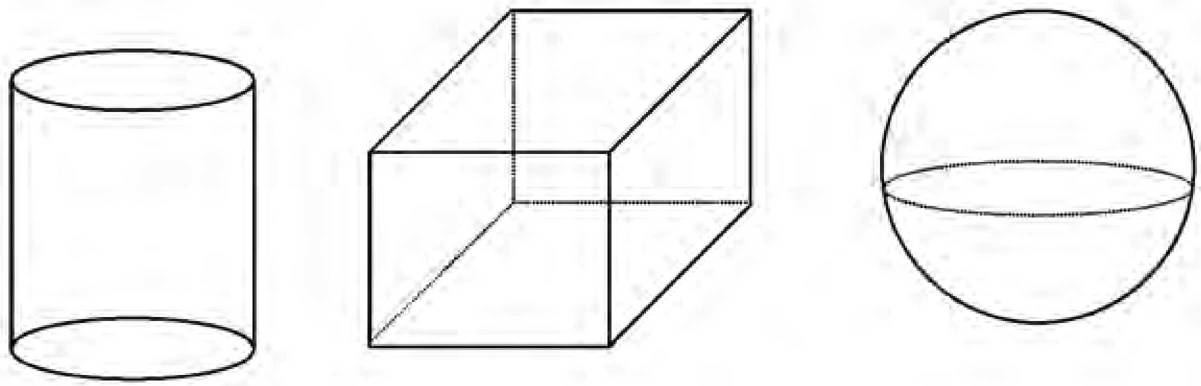
2. ______________________________

3. ______________________________

GLE 3.1.1

Draw a line to match these figures with the correct names.

SPHERE **CYLINDER** **CUBE**



GLE 3.3.8

Which of the following units could you reasonably use to describe each of the following?

cm, m, in, ft, yd, mi, pint, quart, gallon, liter, ml

a. The height of your school building? ________________

b. The distance from New Haven to New York? _________

c. The amount of liquid in the small carton of milk? ____

GLE3.3.8

Name an object best measured in each of the following units:

Meters ____

Inches ____

Quarts ____

Milliliters ______________________________________

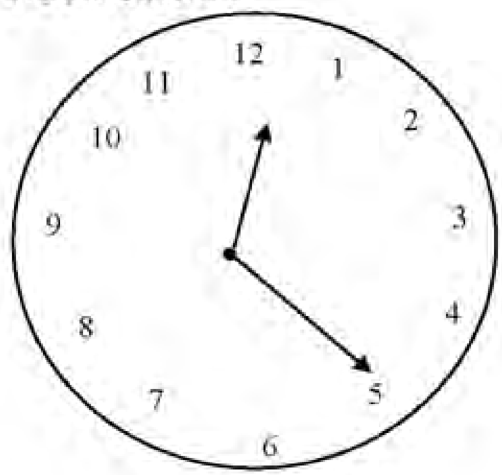
GLE 3.3.9

Name 3 things that are sold in gallons.

_______________ _______________ _______________

GLE 3.3.6

What time is shown on the clock below?



____

GLE 3.3.6

Tell how two different people could describe the time shown on the clock below.

3:45

____

GLE 3.3.6

Luis' watch said 11:00 a.m. when he left to drive to Boston. The watch said 2:00 p.m. when he arrived in Boston. How long did the trip take?

____

GLE 3.3.5

Use your ruler to draw a rectangle with a length of 6.5 cm and a width of 4 cm.

GLE 3.3.5

Use your ruler to find the perimeter of the figure below to the nearest centimeter. Mark your measurements on the figure.

P = ____________

GLE 4.3.5

Suppose you have a bag with 25 green counters and 10 yellow counters.

a. If you pick a counter without looking, which color are you most likely to pick?

____

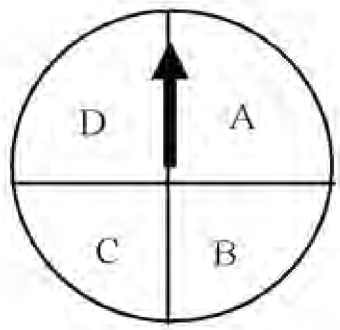
b. Explain how you decided.

____

____

GLE 4.3.5

If you spin the spinner below 40 times, how many times do you think it will land on A?



____

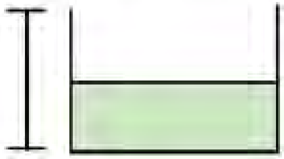
Explain how you decided.

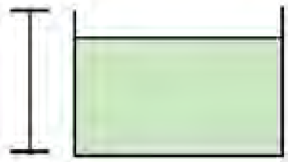
____

____

GLE 2.1.8

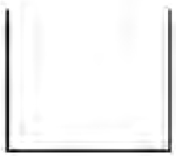
What fractional part of each container shown below appears to be full?

a. 

b. 

Fractional part ______________ Fractional part ______________

Draw a line on each container below that shows the container filled to the fractional part shown

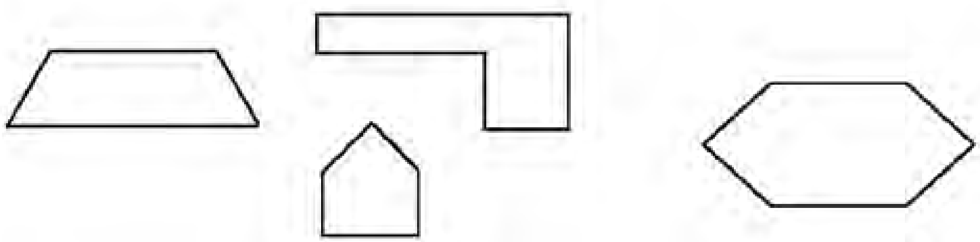
a. 

b. 

Fractional part ____7/8______ Fractional part ____2/5______

GLE 3.1.3

Circle the shape below that has MORE than one line of symmetry.



GLEs 3.3.7, 3.3.8, 3.3.9

My little brother came home from school and told me what he learned about beavers.

Beavers are very strong animals. They have sharp teeth that they use to build dams that are an average of 65 feet long. The teeth and jaws of a beaver are so powerful they can cut through a tree 20 inches thick in 15 minutes.

If a family of 5 beavers was building a dam and they worked for 1 1/4 hours getting trees, about what total thickness of trees would they have cut through?

GLE 2.1.13

COMPARING QUANTITIES

A car dealer orders sedans and SUVs based on what colors her customers usually buy.

	Sedans	SUVs
Green		
White		
Black		
Red		
Total	32	16

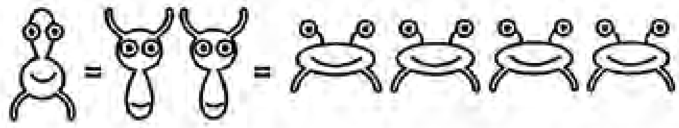
Ways to Write	Compare Red Sedans to All Sedans (part to all)	Compare Red Sedans to White Sedans (part to part)	Compare Red Sedans to Red SUVs (part to part)	Compare Sedans to SUVs (all to all)
Use to	8 to 32	8 to 10	8 to 4	32 to 16

Write the ratios that show other comparisons of the cars and tell what they mean.

GLE 2.1.13

Creature Trades (F)

1 ping = 2 pongs = 4 pogos



1 How many pogos would you trade to get 16 pongs?

____

2 Would you get more pings or more pogos for 8 pongs?

_______________________ How do you know?

3 How many more pongs than pings would you get for

48 pogos? _______________ Tell how you know.

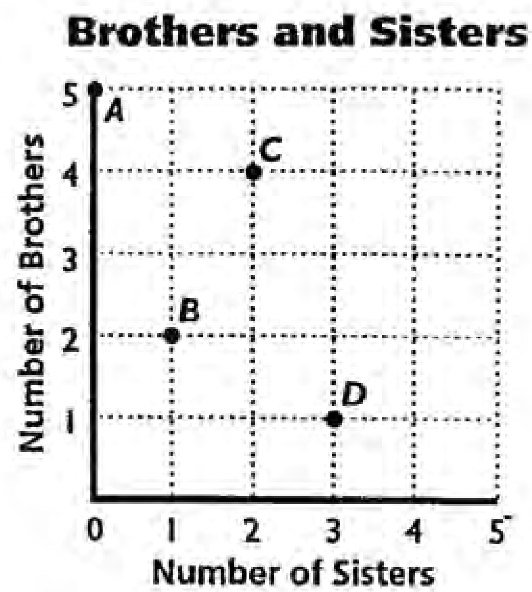
Source: *Connections – Linking Manipulatives to Mathematics – Grade 4*, Creative Publications. Reprinted by permission.]

GLE 3.2.4

COORDINATE PUZZLES

Who Is It? (B)

The graph shows the number of brothers and sisters for four children.



Clues

a. Eric has the fewest sisters.

b. Matt has the fewest brothers.

c. Diane has one more sister than Josh has.

1 Who is A? __________ 2 Who is B? __________

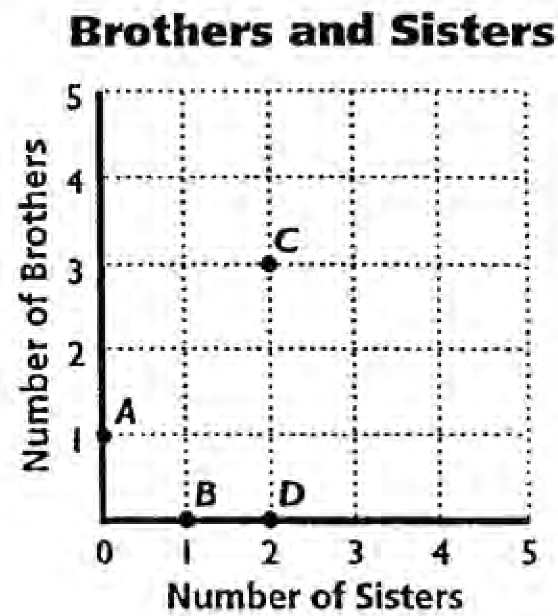
3 Who is C? __________ 4 Who is D? __________

[Source: *Groundworks Grade 4*, p. 10, Creative Publications. Reprinted by permission.]

GLE 3.2.4

Who Is It? (C)

The graph shows the number of brothers and sisters for four children.



Clues

a. Angela and Larry together have four brothers.

b. Sid and Beth together have no brothers.

c. Beth has one more sister than Larry.

d. Sid has two more sisters than Larry.

1 Who is A? __________ 2 Who is B? __________

3 Who is C? __________ 4 Who is D? __________

[Source: *Groundworks Grade 4*, p. 10, Creative Publications. Reprinted by permission.]

Curriculum Standards Connections

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS. Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 1.1. UNDERSTAND AND DESCRIBE PATTERNS AND FUNCTIONAL RELATIONSHIPS

Grade-Level Expectations

1. **Extend and compare numerical and geometric sequences and classify patterns as growing or repeating, e.g., 2, 4, 8, _, _, grows and the following sequence repeats:** 
   - Create growing pattern or repeating pattern sequences using geometric shapes.
   - Use locomotor movement to demonstrate growing or repeating patterns e.g., square dancing in music class and exercise routines in physical education class.
2. **Develop and test generalizations based on observable patterns and relationships and describe the rules for number patterns using equations, e.g., in this sequence 1, 6, 16, 36 …, to get the next number the current number can be doubled and four added to the product.**
   - Describe changes in numeric and geometric patterns, state the changes as a generalized rule and justify by testing.
   - Compare growing and repeating patterns using written explanations and pictures.
   - Use input/output boxes to show whole number functions or patterns.

❖ **Possible Assessment Opportunities**

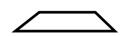
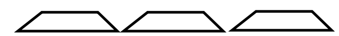
❖ Create written directions for a pattern sequence.

Intervention: Provide directions on sentence strips and have the children arrange them in the correct order.

Challenge: Working as a pair, one child creates directions with a deliberate error. The partner must find and explain the error and correct the directions.

COMPONENT STATEMENT: 1.2. REPRESENT AND ANALYZE QUANTITATIVE RELATIONSHIPS IN A VARIETY OF WAYS.

Grade-Level Expectations

3. Describe mathematical relationships and situations, involving ratios and computation of whole numbers, in all four operations with using symbols, number sentences and equations. If  **= ΔΔΔ Then**  **=____**

- Provide opportunities to solve problems involving proportional relationships using charts or tables for whole number functions or growing patterns. Rates, unit pricing and ratios can be used, e.g., one pint costs $1.50, so one quart costs___ or three toy cars cost 60 cents, so one car costs 20 cents.

COMPONENT STATEMENT: 1.3. USE OPERATIONS, PROPERTIES AND ALGEBRAIC SYMBOLS TO DETERMINE EQUIVALENCE AND SOLVE PROBLEMS.

Grade-Level Expectations

4. **Represent possible values by using symbols, e.g., variables, to represent quantities in expressions and number sentences. Use number sentences (equations) to model and solve word problems.**

    - Use a balance scale to explore algebraic equations. For example, if one triangle weighs 6 grams the number sentence would be Δ = 6g.

    - Use concrete materials to build an understanding of equality and inequality, e.g., 7⌂ ≠ 30 or 7⌂ > 30.

5. **Solve problems and demonstrate an understanding of equivalence in mathematical situations that reflect the commutative and associative properties of addition and multiplication of whole numbers and the distributive property**

    - Give children numerous opportunities to solve problems by using numbers flexibly: using the commutative property 23 + 7 = 7 + 23; the associative property (15 +35) +8 = 15 + (35 + 8) and the distributive property 12 x 8 = (10 x 8) + (2 x 8)

SAMPLE INTEGRATED LESSON – CHANGING VARIABLES

Context: Lizette and Sue were watching their friends play with different types of paper airplanes. They noticed that different planes went different distances. The girls think that the angles of the airplane wings make a difference in the flight. What do you think? Construct two different types of wings to test their hypothesis.

GLEs: 1.1.2, 1.2.3, 3.3.8, 4.2.3

Time: Two instructional periods

Objective: Children will recognize how the change in one variable (the wing) affects a result (the distance).

Materials: Different types of heavier 6-inch square paper, e.g., construction, cardstock, or oak-tag, scissors, rulers, compasses, protractors

Procedure:

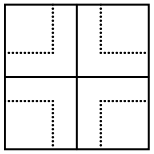


Fig. 1

1. Discuss the context and have the children choose two sheets of the same weight paper.
2. On the first sheet, bisect each side. (See Fig. 1.)
3. Using a ruler, draw dotted lines ½-inch from line. Cut on the dotted line. (See Fig. 1.)
4. On the second sheet, draw a line from the center at the top to the middle of the square. Draw a line from each bottom corner to the line in the middle. Draw a dotted line ½ ” from each side of the line. (See Fig. 2.)

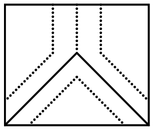


Fig. 2

5. Cut out along the dotted line. (See Fig. 2.)
6. Balance the first plane on the edge of a book, and tap the side of a wing with your finger.
7. Measure how far your plane goes and record your findings in a table. Try the second plane.
8. Look at the relationship between the two variables. Ask questions such as:
   a. What happened with each plane?

b. Was there any difference between the “flight” of the planes?

c. Does the shape of the wing make a difference?

9. Do a second test of both planes and record the findings. Compare the findings of the class.

❖ Possible Assessment Opportunities

- ❖ Explain if changing wing type affects the performance of a plane.

Intervention: Use sentence starters or a word bank.

Challenge: Design another test of the two types of planes, identify the two variables, perform the tests, and explain the relationship between the two variables.

Interdisciplinary Framework Connections				
Science	**English/Language Arts**	**Social Studies**	**Visual and Performing Arts**	**Physical Education**
B INQ.1 Make observations and ask questions about objects, organisms and the environment. **B INQ.2** Design and conduct simple investigations. **B INQ.3** Employ simple equipment and measuring tools to gather data and extend the senses. **B INQ.4** Use data to construct reasonable explanations.	• Organize relevant information and use in a summary. • Draw conclusions and use evidence to substantiate them by using text heard, read and viewed. • Make and justify inferences from explicit and/or implicit information.	• Create timelines that sequence events and people, using days, weeks, months, years. • Locate events, people and places they have studied in time and place.	**Dance** • Demonstrate non-locomotor movements (such as bend, twist, stretch, sway, swing). • Demonstrate eight basic locomotor movements. • Demonstrate accuracy in moving to a musical beat and responding to change in tempo. • Identify and demonstrate basic dynamic contrasts (slow/quick, gentle/strong).	• Explore and adapt fundamental movement skills to meet a variety of challenges. • Interact with peers while participating in group activities.

