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

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

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 $14 \div 3 = 4$ with a remainder of 2 or 4 ⅔).				▨
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:

$345 - 217 =$ ☐

_____

_____

_____

GLEs 2.2.16, 2.2.17

Write a story problem that can be solved using the number sentence:

$5 \times 7 =$ ☐

_____

_____

_____

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 _
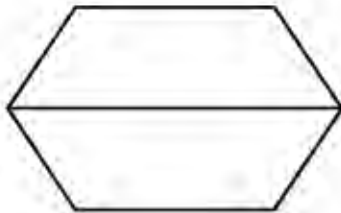
GLE 2.1.7

   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.
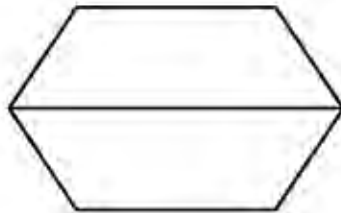
GLE 2.1.10

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
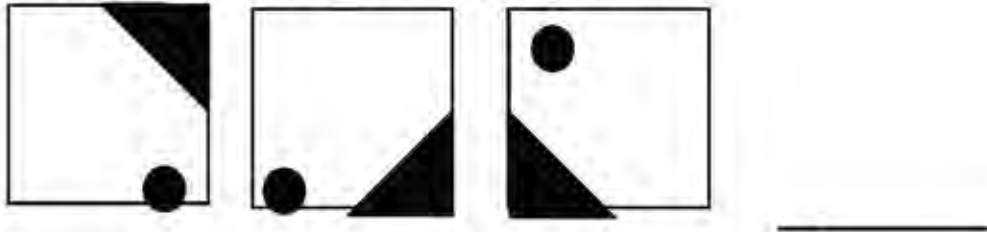
Consider the following seven fractions:

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

1988 ⌂⌂◁

1989 ⌂⌂⌂◁

1990 ⌂⌂

1991 ⌂⌂◁

(Each ⌂ = 4 houses)

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.

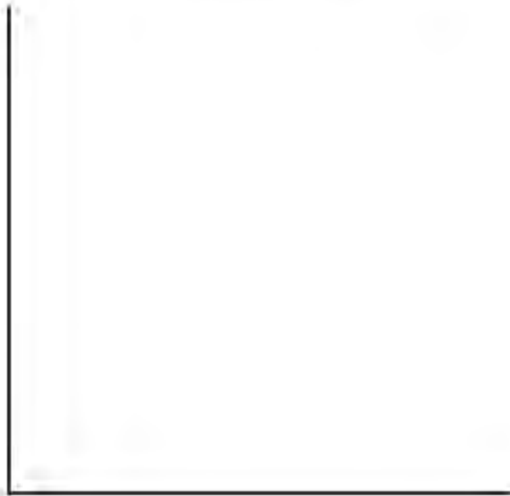**e. About what was the total number of houses built in the four years**

_____

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

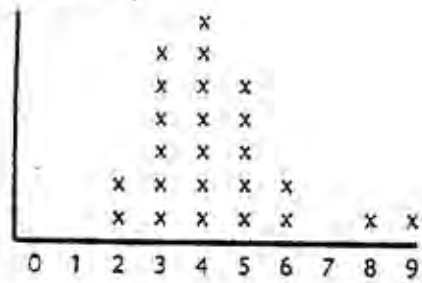Look at the five graphs on the next page. Each graph shows something about a classroom of fourth graders.

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? _____
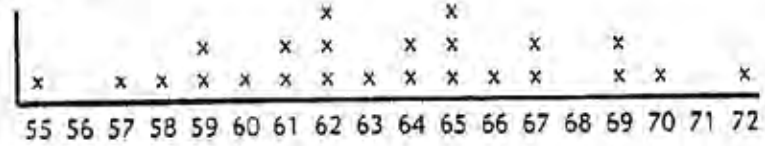
- The number of people in the 4th graders' families? __

b. Explain why you think the graph you picked for the heights of the 4th graders in inches is the one correct graph.

_____

_____

_____

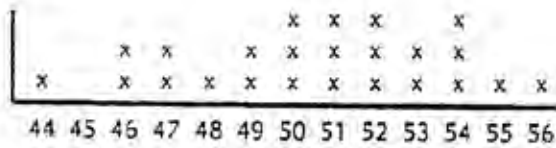c. Why do you think the other graphs do not show the 4th grader's heights?