Vocabulary: value, function, variable, growing pattern, sequence, equivalence, inequalities, pattern, relationship, repeating pattern, sequences, equations, equalities, inequalities, expression, symbols, trends, generalizations. CMT Handbook Web site - http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/math/cmtgrade4.pdf

Resources:

Electronic Resources:

National Library of Virtual Manipulatives http://nlvm.usu.edu/en/nav/grade_g_1.html

Math Forum http://mathforum.org

Great Sites for Kids http://www.greatsitesforkids.com/gsfk/mathlessons.asp

Mirror Tool http://illuminations.nctm.org/ActivityDetail.aspx?ID=24

Illuminations http://illuminations.nctm.org/

50 Green Doors – Goals 2000

Archimedes' Mobiles – Goals 2000

Understanding Opposite Functions – Goals 2000

Patterns with Multiples – Goals 2000

The Pattern Machine – Goals 2000

Teacher References:

Putting Fun in Functions – Teaching Children Mathematics – NCTM – Dec/Jan 2006

Navigating through Algebra – Grades 3-5 - NCTM

Children's Literature:

Patterns, by Henry Arthur Pluckrose

Counting on Frank, by Rod Clements

If You Hopped Like a Frog, by David Schwartz

The Borrowers, by Mary Norton

The Nature and Science of Patterns, by Jane Burton

Two of Everything, by Lily Toy Hong

So You Want to be President, by Judith St. George

A Cloak for the Dreamer, by Aileen Friedman

Eight Hands Round, by Whitford Paul

Piece=Part=Portion: Fractions=Decimals,=Percents by Scott Gifford

If Dogs Were Dinosaurs, by David Schwartz

Can You Count to a Googol? by Robert E. Wells

The Mirror Puzzle Book, by Marion Walter

The King's Chessboard, by David Birch

One Grain of Rice, by Helena Clare Pittman

Spaghetti and Meatballs for All, by Marilyn Burns

Notes:

NUMERICAL AND PROPORTIONAL REASONING. Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

~ *COMPONENT STATEMENT: 2.1. UNDERSTAND THAT A VARIETY OF NUMERICAL REPRESENTATIONS CAN BE USED TO DESCRIBE QUANTITATIVE RELATIONSHIPS.*

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

1. ***Locate, label, compare and order numbers up to 100,000 using place value models, number lines and number patterns (including multiples of 1,000 and 10,000).***

2. **Extend number patterns to determine 1,000 and 10,000 more and less than a given number in practical situations.**

3. **Round whole numbers up to 100,000 using number patterns, number lines, diagrams and place value models.**

4. **Write and describe equivalent representations of four- and five-digit whole numbers up to 100,000 and beyond, in expanded and regrouped forms. Use the forms to support computational strategies.**

5. **Relate multiplication and division to number patterns and models of groups and rectangular arrays.**

   - Make up interesting contextual multiplication problems using 1 and 0 and discuss the results; lead children to discover the rules for the properties of multiplying by 0 and 1.

6. **Identify and define prime and composite numbers through the use of models including rectangular arrays, place value models and pictures.**

   - Choose a number, like 36, and have the children make as many rectangular arrays as they can to represent the factors. When using base-10 blocks, start with three rods and six cubes to make three groups of 12 before trading the tens for ones to find the other factors.

7. **Construct and use number lines, pictures and models, including rulers, to determine and identify equivalent ratios and fractions. (See also GLEs 2.1.8, 2.1.9, 2.1.10.)**

- Give the children circular pie fraction pieces, or other fraction model. Using a picture of the whole fraction model, outline a section of the whole model so that the children can other use fraction pieces to fill in the outlined section to demonstrate equivalence. Each equivalent should be recorded in picture, written and symbolic form. Have the class share their findings so that a class chart of equivalent fractions can be made

8. **Locate, label and estimate (round) fractions with like and unlike denominators of 2, 3, 4, 5, 6, 8 and 10 by constructing and using models, pictures and number lines. (See also GLEs 2.1.7, 2.1.9, 2.1.10.)**

- Use a variety of fraction models including commercial products like Fraction Factory, Fraction Tiles, Rainbow Fraction Tiles or construct fraction strips from construction paper. Have the whole class use the same color of paper for halves, thirds, fifths and so on.

- Use one model for an activity and have children compare fractions with unlike denominators and record their results on a number line with zero and one as endpoints.

9. **Construct and use models, pictures and number lines, including rulers to compare and order fractional parts of a whole and mixed numbers with like and unlike denominators of 2, 3, 4, 5, 6 and 8 and 10. (See also GLEs 2.1.7, 2.1.8, 2.1.10.)**

- Show two or three pairs of fractions to the children. Children must decide which fraction is greater, explain their thinking, and then verify their decision using a model of their choice.

10. **Construct and use models, pictures and number lines, including rulers, to identify wholes and parts of a whole (including a part of a group or groups) as simple fractions and mixed numbers. (See also GLEs 2.1.7, 2.1.8, 2.1.9.)**

- Give each child a collection of fractional parts that are all the same size or denomination (fifths, eights, tenths, etc.). Children should decide if their collection is less than one whole, one whole or more than one whole.

❖ **Possible Assessment Opportunities**

❖ Provide the children with three or four sheets of paper. Have them fold each in half and in half again, creating four boxes. Draw lines on the fold lines. Given an improper fraction, have the children shade in the appropriate number of boxes. To show the mixed number, turn over the papers with the whole set shaded and label as 1.

Intervention: Use pattern blocks or interlocking cubes to make improper fractions and mixed numbers.

Challenge: Create two sets of improper fractions using blocks. Combine the sets to make a new improper fraction. Repeat with mixed numbers. Write the number sentences.

11. Use models to represent tenths and hundredths and record the representations using equivalent ratio, fraction and decimal notation. ($\frac{1}{10}$, 0.1)

- Give the children circular pie pieces, or any fraction model divided in tenths. Using a picture of the whole fraction model, outline a portion of it. To demonstrate fraction and decimal equivalence, have the children use fraction pieces to make as many single fraction names for the outlined region as they can.

12. Express a ratio or division problem as a fraction and describe the relationship between the divisor and the remainder written as a fraction. For example: When determining the number of groups of 3 in 14, we say $14 \div 3 = 4$ with a remainder of 2 or 4 $\frac{2}{3}$).

- Illustrate a division problem by placing it in a context. The problem 637 divided by 4 can be changed to six boxes (hundreds), three cartons (tens) and seven pieces (ones) of candy to share among four classrooms. Have the children write the problem, the question and the solution.

❖ **Possible Assessment Opportunities**

❖ Give the children a strip of paper and have them label it seven equal units. Ask them to divide it into three equal parts.

Have children share how they divided it, without measuring. Next, ask the children to figure out what one “part” would be equal to. (Answer: $2\frac{1}{3}$.)

Intervention: Give the child a strip of paper with six equal units. Ask them to divide it into three equal units.

Challenge: Have the child fold the strip into four equal parts. Ask: If this is one-half of a set, how big is the set?

13. **Solve practical problems involving simple ratios and proportions, e.g., determining distance on maps, by using models, pictures and number patterns**

COMPONENT STATEMENT: 2.2. USE NUMBERS AND THEIR PROPERTIES TO COMPUTE FLEXIBLY AND FLUENTLY AND TO REASONABLY ESTIMATE MEASURES AND QUANTITIES.

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

14. ***Develop and use a variety of computation strategies including place value concepts, number lines and the commutative and associative properties to add and subtract three- and four-digit numbers and money amounts up to $1,000.00.***

15. **Solve contextual problems involving addition and subtraction of whole numbers using a variety of methods, including writing appropriate number sentences (equations) and explaining the strategies used.**

    - Create a menu that has two kinds of pizzas, in two sizes, and a small and large drink. Set the price for each item and student preferences about toppings and drinks. Have the children devise a pizza and drink order for their classmates with a limited amount of money.

16. **Create story problems to match a given number sentence (equation).**

17. **Recall the multiplication and division facts 1 through 10.**

18. **Write multiplication and division story problems involving basic facts and two- and three-digit by one-digit numbers to match a given number sentence and vice versa; solve the problems using strategies that include models and arrays and justify the solutions.**

- Give children a multiplication problem to solve using their own strategies. Have one child explain how they solved the problem. Ask another child to explain the first child's strategy for solving the problem. Discuss with the class what other facts could be determined using the same strategy. Write a similar problem in their journal.

- Mix ordinary multiplication flash cards from two or more strategies into one pile. Make simple pictures or labels for the strategies in the pile. Children match a card with a strategy and then use the strategy to solve the problem.

- "How close can you get?" Write a number of one digit multiplication problems on the board as shown: (e.g., 4 x ☐ = 23). Find the nearest factor without going over the target number (23).

19. Determine and explain in writing when an estimate is appropriate and whether a particular estimation strategy is reasonable or will result in an overestimate or underestimate involving computation with three- and four- digit numbers and money amounts up to $1,000.

20. Use models and pictures to add and subtract fractions with like and unlike denominators of 2, 3, 4, 5, 6, 8 and 10 and match number sentences or equations to the problems. (See also GLEs 2.1.7, 2.1.8, 2.1.9, 2.1.10.)

21. Identify or write number sentences to solve simple problems involving fractions with like denominators, decimals (tenths) and mixed numbers.

22. Write contextual problems involving the addition and subtraction of fractions with like denominators, decimals (tenths) and mixed numbers; solve the problems and justify the solutions.

23. Estimate a reasonable answer to simple problems involving fractions, mixed numbers and decimals (tenths).

24. Write and solve multistep contextual problems, including problems with extraneous information and explain orally and in writing how the answers were determined.

SAMPLE INTEGRATED LESSON — WHAT'S IT WORTH?

Context: Maria was shopping at the school store. She wanted to buy the one yellow wrist band that was imprinted with "KEEP TRYING". There also were ten green bands imprinted with "PEACE". The green bands were on sale and cost half as much as the yellow bands. That didn't seem fair to Maria. Later she asked her teacher, Ms. Jones, "How are prices of things determined?" Help Mary answer that question.

GLEs: 2.1.1, 2.1.3, 2.2.14, 2.2.18, 2.2.19, 4.1.2, 4.2.4

Time: Two instructional periods

Objectives: Children will compute efficiently with whole numbers and decimals. Children will determine how supply and demand affects the prices of goods. Children will make estimates to solve a problem.

Special note: This activity can be conducted using newspapers, store flyers or the internet, to give students contextual opportunities to work with larger numbers.

Materials: School supplies, index cards, markers, *The Turtle Street Trading Co.* by Jill Ross Klevin (page 160)

Procedure:

Assign the book for pre-reading or read aloud *The Turtle Street Trading Co.* by Jill Ross Klevin. Children can be reading anywhere in the book when doing this activity.

1. Ask children to think of three items in their desk or backpack and secretly set a price, in dollars and cents, for each one of the items. Have them write the price on an index card which is folded so that it can stand upright on the desk.
2. Instruct students to take out the items and place them by the appropriate "price tag" on their desks.
3. Invite students to go "window shopping" by checking out all the items and prices on their classmate's desks.
4. Have small groups of children work together to organize information about the items displayed, the number of items displayed and the prices of the items. Each group should share their findings with the class.

5. Lead the students in the discussion with questions such as:
   - Did similar items have the same price? Why or why not?
   - Now that you know how other children priced their items, how will that affect the pricing of your items, especially if you have the same items?
   - Were there some items that would be or are in high demand? How did the amount or supply of those items influence the demand? How might that affect pricing?

6. Give children the opportunity to change their items, their prices, or both.

7. Based on the prices the children set, the teacher should set a spending and time limit for children to go “shopping”. This time have them “purchase” items that do not go over the limit. To “purchase” items, the children write down the price of each item they “purchase.” Once they return to their desks, they should write an estimated total price of all their items on another index card.

❖ Possible Assessment Opportunities

- ❖ Children should total their “purchases” and compare the total to their estimate and to the limit. All should write about their shopping experience and what they might do differently, given another opportunity to “shop”. Have volunteers discuss their results. Lead children in another discussion about the reasonableness of the new prices and explanations of the thinking behind the purchases they made.

Intervention: Write each price on a separate post-it note. Use a calculator to find the total.

Challenge: Find items that are the same and record their prices and find the mean, median or mode of the prices for that item. Write riddles for classmates to solve using clues that include information about the item.

Extension: Have the students make signs for the school store explaining how items were priced, due to supply and demand, or write a letter to the principal suggesting more appropriate prices for items.

SAMPLE INTEGRATED LESSON 2 — FOOD AND FRACTIONS

Context: Your parents said you could have some friends over on Saturday afternoon. You will need to have some snacks. You decide to make one of your favorite snacks. The recipe says to measure each ingredient carefully. You look in the kitchen cabinet and discover that there is only a ¼ measuring cup. You will have to figure out how many fourths you will need to use to measure the equivalent amounts in the recipe.

GLEs: 2.1.7, 2.2.20, 2.2.21, 2.2.22

Time: One instructional period

Objectives: Children will determine equivalent fractions.

Materials: Shake ’n’ Go Snack recipe, ¼ measuring cups, ingredients from the list

Procedure:

1. Complete the following chart rewriting the recipe because you only have a ¼ measuring cup to use to measure the ingredients.

   Intervention: Provide the recipe ingredients premeasured in their total amounts, then have the children use the ¼ measuring cup to determine the equivalent fraction.

   Challenge: Have the children half, double and/or triple the recipe and estimate how many people the new recipe will feed.

2. Measure the ingredients using your final answer and make the snack mix.
3. Figure out how many cups the completed snack mixture will make to see if you will have enough for you and your friends.

Shake ’n’ Go Snack Mix		
Ingredients	**Calculations**	**Final answer**
1. 5 cups Chex cereal		
2. 1 cup teddy bear-shaped graham snacks		
3. ½ cup honey-roasted peanuts		
4. ½ cup raisins		
5. ¼ cup candy-coated chocolate candies		
6. Total number of cups in a complete snack mix		

Interdisciplinary Framework Connections			
Technology	**English/Language Arts**	**Social Studies**	**Visual and Performing Arts**
• Use basic operational features of school hardware (accessing programs, input devices, printing, output devices, keyboard, etc.)	• Use oral language with clarity, voice and fluency to communicate a message. • Use the appropriate features of persuasive, narrative, expository or poetic writing. • Determine purpose, point of view and audience, and choose an appropriate written, oral or visual format.	• Describe how the price of a good or service in a market is related to how much of it there is and how many people want it.	**Visual** • Select and use subject matter, symbols and ideas to communicate meaning

Vocabulary: prime, composite, place value, ten thousands, thousands, hundred more, hundred less, close to, closer to, about , almost, referent, visual organizer, unit, part-whole, whole, numerator, denominator, improper fraction, mixed number, region model, length model, measurement model, fractional parts, fractional value, property, target number, factor, product, partitioning, quotient, divisor, multiple, base-ten pieces, decimal, decimal notation, regroup, commutative property, associative property, distributive property, compare, round, estimate, reasonable, approximate, under-estimate, over-estimate, analog, digital, hour, minute, AM, PM, range, mode, median, mean. See page in frameworks at CMT Web site: http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/math/cmtgrade4.pdf

Resources:

Electronic Resources:

4th Grade Mathematics Skills: http://www.internet4classrooms.com/skills_4th_math.htm

4th Grade Skill Builders - Interactive Sites: http://www.internet4classrooms.com/skills_4th_original.htm

Math: http://www.dositey.com/math34.htm

Fun Mathematics Lessons: http://math.rice.edu/~lanius/Lessons/index.html

Visual Fractions: http://www.visualfractions.com

Fraction Books — Goals 2000

How Old Am I ? — Goals 2000

An Estimating Mind Set — Goals 2000

A Tale of Two Candies — Goals 2000

Vending Machines — Goals 2000

Teacher References:

Teaching Student-Centered Mathematics, Grades 3 – 5 by John Van de Walle and LouAnn Lovin

Explain It! Grades 3 – 4 by Creative Publications

Math and Literature, Grades 4 – 6 by Marilyn Burns

Children's Literature:

What's Cooking, Jenny Archer? by Ellen Conford

One Hundred Hungry Ants by Elinor J. Pinczes

One Grain of Rice by Demi

Math Curse by Jon Scieszka

Counting on Frank by Rod Clement

A Million Fish More or Less by Patricia McKissack

One Tiny Turtle by Nicola Davies

Math Appeal by Gregory Tang

Pumpkins: A Story for a Field by Mary Lyn Ray

How Much, How Many,...is 1000? By Helen Nolan

The Best of Times by Greg Tang

Betcha by Stuart Murphy

How Much is a Million? by David Schwartz

If You Made a Million by David Schwartz

On Beyond a Million by David Schwartz

The Turtle Street Trading Co., by Jill Ross Klevin

The I Hate Mathematics Book ,by Marilyn Burns

A Remainder of One, by E. J. Pinczes

Gator Pie, by Louise Mathews

The Great Take-Away, by Louise Mathews

Calculator Riddles, by David Adler

Anno's Mysterious Multiplying Jar, by Masaichiro Anno

Polar Bear Math: Learning About Fractions from Klondike and Snow by Ann Whitehead Nagda

Notes:

GEOMETRY AND MEASUREMENT. Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 3.1. USE PROPERTIES AND CHARACTERISTICS OF TWO- AND THREE-DIMENSIONAL SHAPES AND GEOMETRIC THEOREMS TO DESCRIBE RELATIONSHIPS, COMMUNICATE IDEAS AND SOLVE PROBLEMS.