_____

Graph 1

x x x x x x x x x x
0 1 2 3 4 5 6 7 8 9

Graph 2

55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72

Graph 3

44 45 46 47 48 49 50 51 52 53 54 55 56

Graph 4

0 1 2 3 4 5 6 7 8

Graph 5

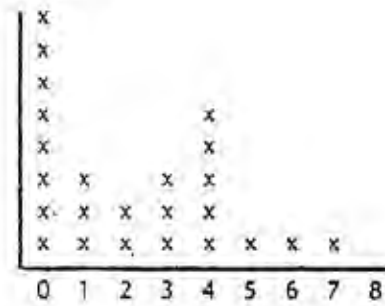24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
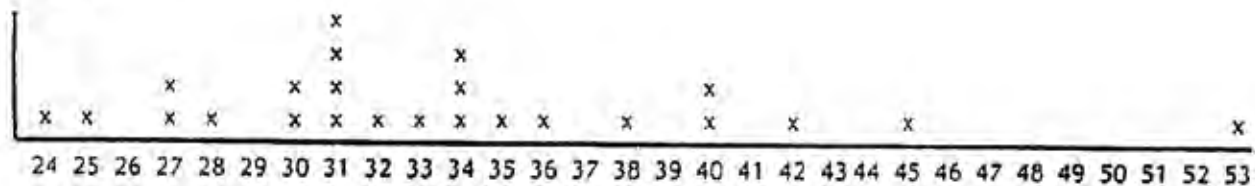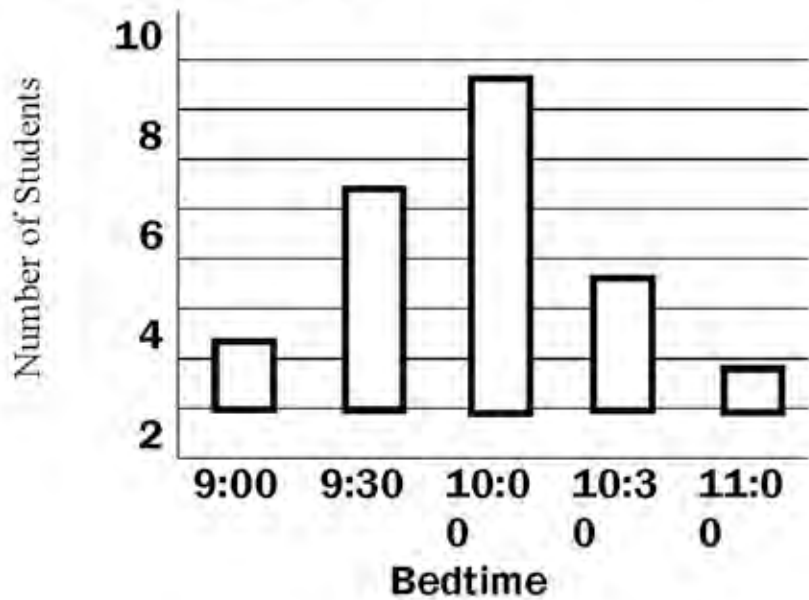
GLE 4.2.3

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.
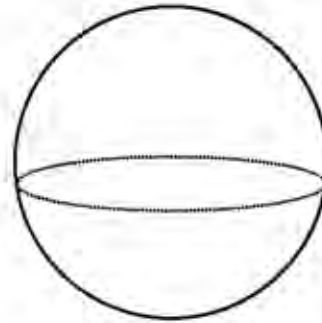

1. _____

2. _____

3. _____

GLE 3.1.1

Draw a line to match these figures with the correct names.

SPHERE	CYLINDER	CUBE
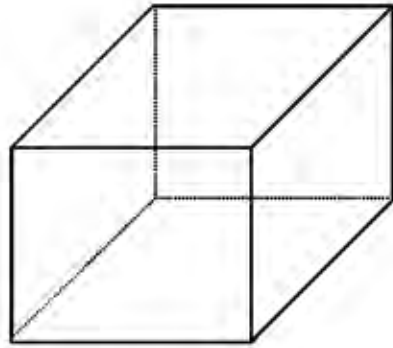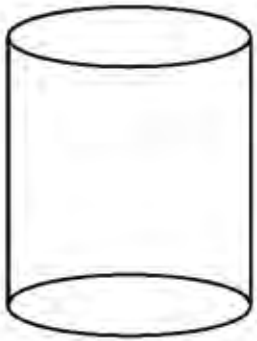
GLE 3.3.8

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 = _____
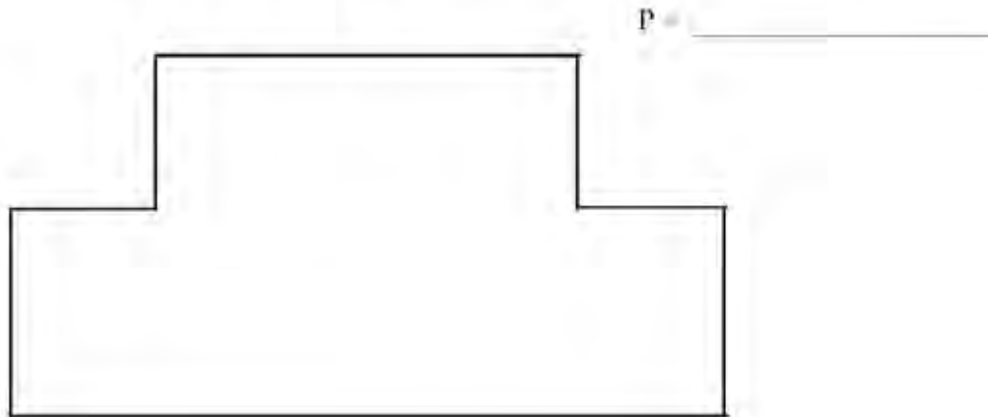
GLE 4.3.5

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?