Grade-Level Expectations

1. **Describe and represent polygons, solids, and other familiar two- and three-dimensional objects.**
    - Children copy a given shape on a geoboard and divide it into smaller shapes. Specify the number of shapes.
    - Challenge children to see how many different shapes can be made of a particular property (e.g., shapes with square corners, a shape with four angles with two acute and two obtuse).
2. **Compare and classify polygons based on relationships such as parallel or perpendicular lines, symmetry and congruence. (See also GLE 3.1.3.)**
    - Have children begin by identifying parallel and perpendicular lines in school in places like floor and ceiling tiles.
    - Have children examine different size squares and rectangles to identify lines that are parallel and perpendicular; figures that are congruent or have symmetry.
3. **Make and test conjectures about polygons using geometric relationships such as symmetry and congruence. (See also GLE 3.1.2.)**
    - Provide children with opportunities to construct or examine polygons and identify lines of symmetry by drawing the lines and explaining why the resulting parts are symmetrical.

- Give each child a paper shape. Have them construct polygons which are congruent and explain why.

COMPONENT STATEMENT: 3.2. USE SPATIAL REASONING, LOCATION AND GEOMETRIC RELATIONSHIPS TO SOLVE PROBLEMS.

Grade-Level Expectations

4. Draw and interpret simple maps with ordered pairs of numbers and/or letters in quadrant one of an x, y coordinate system and find possible paths between two points.

- Provide opportunities to use grid coordinates to read or locate information.
- Make a grid on the floor using masking tape or mark off a grid on the playground. Have students be the actual numbers on the x and y axes. Call out an ordered pair and ask the children representing those numbers to walk toward each other to mark the location of the point they identify.

5. Analyze geometric reflections (flips), rotations (turns), and translations (slides) of plane figures and describe the relationship to the original figure

- Use geometric shapes to explore constant areas and/or perimeters to discover and discuss the patterns that emerge after exploring a variety of shapes.
- Have children create geometric designs. Group children into pairs, place a divider between them and have each child describe his/her design, using appropriate vocabulary such as slide, flip, rotate, etc., and have his/her partner recreate the design as it is being described.
- Explore simple tessellations on the computer or in art work, e.g., work by M.C. Escher.

COMPONENT STATEMENT: 3.3. DEVELOP AND APPLY UNITS, SYSTEMS, FORMULAS AND APPROPRIATE TOOLS TO ESTIMATE AND MEASURE

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

6. **Use calendars and clocks to solve problems and schedule events involving elapsed time.**
   - Challenge children to estimate how long it will take to complete an activity or event.
   - Practice telling time to the nearest minute.
   - How do you spend a typical Saturday? Construct a schedule to show how you spend your Saturday.
   - Create a timeline using events in a story such as *Araminta's Paint Box* (historical fiction).
   - Plan a trip using bus, train or plane schedules.
7. ***Write and solve problems involving the conversion of simple measures of time, e.g., minutes to hours, hours to days and days to weeks and months.***
8. **Use customary and metric tools and units and non-standard units to estimate, measure and solve problems involving length and perimeter to the nearest quarter-inch or half-centimeter, area, capacity, weight, temperature and volume.**
   - Find different ways to measure the same length with one ruler, e.g., start at a point not the end.
   - Find examples of all types of measurements in everyday situations, present the context and measures. Have the children predict the appropriate unit of measure and defend their choices.
   - Estimation Scavenger Hunt – Create a list of measurements. Give teams the list and have them find the items that match the measurements. Measuring tools are not allowed.
9. **Use estimation strategies to predict reasonable answers to measurement problems and explain the reasoning used orally and in writing.**

SAMPLE INTEGRATED LESSON — HOW TALL? HOW FAR?

Context: The Junior Olympics are coming and your physical education teacher wants some students to enter the standing long jump. He has heard that the distance someone can jump is related to his height. He is wondering if he should encourage his tallest "athletes" to participate. The teacher has asked the students to help him with the investigation.

GLEs: 3.3.8, 4.1.2, 2.1.1

Time: Two instructional periods, see procedure for details

Objective: The children will collect and organize data to create graphs that compare the height and distance jumped for a small group.

Materials: Tape measures or other measuring tools, standing long jump mat, graph paper, rulers, pencils

Procedure: (Nos. 1-7 in P.E. class, Nos. 8-11 in math class)

1. Place children in cooperative groups of four or five.
2. Pose the question: "How does a person's height relate to the distance that he or she can jump?"
3. The children should design a way to use data to answer the question.
4. Children measure the height of each group member.
5. If necessary, set up a long jump by marking a distance of 7 feet in 1-foot intervals.
6. Each child jumps and members of the group measure the results.
7. Each group member records the distance jumped by all members of his or her group.
8. Once the data are collected, the children in each group should discuss how to organize the information.
9. Elicit from the children the components of a quality graph and have groups construct their graphs using that information.

10. After the groups have made their graphs, they can use computers to “publish” their graph.

11. Display the graphs and discuss the results. Ask questions such as:

    - What does this graph tell us?
    - Who is tallest?
    - Who jumped the farthest?
    - Who was able to jump at least his or her height?
    - Why do you think it is a measure of physical fitness to be able to jump your height?
    - Think of questions you can ask about these graphs.

❖ Possible Assessment Opportunities

- ❖ After discussion, ask the children to write a persuasive letter to the teacher recommending which students he should encourage to participate including mathematical reasoning to justify the recommendation. Provide an opportunity for the children to share their writing and to constructively analyze each other’s work

Intervention: Organize the group’s data using a table or chart. Make an oral recommendation.

Challenge: Decide on a question that might affect participation in a Junior Olympics event and conduct another investigation.

Interdisciplinary Framework Connections				
Science	**English/Language Arts**	**Social Studies**	**Visual and Performing Arts**	**Physical Education**
B INQ.1 Make observations and ask questions about objects, organisms and the environment. **B.INQ.4** Employ simple equipment and measuring tools to gather data and extend the senses. **B.INQ.5** Use data to construct reasonable explanations. **B.INQ.8** Analyze, critique and communicate investigations using words, graphs and drawings. **B INQ.9** Use measurement tools and standard units (e.g., centimeters, meters, grams, kilograms) to describe objects and materials. **B.INQ.10** Use mathematics to analyze, interpret and present data. **B.1** Describe how different plants and animals are adapted to obtain air, water, food and protection in specific land habitats.	• Generate and respond to questions • Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.). • Use oral language with clarity, voice and fluency to communicate a message. • Determine purpose, point of view and audience, and choose an appropriate written, oral or visual format. • Use strategies to generate and develop ideas for speaking, writing and visual activities. • Publish and/or present final products in a myriad of ways, including the use of the arts and technology.	• Create timelines that sequence events and peoples, using days, weeks, months, years, decades and centuries. • Locate the events, peoples and places they have studied in time and place (e.g., on a timeline and map) relative to their own location. • Exhibit curiosity and pose questions about the past when presented with artifacts, records or other evidence of the past. • Create information from maps, globes and geographic models in graphs, diagrams and charts.	**Art** • Use different media techniques and processes to communicate ideas, feelings, experiences and stories. • Use elements of art and principles of design to communicate ideas. • Select and use subject matter symbols and ideas to communicate meaning. • Identify specific works of art as belonging to particular styles, cultures, times and places.	• Engage in sustained physical activity that causes increases in heart rate and breathing (e.g., keep track of the time needed to increase heart rate and breathing). • Meet and/or show improvement in all components of the health-related fitness standards as defined by the Connecticut Health-Related Fitness Assessment.

Vocabulary: measure, minutes, hours, days, week, month, calendar, clock, digital, analog, data, length, area, weight, capacity, volume, inches, centimeters, foot, key, axis, horizontal, vertical, graph. See also page 52 of the CMT math handbook: http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/math/cmtgrade4.pdf

Resources

Electronic Resources:

Exploring Properties of a Rectangle: http://standards.nctm.org/document/eexamples/chap5/5.3/index.htm

Shape Explorer. Exploring Area: http://www.shodor.org/interactivate/lessons/area.html

Comparing Quantities – Goals 2000

Shoefuls – Goals 2000

Soma Cube – Goals 2000

Coordinate Puzzles – Goals 2000

Children's Literature:

Numbers and Measuring, by John M. Patterson

The Greedy Triangle, by Marilyn Burns

Araminta's Paint Box, by Karen Ackerman

How Much, How Many, How Far, How Heavy, How Long, How Tall is 1000? by Helen Nolan

Size: Many Ways to Measure, by Michelle Koomen

Reflections, by Ann Jones

Notes:

WORKING WITH DATA: PROBABILITY AND STATISTICS. Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 4.1. COLLECT, ORGANIZE AND DISPLAY DATA USING APPROPRIATE STATISTICAL AND GRAPHICAL METHODS

Grade-Level Expectations

1. **Pose questions and develop a plan to collect data using observations, surveys and experiments to answer the questions.**

2. **Collect, organize and represent the data that answer the questions using simple circle graphs and broken line graphs.**

   - Collect and organize data from a science experiment, by recording and classifying observations or measurements, in response to a student- generated question, e.g., observations about the weather or recording the amount of precipitation during a specified period of time.

COMPONENT STATEMENT: 4.2. ANALYZE DATA SETS TO FORM HYPOTHESES AND MAKE PREDICTIONS.

Grade-Level Expectations

3. **Discuss, make predictions and write about patterns and trends in categorical and numerical data that have been represented in a variety of ways.**

   - Engage students in conversations about different ways to represent categorical and numerical data. Encourage children to state which representation is easier to create and use.

- Give children opportunities to represent the same information using at least two different forms including: charts, tables, line plots, picture graphs, or bar graphs.

4. **Determine the range, median, mode and mean of a set of data and describe characteristics of the data set as typical or average based on those determinations. (See also Geometry and Measurement Sample Integrated Lesson)**

    - Encourage the children to determine the mean, median or mode of a set of data they have collected or are studying, especially in science or social studies lessons.

COMPONENT STATEMENT: 4.3. UNDERSTAND AND APPLY BASIC CONCEPTS OF PROBABILITY.

Grade-Level Expectations

5. **Conduct probability experiments and express the probability based on possible outcomes, e.g., 8 out of 10 tiles chosen were red.**

    - Conduct simple experiments or simulations of simple event of chance, organize the data and use the results to draw conclusions about the likelihood of possible outcomes.

6. **Determine and describe possible combinations, where order does not matter, e.g., when there is a choice of vanilla (V), chocolate (C) or strawberry (S) ice cream for a two-scoop cone and two different scoops are desired, the possible combinations are CV, CS, or VS.**

SAMPLE INTEGRATED LESSON – HOW THINGS CHANGE

Context: Brian and Michael were looking at the classroom plants. Some of the plants looked great and others were wilted or yellow. In class they had been studying about plants and the conditions plants need to grow and survive. The boys wondered how a plant would react if it was not given one of the things it needed to survive.

Grade-Level Expectations: 4.1.2, 1.1.2, 3.3.8

Time: One instructional period for introduction, one instructional period for conclusion

Objective: The children will examine any patterns evident while determining how restricting one essential condition affects plant growth and survival.

Materials: Household plants, magnifying glass, containers such as graduated cylinders or measuring cups, water, paper towels

Procedure:

1. Discuss the essential conditions for plants to survive and grow.
2. Allow children to develop a way to test how changing one of the essential conditions will affect plant growth and survival (Water is the easiest to measure and adjust).
3. In teams of two, children should plant two plants. The plants should be kept in a consistent place.
4. Using graduated cylinders, children measure water and water both plants for several days, keeping the amount of water the same.
5. Have the children measure and record the plants' height and water amount, and label diagrams daily in their "lab" journal.
6. After watering both plants for several days, stop watering one plant.
7. Have the children predict what will happen.
8. Have the children record in journals, water amounts, height measurements, labeled diagrams and a descriptive entry of what they observe with both plants.

9. After the waterless plant starts to change, keep track of how long it survives without water.

❖ **Possible Assessment Opportunities**

- ❖ Organize the data and write a report sharing the observations. Discuss any patterns that are represented in the table and/or graph and the relationship between watering the plant and its ability to survive.

Intervention: Record data by filling in missing information in a partially completed table.

Challenge: Use a line graph to represent the data.

Interdisciplinary Framework Connections				
Science	**English/Language Arts**	**Social Studies**	**Visual and Performing Arts**	**Physical Education**
B INQ.1 Make observations and ask questions about objects, organisms and the environment. **B.INQ.4** Employ simple equipment and measuring tools to gather data and extend the senses. **B.INQ.5** Use data to construct reasonable explanations. **B.INQ.8** Analyze, critique and communicate investigations using words, graphs and drawings. **B INQ.9** Use measurement tools and standard units (e.g., centimeters, meters, grams, kilograms) to describe objects and materials. **B.INQ.10** Use mathematics to analyze, interpret and present data. **B.1** Describe how different plants and animals are adapted to obtain air, water, food and protection in specific land habitats.	• Generate and respond to questions. • Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.). • Use oral language with clarity, voice and fluency to communicate a message. • Determine purpose, point of view and audience, and choose an appropriate written, oral or visual format. • Use strategies to generate and develop ideas for speaking, writing and visual activities. • Publish and/or present final products in a myriad of ways, including the use of the arts and technology.	• Locate the events, peoples and places they have studied in time and place (e.g., on a timeline and map) relative to their own location. • Exhibit curiosity and pose questions about the past when presented with artifacts, records or other evidence of the past. • Create information from maps, globes and geographic models in graphs, diagrams and charts.	**Art** • Use different media techniques and processes to communicate ideas, feelings, experiences and stories. • Use elements of art and principles of design to communicate ideas. • Select and use subject matter symbols and ideas to communicate meaning. • Identify specific works of art as belonging to particular styles, cultures, times and places.	• Engage in sustained physical activity that causes increases in heart rate and breathing (e.g., keep track of the time needed to increase heart rate and breathing). • Meet and/or show improvement in all components of the health-related fitness standards as defined by the Connecticut Health-Related Fitness Assessment.

Vocabulary: measure, minutes, hours, days, week, month, calendar, data, length, volume, graph, chart, table, pictograph, bar graph, estimate, ruler, thermometer, scale, inches, centimeters, tally marks, survey, line graph, key, axis, horizontal, vertical. See also page 52 of the CMT math handbook: http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/math/cmtgrade4.pdf

Resources:

Electronic Resources:

Categorical and Numerical Data: http://illuminations.nctm.org/LessonDetail.aspx?ID=U116

Line Plots & Graphing with M&M's: http://score.kings.k12.ca.us/lessons/mandm.html

Dealing with Data: http://illuminations.nctm.org/LessonDetail.aspx?ID=L1297

Graphing the Weather: http://score.kings.k12.ca.us/lessons/graphweather.html

Math Playground: http://www.mathplayground.com/InteractiveGeometry.html

The Birthday Party – Goals 2000

Teacher References:

NCTM Data Analysis Standards 3-5

Adding It Up, National Research Council

Elementary and Middle School Mathematics by John Van De Walle

Graphing and Computers in Grades 3-5: http://www.venturaes.com/graphing/

Developing Graphing Comprehension, NCTM

Children Are Mathematical Problem Solvers, by Lynae E. Sakshaug

Children's Literature:

Grandfather Tang, by Greg Tang

One Tiny Turtle, by Nicola Davies

Betcha, by Stuart Murphy

What's Cooking,Jenny Archer? by Ellen Conford

One Grain of Rice, by Demi

Notes:

Grade 5

CONTENTS

The Learner at This Level

THE FIFTH-GRADE CHILD:

- Likes order and a harmonious environment.
- Finds comfort in themselves, their parents and siblings and teachers.
- Learns factual information easily.
- Knows the rules.
- Works well with others.
- Enjoys group games and projects.
- Concentrates on completing projects and tasks.
- Needs breaks and rest periods.
- Is a good problem solver.

Source: *Yardsticks: Children in the Classroom Ages 4-14* by Chip Woods, pages 105-115

ALGEBRAIC REASONING

- Performs complex classification and seriation tasks.
- Thinks based on rules and logic.
- Can articulate the rules embedded in a function, relationship, or pattern.
- Represents patterns in words, tables, graphs and equations.
- Describes how the change in one variable affects another variable in everyday situations.
- Models equivalence and solves one step equations using manipulatives

NUMERICAL AND PROPORTIONAL REASONING

- Selects, uses, and explains various meanings and models for multiplication and division.
- Computes efficiently and accurately in all four operations.
- Solves computation problems using the order of operations.
- Comprehends the relationship between fractions, decimals and percentages.
- Realizes that a percent means part of 100.
- Identifies and represents decimals, fractions, mixed numbers, and positive and negative integers on a number line.
- Uses drawings, number patterns or models to explain solutions for fraction and decimal problems.
- Converts improper fractions to mixed numbers.

- Makes efficient use of technology when precision is necessary in complex computation.
- Demonstrates an understanding of a ratio of whole numbers as a fraction.
- Recognizes classes to which a number may belong, including odd, even, prime, composite or square numbers.
- Explores integers using models and coordinate grids.

GEOMETRY AND MEASUREMENT

- Solves problems involving computation with measurements.
- Uses combinations of attributes to describe phenomena.
- Utilizes tools like a compass and protractor.
- Uses ratio and proportion to solve practical problems.
- Explores the relationship between changes in the area and perimeter of a polygon.
- Develops formulas to describe area and perimeter of squares, rectangles, and triangles.
- Selects and uses appropriate tools and units for attributes being measured.
- Determines when precision or estimation in measurement is appropriate.
- Uses models and drawings of shapes to make and test hypotheses and make generalizations about geometry.
- Explains and illustrates spatial relationships using coordinate geometry.
- Describes and analyzes the results of combining and subdividing shapes.
- Creates and uses formulas to solve problems.

WORKING WITH DATA

- Recognizes the impact a variable has on data collection and analysis.
- Evaluates how well a display represents the features of the data.
- Recognizes the significance of probability and fairness and represents the data in multiple ways.

Mathematics Background for Teachers

MATHEMATICS BACKGROUND FOR GRADE 5 TEACHERS

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS:

Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

Central Understanding: Numerical relationships can be represented using symbols.

Background: Functional relationships are represented by: describing a pattern, using a chart or table, using a graph, and by using descriptive language. Functions in their most abstract form are written as equations. Equations apply the rules of arithmetic and algebra to determine equivalence and calculate values. A value can be represented as a number, a numerical expression, an algebraic expression, or an equation. Different symbols in an equation can have the same, or different, values. In mathematical situations and structures, using letters as variables facilitates generalizations and the exploration of numbers and their operations.

NUMERICAL AND PROPORTIONAL REASONING

Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

Central Understanding: Numerical relationships are not changed when rational numbers are represented in different ways.

Background: Rational numbers are numbers which can be expressed as ratios and operated upon as division problems. The equivalence of fractions, decimals and percent allows for translation among different representations for the same quantity. Context and efficiency dictate the appropriate representation when solving problems. Operations involving rational numbers are consistent with whole number operations. Familiar situations can also be described using , which are positive numbers, negative numbers that represent quantities less than zero and zero.

GEOMETRY AND MEASUREMENT

Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

Central Understanding: Geometric relationships can be represented spatially and generalized through formulas.

Background: The exploration and analysis of shapes, structures, and properties leads to generalizations that can be expressed as formulas. Measures of attributes provide numerical data which summarize what is typical for a specific situation and condition.

WORKING WITH DATA: PROBABILITY AND STATISTICS

Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

Central Understanding: Organized data can be used to summarize what is typical for a specific situation and condition.

Background: Measures of central tendency are descriptors of what is typical for a specific situation or condition. Data from a sample that is representative of a larger population are used to identify trends, make generalizations and make predictions, providing the foundation for further investigations of conjectures and conclusions.

Correlated Grade-Level Expectations

Click here to access correlated grade-level expectations for Grade 5 on the State Department of Education Web site.

Sequenced Grade-Level Expectations

GRADE 5 SEQUENCED GLES

Grade-Level Expectations	Fall	Winter	CMT	Spring
ALGEBRAIC REASONING				
1.1 Understand and describe patterns and functional relationships.				
1. Represent, extend and compare geometric and numeric patterns using words, tables, graphs and equations.				
2. Analyze patterns and data to make generalizations, make predictions and to identify trends.				
1.2 Represent and analyze quantitative relationships in a variety of ways.				
3. Represent and describe mathematical relationships using variables or symbols in expressions, equations and inequalities.				
4. Describe how a change in one variable relates to a change in a second variable in context. For example: If a recipe requires two cups of flour for eight servings, the flour must be doubled for 16 servings or increased by ½ for 12 servings).				
1.3 Use operations, properties and algebraic symbols to determine equivalence and solve problems.				
5. Replace variables or symbols in algebraic expressions with given values and evaluate or simplify the expression e.g., If = 5, find the value of 4 *x* +7.				
6. Model, write and solve one-step equations by using appropriate concrete materials that model equivalence, e.g., if 4 x Δ = 36, then Δ equals 9.				
NUMERICAL AND PROPORTIONAL REASONING				
2.1 Understand that a variety of numerical representations can be used to describe quantitative relationships.				
1. Compare, order and round whole numbers to 1,000,000 using number patterns, number lines and diagrams.				
2. Represent whole numbers up to 1,000,000 in expanded and regrouped forms and use the forms to support computation.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
3. Construct and use models, number patterns and pictorial representations to extend place value concepts and patterns to decimals, e.g., 0.1 is one-tenth of 1 and 0.01 is one one-hundredth of 1 and one-tenth of 0.1.				
4. Investigate negative integers (values less than zero) using place value models, diagrams and number lines and represent negative integers in practical applications, e.g., temperatures, money and locations below sea level.				
5. Classify numbers as prime, composite or perfect squares and identify factor pairs using rectangular arrays.				
6. Represent equivalent fractions, decimals, ratios and percents using models, pictures, number patterns and common factors.				
7. Choose and use benchmarks to approximate locations, of fractions, mixed numbers and decimals, on number lines and coordinate grids.				
8. Write division problems in fraction form and round the fraction form to estimate an answer to a division problem, e.g., $^{14}/_{3} = 4\ ^{2}/_{3} \approx 5$.				
9. Use models and pictures to identify and compare ratios and represent ratios in equivalent fraction and decimal forms.				
2.2 Use numbers and their properties to compute flexibly and fluently and to reasonably estimate measures and quantities.				
10. Solve practical problems involving 10, 100, 1000 and *10,000* more or less than a number.				
11. Estimate products and missing factors using multiples of 10, 100 and 1000.				
12. Develop and use strategies involving place value relationships, inverse operations and algebraic properties (commutative, associative and distributive) to simplify addition, subtraction and multiplication problems with three-, four- and five-digit numbers and money amounts and division by one-digit factors.				
13. Multiply and divide decimals and money amounts by whole numbers				
14. Write and solve multistep problems for all four operations involving multidigit whole numbers and money amounts and explain how answers were determined, orally and in writing.				
15. Find fractional parts of a set by using estimation, counting, grouping of objects, number patterns, equivalent ratios and division.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
16. Add and subtract fractions, decimals and mixed numbers using a variety of strategies (e.g., models, mental math, equivalence and substitution: ½ + ¾ can also be solved using 0.5 + 0.75).				
17. Construct and use models and pictorial representations to multiply common fractions and mixed numbers by whole numbers.				
18. Use ratios and proportions to solve practical problems, e.g., interpreting scale drawings and maps, and determining the probability of an event.				
19. Use estimation to predict results and to recognize when an answer is or is not reasonable, or will result in an overestimate or underestimate and explain the reasoning used orally and in writing.				
GEOMETRY AND MEASUREMENT				
3.1 Use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.				
1. Represent the surface of three-dimensional solids using two-dimensional nets.				
2. Develop formulas for finding the perimeter and area of squares, rectangles and triangles and use them to solve problems.		Squares, rectangles		Triangles
3. Use the attributes of parallel sides, perpendicular sides, congruent sides/angles, number and length of sides or faces and number and kinds of angles (right, acute or obtuse) to describe, classify and sort polygons and solids (cube, prism, pyramid and sphere).				
4. Make and test conjectures about polygons using geometric relationships.				
3.2 Use spatial reasoning, location and geometric relationships to solve problems.				
5. Use an *x*, *y* coordinate system to plot points, to estimate the distance between points and to determine the horizontal or vertical distance between two points.				
6. Analyze and describe the effect that changing the dimensions (perimeter) of a polygon has on its area and vice versa.				
3.3 Develop and apply units, systems, formulas and appropriate tools to estimate and measure.				
7. Use calendars and clocks to plan and sequence events and to solve problems involving the conversion of measures of time and elapsed time using days, hours, minutes and seconds.				

Grade-Level Expectations	Fall	Winter	CMT	Spring
8. Estimate and measure to solve a variety of problems that involve angles, length, area, weight, mass, temperature, capacity and volume in either metric or customary units and explain the reasoning used orally and in writing.				
9. Use cubic inch or cubic centimeter models to find the volume of rectangular solids.				
10. Solve length problems involving conversions of measure within the customary (inches, feet, yards, and miles) or metric systems (millimeters, centimeters, meters and kilometers).				
WORKING WITH DATA				
4.1 Collect, organize and display data using appropriate statistical and graphical methods.				
1. Represent sets of data using line plots, bar graphs, double bar graphs, pictographs, simple circle graphs, stem and leaf plots and *scatter plots*.				
2. Compare different representations of the same data set and evaluate how well each kind of display represents the features of the data.				
4.2 Analyze data sets to form hypotheses and make predictions				
3. Design and conduct surveys of a representative sample of a population and use the data collected to begin to make inferences about the general population.				
4. Determine the mean, mode and median of a data set and explain in writing, how they are affected by a change in the data set.				
4.3 Understand and apply basic concepts of probability				
5. Design and conduct probability experiments and simple games of chance to test predictions about outcomes and fairness.				
6. Determine and describe possible outcomes and express the likelihood of events as a fraction.				
7. Determine and describe possible outcomes using permutations, where order does matter, e.g., when there is a choice of vanilla (V), chocolate (C) or strawberry (S) ice cream for a three scoop cone, there are two possible ways to have the chocolate scoop on top CVS or CSV.				

Correlated GOALS 2000 Criterion Referenced Test

GRADE 5 CORRELATED GOALS 2000 CRT

The Goals 2000 Mathematics Curriculum was written as a companion to the 1998 Mathematics Framework. The Goals 2000 resources cited in this 2008 Model for Mathematics Curriculum are aligned to the 2005 Mathematics Curriculum Framework, 2007 Curriculum Standards and the fourth generation Connecticut Mastery Test.

The Grade 5 Criterion Referenced Test Part A from the Goals 2000 Mathematics Curriculum is aligned to the Grade 5 sequenced GLEs and can be used for pre- and post-assessment.

Please use the link below to access the electronic version of the complete document, which includes other activities, such as opportunities for open-ended and challenge experiences that must be examined for alignment prior to use.

http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=321084

Grade 5 Correlated Mathematics CRT

GLE 2.2.19

Mr. Lopez is redoing his kitchen. The following list shows the cost of new appliances.

Appliance	Cost
Stove	$479.29
Refrigerator	$649.89
Dishwasher	$329.59
Microwave	$269.29
Toaster	$ 39.95

a. ABOUT how much will Mr. Lopez spend on the stove and the refrigerator together?

Estimate ___________________

b. Write a number sentence that shows how you would use estimation to figure how much more expensive the dishwasher is then the microwave.

____

c. Mr. Lopez has budgeted $1500 for appliances for the kitchen. Explain how he can use estimation to find out if he has enough money to buy all five appliances.

____

____

____

GLE 2.1.1

Consider the number 247,954.

a. Write the number that is 10,000 more ______________

b. Write the number that is 1000 less ______________

c. Write the number that is 1000 more ______________

d. Write the number that is 100,000 less ______________

e. Write the number that is 10 times greater ______________

Darlene's new stereo cost $485. Before she bought the stereo she had about $1000 in the bank. ABOUT how much does she have left in the bank?

a. A little less then $500

b. A little more then $500

c. A little less then $600

d. A little more then $600

GLE 3.3.7

Evan can type at a rate of about 30 words per minute. About how many words can he type in an hour and a half? Explain

____

____

GLE 2.2.12

Use each of the digits 3, 4 and 6.

a. Put one digit in each box to get the greatest possible quotient.

$$\square \;\overline{)\;\square \quad \square}$$

b. Now rearrange the digits to get the least possible quotient.

$$\square \;\overline{)\;\square \quad \square}$$

c. Explain how you decided where to place the digits in the problems above.

GLE 2.2.12

Show how you can arrange 8 of the 10 numbers below in the boxes below to get a difference close to $10. Use each number only once.

0 1 2 3 4 5 6 7 8 9

$$
\begin{array}{rl}
 & \$\,\square\,\square\,.\,\square\,\square \\
- & \$\,\square\,\square\,.\,\square\,\square \\
\hline
\end{array}
$$

GLE 2.2.16

Place four different digits in the boxes below so that the sum of the two fractions is about one.

a.

$$\frac{\square}{\square} + \frac{\square}{\square} =$$

Explain why you think the sum is about one.

GLE 2.1.7

Place the following on the number line: 2/3, 7/8, 0.6, 1.25, 1 3/4, 0.78, 1.09, 1 9/10

GLE 2.2.19

Maria needs to estimate the difference between 3867 and 8129. Her estimate could either be 4000 or 4300.

a. When would 4000 be the most reasonable estimate?

b. When would 4300 be the most reasonable estimate?

GLE 2.2.16

Pasqual needs to add 3 7/8 and 7 1/9. Show the whole numbers he would use to ESTIMATE this sum. Then write one or two sentences to explain why you used these numbers.

GLEs 2.2.11; 2.2.13, 3.3.10

Place a decimal point in the last number to make each sentence correct.

a. 500¢ = $500

b. 374 ÷ 10 = 374

c. 134 x 100 = 13400000

d. 135 centimeters = 135 meters

e. 1000 millimeters = 1000 centimeters

GLEs 2.2.14, 4.2.4

The school store has the following price list:

Item	Cost
Pen	$0.85
Pen Set	$2.29
Pencil	$0.69
Lead Pencil	$3.29
Crayons	$2.75
Binder	$1.79
Hole Punch	$4.49
Stapler	$3.99
Envelopes (box)	$1.29
Pad	$1.69

a. What is the cost of 3 pens, 2 pencils and 5 binders? ____________________

b. Mary buys one hole punch and one stapler. She pays for them with a $20 bill. How much change should she receive?

____

c. What is the average (mean) cost of the first 5 items on the list?

____

GLE 2.1.1

. Write each of the following in standard form:

a. 6 hundreds, 4 tens and 5 ones ____________________

b. 4 thousands, 8 hundreds and 1 one ____________________

c. 3 ones and 5 tenths ____________________

d. 2 tens, 5 ones and 6 hundredths ____________________

GLE 2.2.12

. Round the following numbers to the stated place:

a. Round 72 to the nearest 10 ____________________

b. Round 2,578 the nearest hundred ____________________

c. Round 4.88 to the nearest whole number ____________________

d. Round 3.732 to the nearest tenth ____________________

GLE 2.2.13

A school bought 16 boxes of new colored pencils. Each box contains 24 pencils. If the new pencils were divided equally among 6 classes, how many pencils will each class receive? Show all of your work.

GLE 2.2.13

Five people split the $38.65 cost of dinner evenly. How much will each person have to pay? Show all of your work.

GLEs 2.1.1, 2.2.12, 4.1.1, 4.2.4

The 15 students in a class each count the number of pumpkin seeds in their pumpkins. The results are shown below.

Student	Number of Seeds
Thomas	381
Andy	325
Pierina	365
Olivia	410
Ginny	467
Kate	479
Mathieu	512
Geoffrey	494
Zachary	455
Elizabeth	367
Rachel	507
James	385
Elizabeth	545
Kristin	568
Lindsay	408

a. Which student found the greatest number of seeds?

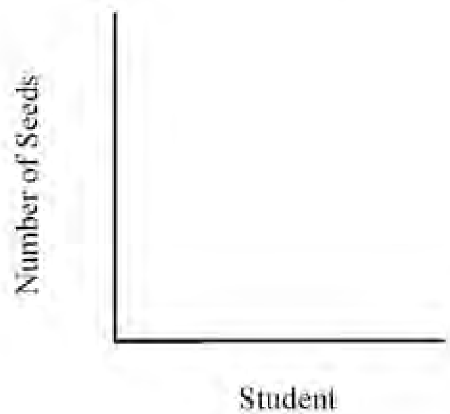
b. Which student found the fewest number of seeds?

c. Name three students who found about 500 seeds in their pumpkin?

d. Pick the students who found between 300 and 400 seeds in their pumpkins. What fractional part of the class did you pick?

e. Calculate the mean number of pumpkin seeds found and compare that to the median. Explain the reason for the difference, if any.

f. Use the first five students in the list and construct a bar graph showing how many seeds they each found in their pumpkin.



GLE 2.1.6

Draw a picture to show what 4/3 means.

GLE 2.1.6

Write two equivalent fractions for 4/5.__________ __________

GLE 2.1.7

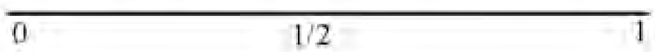
Consider the following fractions:

6/11 5/8 9/20 3/7 7/15 11/123/10

a. Circle those fractions that are less than 1/2

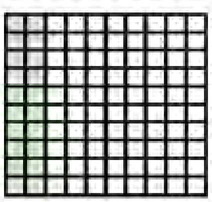
b. Underline the largest fraction

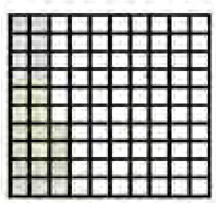
c. Put an X on the number line to show where 3/10 is.



GLE 2.1.3

If the large square represents one whole, what decimal is represented by the shaded part of the square?

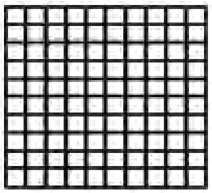
a.  ________

b.  ________

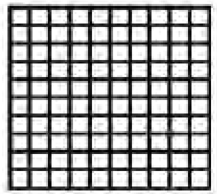
GLE 2.1.3

Shade in the squares to show:

a. .42



b. .3



GLEs 1.1.1, 1.1.2

Write the next three numbers in each sequence and explain the rule for the pattern.

a. 32 28 24 _____ _____ _____

Rule ____

b. 1 4 7 10 _____ _____ _____

Rule ____

c. 1 2 4 8 16 _____ _____ _____

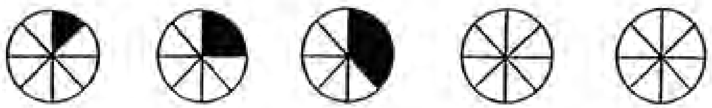
Rule ____

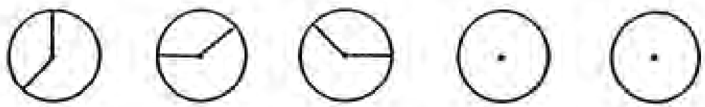
d. 1 2 4 7 11 16 _____ _____ _____

Rule ____

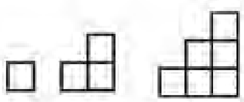
GLE 1.1.1

Draw the next figure in each of the following patterns.

a.  ____________

b.  ____________

c.  ____________ ____________

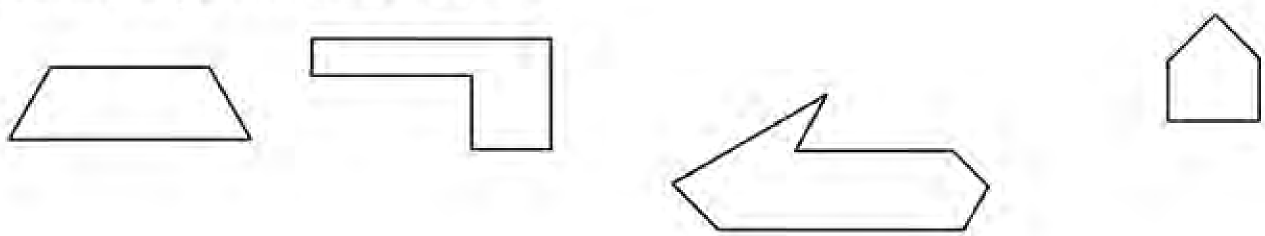
d.  ____________ ____________

GLE 3.1.2

Find the perimeter of this figure. Explain what you did to find the perimeter and show a generalized (formula) way to find perimeter.

GLE 3.1.3

Circle the shape below that is a hexagon.



GLE 3.1.3

Draw a rectangle below and identify two properties of all rectangles.

Property 1 ____________________

Property 2 ____________________

GLE 3.1.2

A square has a side 7 inches long.

a. What is the perimeter of this square? ____________

b. What is the area of this square? ____________

GLE 2.1.1

The table below shows the number of pizzas sold at Gino's last year.

Type of Pizza	Number Sold
Cheese	6428
Pepperoni	6249
Mushroom	7248
Sausage	6981
Onion	6212

a. Of the types of pizza sold, which type was the LEAST popular?

b. Of the types of pizza sold, which type had sales between 6500 and 7000?

c. Write one additional question this graph could answer.

GLE 4.1.1

Construct a graph that represents the data in the table below. Explain which representation is more useful and why.

Town	Population
Winterston	40,000
Tunxisville	60,000
Salisburg	70,000
Franklin	20,000
Marshlock	80,000

GLEs 2.1.6, 2.2.16, 4.1.2

Consider the data in the chart below regarding how the students in a class got to school one day.

Student	Time (minutes)	Distance (miles)	Mode of Travel
TC	60	4.7	Bus
RC	30	1.9	Bus
DD	15	1.5	Car
MR	20	0.4	Walk
LS	15	1.3	Bus
SW	8	0.9	Car
MB	45	3.9	Bus
SL	25	2.2	Bus
DH	30	4.2	Car
RT	10	1.0	Bus
GT	35	1.6	Walk

a. Name the students who traveled close to 3 miles. _______ _______

b. Name the students who traveled less than 1 mile. _______ _______

c. Name the student who traveled 1 1/2 miles. _______________

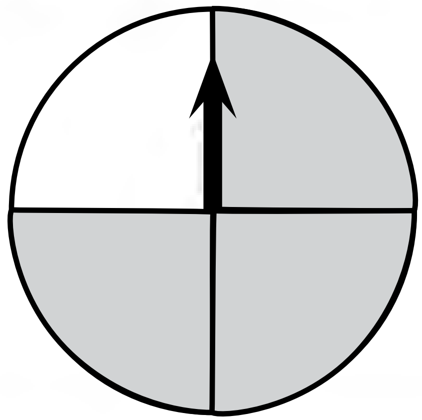
d. How many miles did the two students who walked travel all together? _______________

GLE 4.3.6

The spinner below is spun 100 times. How many times would you predict the arrow will land on the shaded section? Explain your answer.

Prediction ____________________

Explanation ____________________

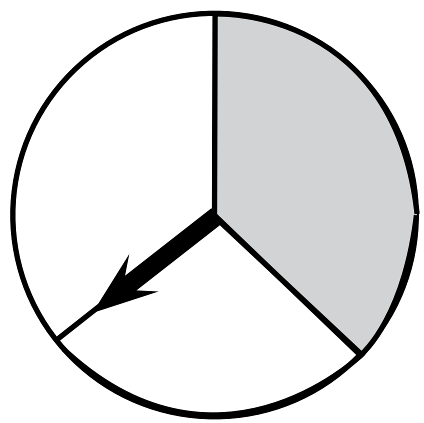


GLE 4.3.6

The spinner below is spun 500 times. How many times would you predict the arrow will land on the shaded section? Explain your answer.

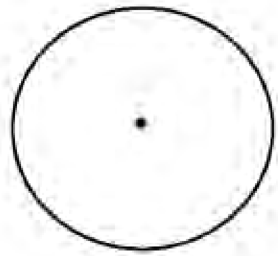
Prediction ____________________

Explanation ____________________



GLE 4.3.5

Draw a spinner that you think will give the following results if the spinner is spun 1000 times. 600 A's 300 B's and 100 C's



GLE 3.3.10

Arrange the units of length below in order from shortest to longest. Write a problem for a classmate to solve that involves converting from one of the units to another.

meter centimeter kilometer millimeter

__________ __________ __________ __________

GLE 3.3.10

Arrange these units of capacity in order from smallest to largest. Write a problem for a classmate to solve that involves converting from one of the units to another.

quart pint cup gallon

__________ __________ __________ __________

GLE 3.3.8

a. Using a standard ruler, draw a line segment that is 2 1/2 inches long. Label the segment XY.

b. Use a metric ruler and draw a line that is 3 cm, 4 mm long. Label the segment AB.

GLE 3.1.3

Draw two different quadrilaterals and label them with their correct names.

GLE 3.3.7

Bobby exercises for 20 minutes every morning except Saturday. How many hours does he spend exercising in one week?

____

The movie started at 7:10 and ended at 9:00 p.m. How long was the movie? ____________

GLE 3.3.10

Measure this line segment using centimeters:

GLE 3.3.7

Megan left for a soccer game at 4:15 and got home at 6:10. How long was she gone?

____

A new Jeep Cherokee cost $31,540 and a new PT Cruiser cost $25,400. If P = the cost of the Cruiser, which equation below can be used to find how much more the Jeep is than the Cruiser?

a. 31,540 + P

b. 31,540 – P

c. 31,540 x P

d. 31,540 / P

GLE 3.3.8

The large stick figure is ABOUT HOW MANY TIMES TALLER than the small figure?

____

GLE 3.1.3

Use a PROTRACTOR to draw a 75 degree angle.

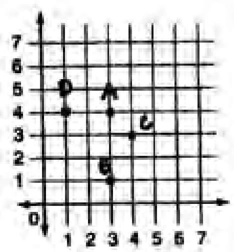
GLE 2.2.12

To ESTIMATE the product of 412 and 625, Jason multiplied 400 x 600. Will Jason's estimate be MORE or LESS than the actual sum?

a. More because he rounded both numbers up.
b. More because he rounded both numbers down.
c. Less because he rounded both numbers up.
d. Less because he rounded both numbers down.

GLE 3.2.5

Look at the grid below. Using horizontal and vertical lines only, determine which two points are the same distance from point A.



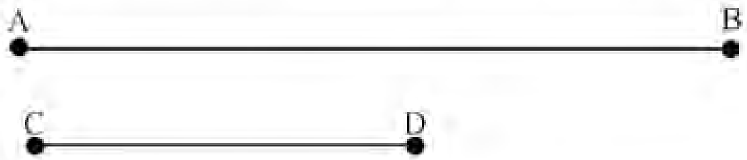
GLE 3.3.8

The amount of water in an eyedropper is best measured using: ________

a. milliliters b. liters c. kiloliters

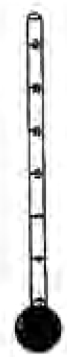
GLE 3.3.8

Line segment AB is about__________ times as large as line segment CD



GLE 3.3.8

23 degrees Celsius is great weather for swimming. Mark this temperature on the thermometer with a heavy line.



GLE 2.2.11

Fill in the missing numbers on this grid and explain your thinking.

X	30	
	120	
7		350

GLE 3.1.3

Draw an octagon. How many obtuse angles does an octagon have? ________________

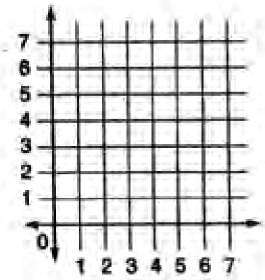
GLE 2.1.8, 2.1.9

Draw an array for 16 / 2

GLE 3.2.5

On the grid below, find each coordinate below and label A, B, or C. Compare the distance between point B and point A point with the distance between Point B and Point C. Write about your findings.

a. (2,1)
b. (2,4)
c. (3,7)



GLE 2.1.5

Solve the riddle:

I am a 2-digit prime number
I am greater than 14 and less than 36
The sum of my digits is 10
Who am I? _________

GLE 2.2.14

Jared has to give each horse 32 ounces of grain each day. There are 12 horses. How much grain will he need to be able to feed the horses for 1 week? Show your work.

GLE 2.2.12

Mrs. Naumac ordered 240 hamburgers for the school. What else do you need to know to find out how many hamburgers each student gets?

GLE 3.3.7

Savva got to his friend's house at 3:25. He left at 5:15. How long was he at his friend's?

GLE 2.1.6

Circle the larger quantity in each pair.

a.	**1/4**	**0.75**
b.	**1/2**	**0.5**
c.	**2/3**	**0.23**
d.	**2/6**	**2/4**

GLE 2.2.12

Crystal is going to put wall paper trim around her room. Her room is 10 ft. long and 12 ft. wide. If the trim cost $2.00 for each foot, how much will it cost her in all?

GLE 3.1.2

Jessica got home at 3:45. She asked her mom, "What time is supper?" Her mom said, "It will be in 1 hour and 45 minutes." What time is supper?

GLE 3.3.7

Circle the bigger decimal and explain your choice. 0.3 0.03

GLE 2.1.1, 2.2.10

If the 6 in 1,268 is changed to a 7, how will that change the value?

a. 1 more
b. 10 more
c. 100 more
d. 1000 more

GLE 2.1.1, 2.2.10

If the 6 in 46,821 is changed to a 5, how will that change the value? ______________

Curriculum Standards Connections

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS. Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 1.1. UNDERSTAND AND DESCRIBE PATTERNS AND FUNCTIONAL RELATIONSHIPS

Grade-Level Expectations

1. **Represent, extend and compare geometric and numeric patterns using words, tables, graphs and equations**

2. **Analyze patterns and data to make generalizations, make predictions and to identify trends. (See also GLE 1.2.4.)**

   - Give children opportunities to create and play "Guess My Rule" games by utilizing different patterns (square numbers, doubles plus one, add the two preceding numbers, etc.).

COMPONENT STATEMENT: 1.2. REPRESENT AND ANALYZE QUANTITATIVE RELATIONSHIPS IN A VARIETY OF WAYS.

Grade-Level Expectations

3. **Represent and describe mathematical relationships using variables or symbols in expressions, equations and inequalities. (See also GLEs 1.3.5 and 1.3.6.)**

   - Have children develop numeric expressions for things that come in multiples (the number of legs on five chairs can be represented as 5 x 4 so the number of legs on *N* chairs can be represented as *N* x 4).

- Give examples of situations like the following, that children can represent using expressions or equations.
    - Tim is 5 years older than his sister Sally. If *t* represents Tim and s represents Sally, we can express their ages like this: Sally (*t* - 5) or Tim (*s* + 5). If Sally is 11 years old, how old is Tim? *t* = 11 + 5

4. **Describe how a change in one variable relates to a change in a second variable in context. For example: If a recipe requires two cups of flour for eight servings, the flour must be doubled for 16 servings or increased by one-half for 12 servings. (See also GLEs 1.1.2 and 3.2.6.)**

- Give children opportunities to solve contextual problems such as:
    - Explain what happens to the perimeter of an equilateral triangle if the length of a side is decreased by one unit?
    - Explain what happens to the perimeter of a rectangle if the base or length is increased by two units?
    - How does the area of a rectangle change if the height or width is decreased by one unit?

COMPONENT STATEMENT: 1.3. USE OPERATIONS, PROPERTIES AND ALGEBRAIC SYMBOLS TO DETERMINE EQUIVALENCE AND SOLVE PROBLEMS

Grade-Level Expectations

5. **Replace variables or symbols in algebraic expressions with given values and evaluate or simplify the expression, e.g., if □ = 5, find the value of 4 *x* □ +7. (See also GLEs 1.2.3 and 1.3.6.)**

- Give children opportunities to express familiar situations algebraically. For example: The supplier for the fifth grade fundraiser will award each class 10 school store credits for every $200 in sales. Six of Mr. Mitchell’s fifth-graders sold $200. How could we show the number of store credits the class will receive?

- Describe real world situations that demonstrate function. (i.e., the number of tickets sold determines the amount of money the class earns).

- Provide opportunities for children to use symbols in expression such as: Myra's number is 10 less than Sara's number, *S***.** Write an expression for Myra's number. If Sara's number is 247, what is Myra's number?

6. Model, write and solve one-step equations by using appropriate concrete materials that model equivalence, e.g., If 4 x Δ = 36, then Δ equals 9.

- Read *Equal Shmequal* by Virginia Kroll. Have children recall the details of the story by acting out the story. Lead a class discussion about balance and equivalence.

- Give children opportunities to solve simple one-step equations by using pattern blocks. Begin by assigning a value of one to the green triangle.

- Use a two pan balance and objects to model equations. Have children record the equations they have created using pictures, symbols and numbers.

SAMPLE INTEGRATED LESSON: DOES SIZE MATTER?

See also Sample Integrated Lessons 1 and 2 in Geometry and Measurement

Context: We were cleaning out our folders and a group of classmates was trying to make baskets in the classroom recycle bin by throwing in wads of paper. Some of the boys were tearing sheets of paper into smaller pieces so that they could have more shoots at the bin. Our teacher reminded us that it was time for math. We were learning about functions, so he suggested that we could make good use of the skills we were developing through our paper throwing activity. Our teacher wondered out loud if the size of the paper wad had an effect on the distance it could be thrown. We were happy to help find the answer to his question.

GLEs: 1.1.2, 1.2.4, 4.1.1, 4.2.4, 3.3.10

Time: Two instructional periods

Objectives: Children will collect and record measurement data to determine if the size of a piece of paper is a function of the distance it can be thrown. Children will measure paper in inches and distance in centimeters. Children will determine the mean for a set of data.

Materials: 2-inch square, 4-inch square, 6-inch square and 8-inch square pieces of scrap paper, masking tape, meter sticks or tape measures, recording sheet, graph paper, calculators if necessary

Procedure: Children should work in teams of three for this activity. Each child should have the opportunity to have the role of recorder, measurer and thrower.

1. Children should cut squares from paper destined for the recycle bin. Use the same type, or weight, of paper for all of the squares. Children could be provided the with precut paper squares for this activity.

2. Each group must set up a test area by marking the throwing line with masking tape.

3. The group must then decide on a way to record the results of the throw trials and set up recording sheets.

4. Each child should have the opportunity to wad two of each size paper square and throw them, one at a time, from behind the line.

5. One teammate measures (in centimeters) the distance each piece of wadded paper traveled and another teammate verifies and records the result on the sheet.

6. Once all team members have completed their throws, the team should find the mean distance each size square traveled.

7. Data should be examined and discussed to determine if the question can be answered. Does size matter?

8. All teams can share their findings during class discussion of the data.

❖ **Possible Assessment Opportunity**

- ❖ Within a team, each child chooses and focuses on a different sized square. Using the data from every classmate, the child creates a table (and graph) showing the distance that size paper square traveled. Each team compares the data and prepares a written report explaining their collective findings and answer to the question.

Intervention: Place data in a table provided.

Challenge: Investigate to explain possible reasons for any unexpected results or trends in the data.

Interdisciplinary Framework Connections		
Science	**English/Language Arts**	**Physical Education**
B. INQ.1 Employ simple equipment and measuring tools to gather data and extend the senses. **B INQ.1** Use data to construct reasonable explanations. **B INQ.2** Analyze, critique and communicate investigations using words, graphs and drawings. **B INQ.3** Use measurement tools and standard units (e.g., centimeters, meters, grams, kilograms) to describe objects and materials. **B. INQ. 10** Use mathematics to analyze, interpret and present data.	• Select and organize relevant information from text to summarize. • Draw conclusions and use evidence to substantiate them by using text heard, read, and viewed. • Make and justify inferences from explicit and/or implicit information.	• Identify the critical elements of increasingly more complex movements and game forms. • Understand and apply increasingly more complete movement sequences and game forms. • Solve problem and make choices by analyzing consequences and solutions.

Vocabulary: T-chart, input value, output value, variable, equation, expression, algebraic symbol, inequalities, trends, predictions, analyze, properties, scale drawings, CMT Web site - http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/math/cmtgrade5.pdf

Resources

Teacher resources:

Putting Fun in Functions – Teaching Children Mathematics – NCTM – Dec/Jan 2006

Navigating through Algebra – Grades 3-5 – NCTM

Groundworks: Algebraic Thinking-grades 4-7 from Creative Publications

Electronic Resources:

The Hundredth Block – Goals 2000

A Teeter-Totter Discovery – Goals 2000

Children's Literature:

Anno's Mysterious Multiplying Jar by Anno and Anno

Patterns by Henry Arthur Pluckrose

My Little Sister Ate One Hair by Bill Grossman

Mathematicles by Betsy Franco

Spaghetti and Meatballs For All by Marilyn Burns

Anno's Magic Seeds by Mitsumasa Anno

Two of Everything by Lily Toy Hong

Bunches and Bunches of Bunnies by Louse Matthews

Piece=Part=Portion by Scott Gifford

Equal Shmequal by Virginia Kroll

Notes:

NUMERICAL AND PROPORTIONAL REASONING. Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 2.1. UNDERSTAND THAT A VARIETY OF NUMERICAL REPRESENTATIONS CAN BE USED TO DESCRIBE QUANTITATIVE RELATIONSHIPS

Grade-Level Expectations

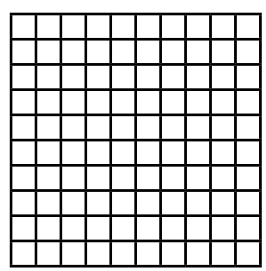
1. **Compare, order and round whole numbers to 1,000,000 using number patterns, number lines and diagrams.**

2. **Represent whole numbers up to 1,000,000 in expanded and regrouped forms and use the forms to support computation.**

3. **Construct and use models, number patterns and pictorial representations to extend place value concepts and patterns to decimals, e.g., 0.1 is one-tenth of one and 0.01 is one one-hundredth of one and one-tenth of 0.1.**

    - Have children begin by constructing human number lines that represent decimal numbers. Initially, the number lines must be from 0-1 and divided into tenths, and then into hundredths so that children understand that 0.45 is between 0.4 (0.40) and 0.5 (0.50).

    - Decimal Squares are a good model to use for conceptual development and can be downloaded. See hundredths below.



4. **Investigate negative integers (values less than zero) using place value models, diagrams and number lines and represent negative integers in practical applications, e.g. temperatures, money and locations below sea level.**

5. **Classify numbers as prime, composite or perfect squares and identify factor pairs using rectangular arrays.**

   - Provide children with numerous opportunities to configure arrays using different materials such as square tiles, cubes, paper squares. Have them record the arrays and factor pairs on 11 x 18 paper so that the numbers can be classified as prime, composite, etc. For example, 29 is prime because it can only be configured in a 1 x 29 rectangle which yields one factor pair.

6. **Represent equivalent fractions, decimals, ratios and percents using models, pictures, number patterns and common factors.**

   - Have children show a fraction using a decimal square or a flat from base-ten blocks. Ask questions such as:

     - How many units are represented here? How many are shaded?
     - Is this fraction more or less than ½? …than ⅔? …than ¾?
     - How can this fraction be represented as a decimal? A percent (which means per 100)

7. **Choose and use benchmarks to approximate locations, of fractions, mixed numbers and decimals, on number lines and coordinate grids.**

   - Use a number line as a guide in estimating decimals. Write a four digit decimal number on the board, e.g. 4.0832. Choose a number which represents something that might be interesting to the children (size of an insect, price of gold or silver). Ask questions such as:

     - Is this closer to four or five?
     - Is it closer to 4.0 or 4.1?
     - Is it closer to 4.08 or 4.09?
     - Is it closer to 4.083 or 4.084?

8. **Write division problems in fraction form and round the fraction form to estimate an answer to a division problem, e.g., $^{14}/_{3} = 4\ ^{2}/_{3} \approx 5$.**

- Have children solve contextual problems such as how many pencils will 23 students receive if there are 27 pencils to share? $^{27}/_{23} = 1\ ^{4}/_{27} \approx 1$. Children should reason that since it is not practical or realistic to divide pencils into 27ths, each student will receive one pencil.

9. **Use models and pictures to identify and compare ratios and represent ratios in equivalent fraction and decimal forms.**

- Give children opportunities to use different colored interlocking cubes to build and compare ratios. For example, use five cubes, two blue and three yellow so that students can see that the ratio of blue to yellow is 2 to 3. Have children build another set of five interlocking cubes to see that a ratio of 4 to 6 is equivalent. Children can record the ratio by coloring a column of five squares the appropriate colors (see model in GLE 2.1.3) on a hundredth square so that they can see the decimal equivalent.

COMPONENT STATEMENT: 2.2. USE NUMBERS AND THEIR PROPERTIES TO COMPUTE FLEXIBLY AND FLUENTLY AND TO REASONABLY ESTIMATE MEASURES AND QUANTITIES

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

10. ***Solve practical problems involving 10, 100, 1,000 and 10,000 more or less than a number.***

11. **Estimate products and missing factors using multiples of 10, 100 and 1,000.**

12. **Develop and use strategies involving place value relationships, inverse operations and algebraic properties (commutative, associative and distributive) to simplify addition, subtraction and multiplication problems with three-, four- and five-digit numbers and money amounts and division by one-digit factors.**

13. ***Multiply and divide decimals and money amounts by whole numbers.***

14. **Write and solve multistep problems for all four operations involving multidigit whole numbers and money amounts and explain how answers were determined, orally and in writing.**

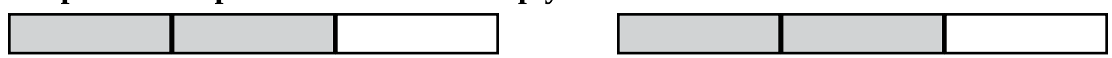
15. **Find fractional parts of a set by using estimation, counting, grouping of objects, number patterns, equivalent ratios and division.**

    - http://www.lessonplanspage.com/printables/PMathPercentFractions.htm

16. **Add and subtract fractions, decimals and mixed numbers using a variety of strategies, e.g., models, mental math, equivalence and substitution: $\frac{1}{2} + \frac{3}{4}$ can also be solved using 0.5 + 0.75.**

    - Encourage children to use more than one way to solve computation problems, especially using fraction representation for decimals and vice versa.

17. **Construct and use models and pictorial representations to multiply common fractions and mixed numbers by whole numbers. $2 \times \frac{2}{3} = 1\frac{1}{3}$**



18. **Use ratios and proportions to solve practical problems, e.g., interpreting scale drawings and maps and determining the probability of an event.**

    - Provide numerous opportunities to use ratio and proportion, such as:
        - If the map key indicates that $\frac{1}{4}$ inch = 50 miles, what distance does a 2-inch long line represent?
        - If $\frac{1}{5}$ of a spinner is colored blue, what is the probability that the arrow will land on blue if it is spun 25 times? 50 times?

19. **Use estimation to predict results and to recognize when an answer is or is not reasonable, or will result in an overestimate or underestimate and explain the reasoning used orally and in writing.**

SAMPLE INTEGRATED LESSON: MAKING A QUILT BLOCK

Context: A safe house on the Underground Railroad has a quilt hanging out of the window or on a fence to give slaves a message. You want to make a replica of one of the quilts. You need to use one of the symbolic blocks and put a border around each block to make it easily visible. Before the quilt can be made, you must make a "mock-up" of the block and decide how much it will cost to make your quilt.

GLEs: 2.1.6, 2.2.13, 2.2.16, 3.1.2, 3.1.3, 3.3.8

Time: This project will require multiple instructional periods in class.

Objectives: Children will create and solve multi-step problems.

Children will develop strategies to simplify computations with two-, three-, and four-digit numbers and money amounts.

Children will measure accurately using a ruler with inches.

Children will identify the difference in perimeter between a block and a block with a border.

Materials: construction paper, graph paper, rulers, pencils, scissors, glue, printed copies of the block designs, *Sweet Clara and the Freedom Quilt* by Deborah Hopkinson

Procedure: Read the book *Sweet Clara and the Freedom Quilt* and discuss the significance of the Underground Railroad.

1. Using the following Web site, http://pathways.thinkport.org/secrets/secret_quilt.cfm, explain that some quilt blocks had special meanings for the slaves.

2. Print out the patterns and distribute a copy to each child. Name each block and discuss its symbolic meaning. Have the children identify the shapes in each of the blocks and determine the number of squares or triangles needed to make each block.

3. Set a price for one square inch of material e.g., $0.20, and a limit for the cost of the block. Colors should be priced differently, e.g., yellow costs $0.30, blue costs $0.50, and white costs $0.10.

4. Have each child choose material in two different colors to construct one quilt block. **Note:** The blocks can be any size as long as all the blocks are the same size. Squares can be cut in half on the diagonal to make triangles.

5. Children should use measurement and/or graph paper to determine the area and cost of the quilt block.

6. Lead the children in a discussion about perimeter. Each child then determines the perimeter of their quilt block. Ask questions such as:

    - How can you find the perimeter without measuring?
    - What shape can you put in the corner to show how the perimeter changes? {a square}
    - What mathematics did you use to find the perimeter?
    - Will the perimeter change when the border is added?
    - Help children understand the changes in perimeter when a border is added to a rectangle or square.

7. Construct a border for the block and find the cost of the border.

❖ Possible Assessment Opportunities

❖ Calculate the cost of the cloth for the entire quilt. Group all the blocks of one design together to make a quilt. The children must write the story of their quilt, including all cost calculations, pattern decisions, squares and perimeter measurements, and the meaning of the quilt. Hang the quilts on the bulletin board with the name for each block and the cost of making the quilt.

Intervention: Guide a small group of four in making a small, four block quilt with a total of two colors. Use the following suggestions as needed. Provide a template or pattern for the children to use when choosing pieces for the quilt block including the border, and determining area. Make a chart with prices for the colors already calculated.

Challenge: Use additional colors to create a more complex design.

Interdisciplinary Connections			
English/Language Arts	**Social Studies**	**Visual and Performing Arts**	**Technology**
• Draw conclusions and use evidence to substantiate them by using texts heard, read and viewed. • Identify and discuss the underlying theme or main idea in texts.	• Demonstrate an in-depth understanding of major events and trends of United States history. • Describe examples of how societies throughout history have used various forms of visual arts, dance, theater, myths, literature and music to express their beliefs, sense of identity and philosophical ideas. • Identify the various causes and effects of movements of people.	**Visual Arts** • Use ways of arranging visual characteristics and reflect upon what makes them effective in conveying ideas • Compare and contrast purposes for creating works of art.	• Describe a course of action for addressing an essential question and completing the task, with prompting • Use menus, icons and links to access and use digital media to conduct basic research.

Vocabulary: prime, composite, referent, visual organizer, part-whole, whole, numerator, denominator, improper fraction, region model, length model, measurement model, fractional parts, fractional value, property, target number, factor, product, partitioning, quotient, divisor, multiple, decimal, decimal notation, regroup, commutative property, associative property, distributive property, compare, round, estimate, reasonable, approximate, underestimate, overestimate, see page in Handbook at CMT Web site: http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/math/cmtgrade5.pdf

Resources:

Electronic Resources:

Best Lessons for All Grades http://score.kings.k12.ca.us/bestofscore.htm

Forty-Eight Word Problems http://www.stfx.ca/special/mathproblems/grade5.html

Grade 5 Math, all topics http://www.aaamath.com/grade5.html

Interactive games http://www.internet4classrooms.com/skills_5th_original.htm

The Factor Game http://www.pbs.org/teachersource/mathline/lessonplans/pdf/msmp/factor.pdf or

http://illuminations.nctm.org/ActivityDetail.aspx?ID=12

Equivalent Fractions http://illuminations.nctm.org/ActivityDetail.aspx?ID=80

Product Game http://illuminations.nctm.org/ActivityDetail.aspx?ID=29

Are You A Daredevil? - Goals 2000

Ballpark Estimation - Goals 2000

Estimates Only - Goals 2000

Fractional Parts of a Group - Goals 2000

Millie's Business - Goals 2000

Are You A Good Adjuster? - Goals 2000

Edible Story Problem - Goals 2000

Flexible Estimator - Goals 2000

Dog Food - Goals 2000

Teacher References:

Fraction Track http://standards.nctm.org/document/eexamples/chap5/5.1/index.htm

Teaching Student-Centered Mathematics, Grades 3 – 5 by John Van de Walle and LouAnn Lovin

Number Sense: The Common Sense of Mathematics by Bill Leibfritz – (a middle school teacher resource book)

Ideas: NCTM Standards-Based Instruction by Michael C. Hynes

Explain It! Grades 5 - 6 by Creative Publications

Research Ideas for the Classroom: Middle School Mathematics

Math and Literature, Grades 4 – 6 by Marilyn Burns

Adding it Up! NRC

Children's Literature:

Math for Smarty Pants by Marilyn Burns

Is a Blue Whale the Biggest Thing There Is? by Robert Wells

The 329th Friend by Marjorie Sharmat

Follow the Drinking Gourd by Jeanette Winter

Sweet Clara and the Freedom Quilt by Deborah Hopkinson

On Beyond A Million by David M. Schwartz

Can You Count To A Google by David Schwartz

How Much Is A Million? by David Schwartz

The Man Who Counted: A Collection of Mathematical Adventures by Tahan.

Counting On Frank by Rod Clement *Pumpkins* by Mary Lyn Ray

How Much, How Many,...is 1000? by David Schwartz *Math Curse* by Jon Scieszka

Fly on the Ceiling by Julie Glass

Cookies by William Jaspersohn

The Phantom Tollbooth by Norman Juster

Sam Johnson and the Blue Ribbon Quilt by L. C. Ernst

Selina and the Bear Paw Quilt by B. Smucker

Gator Pie by Lousie Matthews

Fraction Action by Loreen Leedy

G is for Google by David Schwartz

Notes:

GEOMETRY AND MEASUREMENT. Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 3.1. USE PROPERTIES AND CHARACTERISTICS OF TWO- AND THREE-DIMENSIONAL SHAPES AND GEOMETRIC THEOREMS TO DESCRIBE RELATIONSHIPS, COMMUNICATE IDEAS AND SOLVE PROBLEMS.

Grade-Level Expectations

1. **Represent the surface of three-dimensional solids using two-dimensional nets.**

    - Children should work in pairs or small groups to create pentominoes from five 1-inch square tiles. Children should record their findings on 1-inch square graph paper and investigate which of the 12 pentominoes can be folded into a topless box. Findings should be recorded and explained in writing

    - Begin with familiar three-dimensional objects such as empty cereal boxes or food containers. Provide numerous opportunities for children to investigate the relationship between the solid and the net which can be created by completely opening the box so that it can be laid flat on a desk or table.

    - Have children open a cylindrical container such as an oatmeal box so that they can see the shapes made by the resulting net. (circles and rectangle)

    - Provide opportunities to explore perspective for cubes and rectangular prisms by using building materials such as Cuisenaire rods or snap cubes to create three-dimensional "buildings" from two-dimensional footprints or orthogonal views and pictures.

2. **Develop formulas for finding the perimeter and area of squares, rectangles and triangles and use them to solve problems. (See also GLEs 3.1.3 and 3.1.4.)**

- Have children use geoboards or grid paper to construct or draw rectangles with a specific area, and then determine the dimensions of the figure.

- Give children the dimensions of a rectangle and ask them to find the area. Grid paper or construction paper and rulers ca be used for this activity.

3. **Use the attributes of parallel sides, perpendicular sides, congruent sides/angles, number and length of sides or faces and number and kinds of angles (right, acute or obtuse) to describe, classify and sort polygons and solids (cube, prism, pyramid and sphere). (See also GLEs 1.1.1, 3.1.1, 3.1.4 and 3.1.2.)**

- Have children construct different sized squares and rectangles using graph paper, construction paper and virtual manipulatives or computer software to explore relationships and develop generalizations.

- Provide opportunities for children to create different triangles from squares, rectangles and other parallelograms.

- In pairs, the children make important discoveries about triangles by measuring and taping strips of construction paper together. Cut out 1 cm x 18 cm strips of construction paper. Children fold the strips into a collection of triangles with different measurements. The pairs record in their math journals discoveries they have made about triangles.

- Working in groups of three or four, have the children examine the diagonals of various classes of quadrilaterals (i.e., parallelograms, rhombi, rectangles and squares). Using the information from the diagonals, list observed properties of that type of quadrilateral. Compare the different quadrilaterals from the list, and write a method or criteria for distinguishing among these quadrilaterals.

❖ **Possible Assessment Opportunity**

❖ Create a collection of mystery shapes and describes one or more of the properties of a shape. Challenge children to create that shape using the given properties on graph paper or a geoboard. Examples: a shape with just one square corner and four sides, or a shape with two pairs of parallel lines and no right angles.

Intervention: Highlight "clue" math words or have the child look at the geoboard to describe and duplicate the shape on another geoboard or graph paper.

Challenge: Provide mysteries that include multiple attributes and characteristics of shapes. Have children recreate and name the shapes. Create new mysteries for others to construct using varied materials.

- Examine commercially produced geometric solid materials to identify and compare characteristics of three-dimensional figures.

- Create Platonic solids using materials like toothpicks and marshmallows. Examine the figures and write descriptions of each using correct terminology.

4. **Make and test conjectures about polygons using geometric relationships. (See also GLEs 3.1.2 and 3.1.3.)**

   - Begin with shapes such as parallelograms, pentagons and hexagons use Mira, mirrors or other reflective materials to determine the lines of symmetry.

   - Geoboards and pattern blocks can be used to create different shapes and designs with reflective symmetry. Identify each line of symmetry and use correct terminology to explain why the parts created are reflective.

   - Use Geostrips or oaktag strips attached with paper fasteners or brads at the vertices to allow for children to investigate physically changing angles of a figure and compare figures.

COMPONENT STATEMENT: 3.2. USE SPATIAL REASONING, LOCATION AND GEOMETRIC RELATIONSHIPS TO SOLVE PROBLEMS.

Grade-Level Expectations

5. **Use an *x*, *y* coordinate system to plot points, to estimate the distance between points and to determine the horizontal or vertical distance between two points.**

   - Provide opportunities to use varied grid coordinates to read or locate information.

- Create maps using coordinate grids and scales of customary and metric measurement.
- Play “Xs and Os,” from NCTM Navigating through Geometry Grades 3–5, to locate points on a coordinate plane using ordered pairs.
- Place various objects in different locations on a large grid (marked by masking tape) on the floor or playground. Have the children describe how to move from one object to another based on location, position and direction, using appropriate terminology.
- Provide a collection of pictures or stickers that the children will arrange on an *x*, *y* (quadrant 1 only) according to directions such as, place the picture of the flower next to the picture of the clown. The picture of the cat will be two places to the right of the clown. Stamps can also be used for this activity.

6. Analyze and describe the effect that changing the dimensions (perimeter) of a polygon has on its area and vice versa. (See also GLEs 1.1.2 and 1.2.4.)

- Have children begin investigations using geoboards to construct a 2 x 2 rectangle and compare to a 2 x 3 rectangle.
- Provide children with square tiles and graph paper to build and record rectangles. Record results and organize the data to determine patterns or relationships discovered through the investigations. Children should explain their findings using drawings and writing.

COMPONENT STATEMENT: 3.3. DEVELOP AND APPLY UNITS, SYSTEMS, FORMULAS AND APPROPRIATE TOOLS TO ESTIMATE AND MEASURE

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

7. Use calendars and clocks to plan and sequence events and to solve problems involving the conversion of measures of time and elapsed time using days, hours, minutes and seconds.

8. **Estimate and measure to solve a variety of problems that involve angles, length, area, weight, mass, temperature, capacity and volume in either metric or customary units explain the reasoning used orally and in writing.**

9. ***Use cubic inch or cubic centimeter models to find the volume of rectangular solids.***

    - Fill a cubic liter container (commercially available) by layering centimeter cubes.
    - Build solids using Cuisenaire rods and determine volume (in cubic centimeters) by counting.

10. ***Solve length problems involving conversions of measure within the customary (inches, feet, yards and miles) or metric systems (millimeters, centimeters, meters and kilometers).***

SAMPLE INTEGRATED LESSONS 1 AND 2 – AS PEOPLE GET OLDER, THEY GET TALLER

http://illuminations.nctm.org/LessonDetail.aspx?ID=L701

GLEs: 3.3.8, 3.3.10

Time: One instructional period

Objectives:

Lesson 1: Students will:

- measure another student using a variety of nonstandard and standard measuring instruments;
- recognize the errors inherent in the use of different methods of obtaining measurements; and
- represent data collected on two variables in a tabular format.

Materials: *If I Were One Inch Tall*, by Shel Silverstein (optional), measuring tape, yardstick, one piece of yarn for each student in the class, about 6 feet in length, one pair of scissors for each student in the class, How Old are We? worksheet (see next page)

How Old Are We? How Tall Are We?

NAME ____________________________ PARTNER'S NAME ____________________________

1. When is your birthday? ___________________________

2. How old are you? _______________________________

3. Measure your height using a piece of yarn.
• Then, find out how long the piece of yarn is by using a yardstick.
• Write down how tall you are:
I am __________ feet and __________ inches tall.

4. When is your partner's birthday? _________________________

5. How old is your partner? ____________________________

6. Measure your partner using a piece of yarn.
• Then, find out how long the piece of yarn is by using a yardstick.
• Write down how tall your partner is:
My partner is __________ feet and __________ inches tall.

http://illuminations.nctm.org/LessonDetail.aspx?ID=L702

GLEs: 1.1.2, 1.2.4, 4.1.1

Objectives:

Lesson 2 Students will:

- represent data collected on two variables in a line graph format;
- understand how changes in one variable relate to changes in a second variable; and
- develop an initial understanding of statistical concepts including slope, sample, The Law of Large Numbers, and variability.

Materials: A measuring tape, large sheets of plain or graph paper, colored markers

SAMPLE INTEGRATED LESSON 3 – GETTING THERE FROM HERE

Context: Jake was describing the different ways he goes from his house to the mall. The more he talked the more Hector was becoming confused. The two boys decided the best way to figure out how Jake gets to the mall was to make a map. Hector wants to know if there is more than one way for Jake to get to the mall. There are obstacles that block them from traveling across the yards, so they stay on the streets. How many different ways can Jake get to the mall?

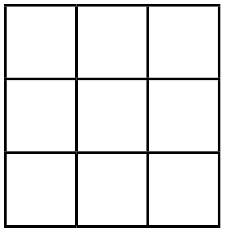
GLEs: 3.2.5

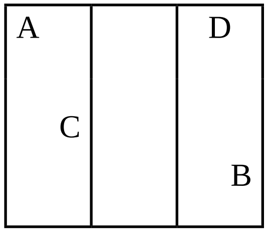
Time: One instructional period

Objective: Children will find multiple ways to move on a coordinate grid between given points.

Materials: Coordinate grid

Procedure:





1. Using a 3 x 3 grid, label Jake's house A and the mall B.
2. How many different ways can the Jake and Hector travel from Jake's to the mall?
3. Staying on the streets, what's the shortest number of blocks they travel?
4. What's the longest number of blocks?
5. The next day before they go back to the mall, they need to stop at the store (C) to bring milk to Jake's aunt (D) before they proceed to the mall. How many different routes can they take?

- ❖ <u>**Possible assessment opportunities**</u>

  - ❖ What is the shortest route? Explain the thinking in your journal.

  Intervention: Use a geoboard or create a grid on the floor or ground, use paper discs or plates as destination points.

  Challenge: Create larger grids with more stops along the way. Given a specific distance to cover, have children find a path.

<table>
<tr><th colspan="5">Interdisciplinary Framework Connections</th></tr>
<tr><th>Science</th><th>English/Language Arts</th><th>Social Studies</th><th>Visual and Performing Arts</th><th>Physical Education</th></tr>
<tr>
<td>• B INQ.1 Employ simple equipment and measuring tools to gather data and extend the senses.
• B INQ.2 Use data to construct reasonable explanations.
• B INQ.3 Analyze, critique and communicate investigations using words, graphs and drawings.
• B INQ.4 Use measurement tools and standard units (e.g., centimeters, meters, grams, kilograms) to describe objects and materials.
• B. INQ. 10 Use mathematics to analyze, interpret and present data.</td>
<td>• Select and organize relevant information from text to summarize.
• Draw conclusions and use evidence to substantiate them by using text heard, read, and viewed.
• Make and justify inferences from explicit and/or implicit information.
• Interpret information that is implied in a text.</td>
<td>• Interpret data in historical maps, photographs, art works, and other artifacts.
• Makes maps, charts, models, and globes.</td>
<td>Dance
• Identify and demonstrate longer and more complex steps and pattern.
• Transfer a spatial pattern from the visual to the kinesthetic.
• Transfer a rhythmic pattern from sound to movement.
Acting
• Describe and compare the functions and interactions of performing artist, visual artists, and audience members in theater.</td>
<td>• Identify the critical elements of increasingly more complex movements and game forms.
• Understand and apply increasingly more complete movement sequences and game forms.
• Solve problem and make choices by analyzing consequences and solutions.</td>
</tr>
</table>

Vocabulary: *x*-axis, *y*-axis, point of origin, measure, digital, analog, length, area, weight, capacity, volume, pictograph, bar graph, estimate, thermometer, scale, polygon, parallel, perpendicular, congruent, attributes, sets and subsets, polygon, quadrilateral, nets, coordinate, conversion, customary, metric, properties, scale drawings, handbook on CMT Web site - http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/math/cmtgrade5.pdf

Resources:

Electronic Resources:

National Library of Virtual Manipulatives http://nlvm.usu.edu/en/nav/grade_g_1.html

Math Forum http://mathforum.org/paths/fractions/e.fraclessons.html

Tennessee State Department of Education http://www.state.tn.us/education/ci/standards/math/5math.php

S.M.A.R.T. http://www.hcpss.org/math/elem.math/smart/gr5/

Great Sites for Kids http://www.greatsitesforkids.com/gsfk/mathlessons.asp

Illuminations -http://illuminations.nctm.org/

Good News Travels Fast – Goals 2000

Garden Fence – Goals 2000

Shape Explorer. Exploring Area: http://www.shodor.org/interactivate/lessons/area.html

Geometry and Measurement: http://www.shodor.org/interactivate/elementary/index.html#geo

Teacher References:

NCTM *Navigating through Geometry* Grades 3 –5

Children's Literature:

Sea Squares by Joy N. Hulme

Three Pigs, One Wolf and Seven Magic Shapes by Grace Maccarone

Mouse Views: What the Class Pet Saw by Bruce McMillan

*Millions to Measu*re by David Schwartz

Scholastic Kid's Almanac for the 21st Century by Scholastic Publishers

The Librarian Who Measured the Earth by Kathryn Lasky

My Map Book by Sara Fanelli

Is the Blue Whale the Biggest Thing? by David Wells

One Grain of Rice by Demi

The Village of Round and Square Houses by Ann Grifalcone

If Dogs Were Dinosaurs by David Schwartz

Evan's Corner by Elizabeth Starr Hill

How Tall, How Short, How Faraway! by David Addler

All in a Day by Mitsumasa Anno

The Mysterious Tadpole by Steven Kellog

The Bedspread by Sylvia Fair

Spaghetti and Meatballs for All by Marilyn Burns

The Amazing Book of Mammal Records by Samuel G. Woods

The Village of Round and Square Houses by Ann Grifalcone

Notes:

WORKING WITH DATA: PROBABILITY AND STATISTICS. Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 4.1. COLLECT, ORGANIZE AND DISPLAY DATA USING APPROPRIATE STATISTICAL AND GRAPHICAL METHODS.

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

1. **Represent sets of data using line plots, bar graphs, double bar graphs, pictographs, simple circle graphs, stem and leaf plots and scatter plots.**

   - Catch It! – Embedded Science Task can be used to measure reaction time and to record and analyze data. http://www.sde.ct.gov/sde/lib/sde/word_docs/curriculum/science/cmtgr5taskstudent.doc

   - Graphs of Skittles – Using skittles have the students sort skittles and display and interpret data by constructing frequency graphs. The children can also explore basic probability by calculating probabilities of selected sub-samples. Ask students to make predictions based on their group data. http://littlegiraffes.com/skittlesgraph.doc

2. ***Compare different representations of the same data set and evaluate how well each kind of display represents the features of the data.***

   - The children decide how to obtain and organize data on the number of students absent from school each day last week. Each child predicts the number of students who will be absent Wednesday of next week and justifies the prediction. Additional question for the children could be, what could you do to make you feel more confident in being able to predict how many students would be absent on any specific day in the future? Explain.

❖ **Possible Assessment Opportunities**

❖ Translate information freely among charts, tables, line plots, picture graphs, and bar graphs; e.g., create a bar graph from the information in a chart.

Intervention: Begin by using picture graphs, line plots, and bar graphs.

Challenge: Determine when specific data can be accurately displayed. Use more complex tables and graphs.

COMPONENT STATEMENT: 4.2. ANALYZE DATA SETS TO FORM HYPOTHESES AND MAKE PREDICTIONS.

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

3. **Design and conduct surveys of a representative sample of a population and use the data collected to begin to make inferences about the general population.**

4. ***Determine the mean, mode and median of a data set and explain in writing, how they are affected by a change in the data set.***

- Provide numerous opportunities for children to explore measures of central tendency using activities like:
  - Have children line up by height to find the median and mode of the set they have created. If Shaquille O'Neill joined the class, how would the median change? Would the median change if Tom Thumb joined the class? Explain. What would happen to the median and the mode if both Shaquille and Tom became classmates? Discuss in class and then ask children to write about it.
  - Use different color interlocking or Unifix cubes to represent the number of family members in each child's family. Working in groups of five, have children decide how to find the mean number of family members for their group. Have each group share their methods and results with the whole class.

⁓ COMPONENT STATEMENT: 4.3. UNDERSTAND AND APPLY BASIC CONCEPTS OF PROBABILITY

Grade-Level Expectations

5. **Design and conduct probability experiments and simple games of chance to test predictions about outcomes and fairness.**

    - http://socrates.acadiau.ca/courses/educ/reid/Elem-math-virtual-Workshops/UpElemStats/Skittles-activity.doc
    - Have children work in pairs to determine the probability of getting certain sums (2–12) when tossing two dice. Once the pair has completed the experiment, they should work on designing a game using dice sums that will be fair to all players.

6. **Determine and describe possible outcomes and express the likelihood of events as a fraction.**

    - When children are considering events, remind them that outcomes must be expressed on the continuum form zero (impossible) to one (certain).

7. **Determine and describe possible outcomes using permutations, where order does matter, e.g., when there is a choice of vanilla (V), chocolate (C) or strawberry (S) ice cream for a three-scoop cone, there are two possible ways to have the chocolate scoop on top CVS or CSV.**

SAMPLE INTEGRATED LESSON 1 – POPULATION CHANGE

Context: Tony's grandfather was talking about the day the census takers came to house to ask who lives there. After they left, Tony was curious about what a census was. Tony and his grandfather decided to find out how many people lived in their town now and how many people lived in town when grandfather was born 50 years ago. What do you think they discovered? (Students need to be able to access information using the internet, read large numbers and graph data using line and bar graphs.)

GLEs: 4.1.1, 4.1.2, 2.1.1

Time: Two instructional periods

Objective: Children will plot a line graph to make predictions

Materials: Library access, Internet

Procedure:

1. Review the census and its purpose. http://www.census.gov/main/www/cen2000.html
2. While working in pairs, the children determine the current population of the town. http://factfinder.census.gov/home/saff/main.html?_lang=en
3. Discuss whether the population has changed over time.
4. Ask questions such as:
    - How could we find out if the population of our town has changed over time?
    - What could cause dips or rises (decreases or increases)?
    - How could we organize this kind of information?
5. Use research to find the population over the last 50 years. Discuss why we don't have the number yearly.

6. Create the graph.
7. Discuss results and predict the population for the next ten years.
8. Encourage children to think of other questions that they could investigate further.

SAMPLE INTEGRATED LESSON 2 — IS A STEM AND LEAF PLOT REALLY A PLANT?

A Dicey Stem and Leaf Plot: http://www.learnnc.org/lessons/DebbieNewton5232002546

Context: Marisol's teacher will introduce the concept of a stem and leaf by using visuals: a stem and leaf on a real plant. She will lead the students in a discussion of this concept.

- The teacher will review place value of tens and ones.
- The teacher will bring together the place value of numbers and the concept of a stem and leaf.

GLEs: 4.1.1, 4.2.4

Time: One instructional period

Objectives: Children will identify the parts of a stem and leaf plot and what they represent and create their own stem and leaf plot in a game-type format.

Materials: One live plant that vividly shows the stem and leaf concept, white construction paper or graph paper, colored pencils, dice (one die per person), display examples of Stem and Leaf Plots.

Procedure:

1. Introduce the lesson by having one or more examples of stem and leaves.
2. After discussing how the stem and leaves are connected and reviewing place value, show the students examples (about two or three) of stem and leaf plots.
3. With class participation, take the plots apart and then put them back together again.
4. Create a class stem and leaf plot by collecting every students' favorite two digit number between 11 and 99. Have them write their number down, hand it in, and then have it read by one student while the teacher puts the numbers on the board. From this point, the class guides the teacher in constructing their favorite numbers' stem and leaf plot.

5. Review quickly the parts and concept of a stem and leaf plot.
6. Hand out paper and dice. Instruct the students to create twenty numbers by rolling their dice once for the tens place and once for the ones place. Then plot their numbers on a stem and leaf plot using colored pencils: stem-green; leaves-any color.
7. Then have students create 20 more numbers and exchange with a partner who will create a stem and leaf plot from their partners' numbers.
8. Collect the students' stem and leaf plots and display them on a giant stem, using the papers as leaves.
9. From this lesson, you can move into range, medium, mean, and mode by using the students' own stem and leaf plots.

<table>
<tr><th colspan="5">Interdisciplinary Framework Connections</th></tr>
<tr><th>Science</th><th>English/Language Arts</th><th>Social Studies</th><th>Visual and Performing Arts</th><th>Physical Education</th></tr>
<tr>
<td>B. INQ. 1 Employ simple equipment and measuring tools to gather data and extend the senses.
B. INQ. 2 Use data to construct reasonable explanations.
B. INQ. 3 Analyze, critique and communicate investigations using words, graphs and drawings.
B. INQ. 10 Use mathematics to analyze, interpret and present data.</td>
<td>• Generate and respond to questions.
• Distinguish between fact and opinion.
• Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.).
• Develop a critical stance and cite evidence to support the stance.
• Use oral language with clarity and voice and fluency to communicate a message.
• Determine purpose, point of view and audience, and choose an appropriate written, oral or visual format.
• Use strategies to generate and develop ideas for speaking, writing and visual activities.
• Research information from multiple sources for a specific purpose.
• Examine sources of information and determine validity.
• Publish and/or present final products in a myriad of ways, including the use of the arts and technology.</td>
<td>• Examine data to determine the adequacy and sufficiency of evidence, point of view, historical context, bias, distortion and propaganda, and to distinguish fact from opinion.
• Analyze data in order to see persons and events in their historical context, understand causal factors and appreciate change over time.
• Locate the events, peoples and places they have studied in time and place (e.g., on a time line and map) relative to their own location.
• Use latitude and longitude to locate places and calculate differences between places.
• Use basic climatic and other physical data to understand how natural processes shape environmental patterns</td>
<td>• Select media, techniques and processes to communicate ideas, reflect on their choices and analyze what makes them effective.
• Use different media, techniques and processes (two-dimensional and three-dimensional, including media/technology) to communicate ideas, feelings, experiences and stories.
• Select and use the elements of art and principles of design to improve communication of their ideas.
• Describe ways in which the principles and subject matter of the visual arts and other disciplines taught in school are inter-related.
• Apply visual arts knowledge and skills to solve problems common in daily life.</td>
<td>• Assess physiological indicators (e.g., heart rate, body temperature, perspiration) of exercise during and after physical activity.
• Maintain personal records of moderate to vigorous physical activity.</td>
</tr>
</table>

Vocabulary: pictograph, bar graph, estimate, survey, line graph, key, line plot, stem-and-leaf plot, survey, sampling, central tendency, mean, median, mode, range, numeric, geometric, ratio, probability, coordinate, conversion, outlier, fairness, display, population. See also page 54 of CMT Math Handbook: http://www.state.ct.us/sde/dtl/curriculum/math/CMTGrade5.pdf

Resources:

Electronic Resources:

Accessing and Investigating Data: http://standards.nctm.org/document/eexamples/chap5/5.4/index.htm Exploring Data: http://mathforum.org/workshops/usi/dataproject/

Dealing with Data: http://illuminations.nctm.org/LessonDetail.aspx?ID=L1297

Plotting with Pennies: http://www.learnnc.org/lessons/NancySaunders5232002144

Solar Sizzler: http://www.learnnc.org/lessons/LarryParker5232002571

Billy's Bath – Goals 2000

Pet Survey – Goals 2000

Decks of Cards – Goals 2000

Representing Data – Goals 2000

Teacher References:

NCTM Data Analysis Standards 3 - 5

Adding It Up by National Research Council

Elementary and Middle School Mathematics by John Van De Walle

Graphing and Computers in Grades 3 – 5: http://www.venturaes.com/graphing/

Developing Graphing Comprehension, NCTM

Teaching Student-Centered Mathematics by John Van De Walle

Children's Literature:

Three Pigs, One Wolf and Seven Magic Shapes by Grace Maccarone

Scholastic Kid's Almanac for the 21st Century by Scholastic Publishers

A Cloak for a Dreamer by Aileen Friedman

One Grain of Rice by Demi

The Village of Round and Square Houses by Ann Grifalcone

Evan's Corner by Elizabeth Starr Hill

The Hundred Penny Box by Sharon Bell Mathis

Notes:

Glossary

GLOSSARY

TEACHER'S VOCABULARY LIST

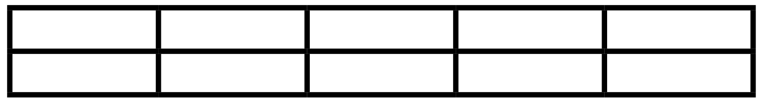
Children need continuing practice in using a variety of language to describe mathematics and to explain their thinking.

additive Inverse	**The opposite of a number that, when added to the original number equals 0 (2 + -2 = 0).**
assigned value	**A predetermined numeric amount.**
attribute	**An inherent characteristic such as the color, size, or shape of an object.**
benchmark	**A point of reference; a standard or level against which others can be measured.**
categorical	**Classification based on specific characteristics.**
central tendency	**A number that is most typical of a particular set of data.**
measure of central tendency	**The mean, median, or mode of a set of data.**
compatible numbers	**Numbers that, because of closeness, can be used as replacements to simplify computation. (For the product of 74 x 19, use 74 x 20 and subtract 74.)**
compose or decompose (numbers)	**Use numbers flexibly to create equivalent representations of numbers by combining or separating. (8 = 4 + 3 + 1, or 43 + 7 = 40 + 3 + 7 and 60 + 19 = 60 + 20 – 1 = 80 – 1 = 79)**
compose or decompose (shapes and figures)	**Build geometric shapes or figures from component parts or partition a geometric shape into its component parts. (Build a rectangle from 2 triangles or partition a trapezoid into a square and a triangle.)**
construct	**To build or to represent through a model.**
congruent	**Having exactly the same size and shape.**
counting numbers	**Positive whole numbers (or natural numbers) 1, 2, 3 and so on.**
data	**A collection of facts, numbers, measurements or symbols.**

decompose	See compose.
differentiation	The process of teaching using diverse approaches to achieve the same instructional goal.
equivalent	Having the same or equal value.
formative assessment	Timely evaluation which informs and directs instruction.
function	A set of ordered pairs such that for any first number (the input) there is only one possible second number (the output).
generalizations	Statements characterizing the common nature of a group.
geometric sequence	Sequence of numbers that is created by multiplying the previous term by a constant (1, 2, 4, 8, 16).
graphic organizer	A tool such as a diagram, table, graph, or chart that is used to display data in a manner that makes it easier to understand and analyze.
growing pattern	A pattern that shows an arithmetic change between elements (2, 4, 6, 8 or triangular numbers).
inverse	Reciprocal or opposite of a number (see Additive Inverse and Multiplicative Inverse).
iteration	Repetition of a sequence of steps; repeating.
line graph	A graph that shows the one-to-one correspondence between two variables on a coordinate grid. A line graph can show change over time.
line plot	A graph showing the frequency of data by using marks to represent each item above a number on a number line.
mean (average)	A measure of central tendency of a set of data, found by adding the numbers of the set and dividing the sum by the number of members in the set.
multiplicative inverse	The reciprocal of a number that when multiplied with that number yields a product of 1. $^{2}/_{3}$ x $^{3}/_{2}$ = 1
net	A two-dimensional pattern that can be folded into a three-dimensional solid.
number sense	A way of thinking and understanding about number, not a set of skills to be learned.
number sentence	An equation, without a variable, or a comparison (7 – 3 = 4; 12 < 15).

numeral	**A symbol used to represent an amount or number.**
numeric	**Having to do with number.**
numerical	**Relating to numbers; expressed in numbers.**
ordinal number	**A number used when ordering elements in a set (first, third, fifth).**
pictograph	**A graph that uses pictures to show data, where each picture represents an amount established by a key.**
picture graph	**A pictograph that uses pictures to show data, where each picture stands for one.**
process skill	**NTCM Process Standards: problem solving, reasoning and proof, communication, connections and representation.**
properties	**Features or characteristics of objects or substances; rules that are true in any given mathematical situation.**
rational Numbers	**Any number that can be expressed as a ratio (fraction).**
real graph	**A display of data using real objects.**
reciprocal	**The multiplicative inverse of a number (3 is the inverse of $^1/_3$).**
referent	**Object or point of reference for which a symbol stands.**
region model	**Visual representation using a two-dimensional grid.**
relationships	**Connections, links, bonds.**
representations	**Symbols used to depict various images.**
statistical relationships	**The interpretation of organized numerical data (mean, median, mode, range).**
subitize	**Instantly recognizing the amount of objects in a small group without having to count.**
summative assessment	**The final evaluation of a complete unit of study.**
systematic	**Methodical in procedure or plan.**

ten frame A visual organizer for counting.



timeline A schedule of events or procedures.

translate patterns Change the representation of a number or pattern. A/B to stomp/clap or ½ to 2/4

unit fraction Fraction with one as the numerator.

www.amathsdictionaryforkids.com reference for children
Math To Know: A Mathematics Handbook. Great Source Education Group
Math To Learn: A Mathematics Handbook. Great Source Education Group
Math on Call: A Mathematics Handbook. Great Source Education Group
Illustrated Math Dictionary: An Essential Student Resource. DeKlerk. Good Year Books.