_____
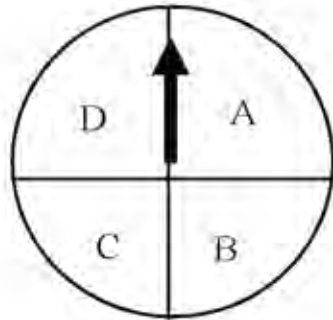
Explain how you decided.

_____

_____

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.
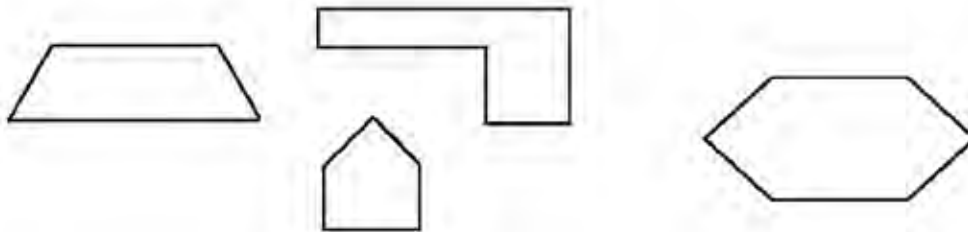
My little brother came home from school and told me what he learned about beavers.

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.

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.

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.

Brothers and Sisters
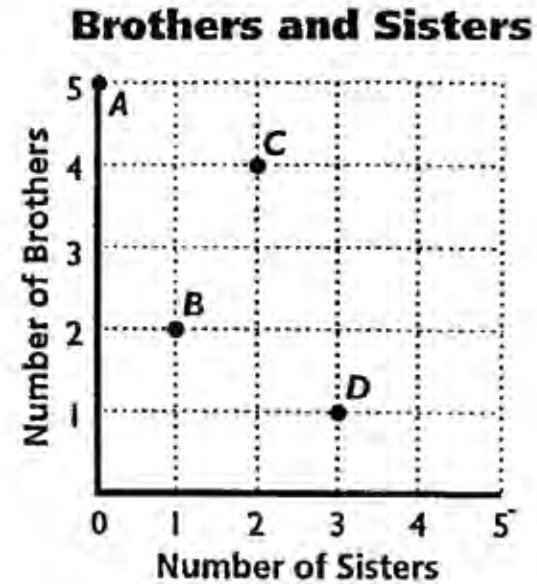
1 Who is A? _____ 2 Who is B? _____

3 Who is C? _____ 4 Who is D? _____

[Source: *Groundworks Grade 4*, p. 10, Creative Publications. Reprinted by permission.]

Who Is It? (C)

The graph shows the number of brothers and sisters

for four children.

Brothers and Sisters

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? _____

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** ⬡ $= \Delta\Delta\Delta$ **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 DETER-MINE 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 $\Delta = 6g$.

    *   Use concrete materials to build an understanding of equality and inequality, e.g., $7\triangle \neq 30$ or $7\triangle > 30$.

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 $12 \times 8 = (10 \times 8) + (2 \times 8)$

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:

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.)

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.)

5. Cut out along the dotted line. (See Fig. 2.)

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?
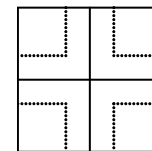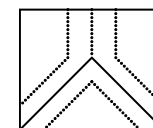
b. Was there any difference between the "flight" of the planes?

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

Illumination*s* 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

Eight Hands Round, by Whitford Paul

Counting on Frank, by Rod Clements

Piece=Part=Portion: Fractions=Decimals,=Percents by Scott Gifford

If You Hopped Like a Frog, by David Schwartz

If Dogs Were Dinosaurs, by David Schwartz

The Borrowers, by Mary Norton

Can You Count to a Googol? by Robert E. Wells

The Nature and Science of Patterns, by Jane Burton

The Mirror Puzzle Book, by Marion Walter

Two of Everything, by Lily Toy Hong

The King's Chessboard, by David Birch

So You Want to be President, by Judith St. George

One Grain of Rice, by Helena Clare Pittman

A Cloak for the Dreamer, by Aileen Friedman

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.

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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: