**Unit 2 Congruence, Constructions, and Proofs**

**(3-4 Weeks)**

**UNIT OVERVIEW**

In keeping with the Common Core Standards, the fundamental idea of congruence is defined in terms of transformations. The properties of transformations discovered in Unit 1 become postulates as we begin to construct a formal system of geometry.

In **Investigation 1** the definition of congruence is used to establish properties of congruent segments, angles, circles and polygons. The symbol ($≅)$ is introduced and its use is illustrated.

In **Investigation 2** the first theorems about congruent triangles, SAS and ASA are proved using transformational methods.

Isosceles triangles are introduced in **Investigation 3**. We prove that if two sides of a triangle are congruent, then the angles opposite these sides are congruent, and conversely. Isosceles triangles are used in the proof of the **SSS Congruence Theorem** in Investigation 4.

Relationships among angles formed by intersecting lines and two parallel lines cut by a transversal are discussed in **Investigation 5**.

We have now proved a small set of theorems that can be used to justify many of the traditional compass and straightedge constructions of Euclidean geometry. **Investigation 6** is open ended. Students are challenged to figure out how to perform certain constructions, for example to construct the perpendicular bisector of a line segment. In **Investigation 7** they use the theorems previously proved to justify their own constructions or one that is given to them.

Students then apply what they have learned in the **Performance Task** to create their own design.

**Essential Questions**

* What are the properties of congruent figures?
* How can two triangles be proved congruent?
* What relationships hold among angles formed by parallel lines and a transversal?
* How can your construct geometric figures with a compass and straightedge?
* How can you prove the constructions work?

**Enduring Understandings**

Theorems about congruent triangles may be proved using transformations and applied to justify constructions.

**Unit Contents**

Investigation 1 Identifying Congruent Figures (2 days)

Investigation 2 Congruent Triangles: SAS and ASA (2 days)

Investigation 3 Isosceles Triangles (2 days)

Investigation 4 Congruent Triangles SSS (2 days)

Investigation 5 Vertical Angles and Parallel Lines (2 days)

Investigation 6 The Construction Game (3 days)

Investigation 7 Proving That Constructions Work (2 days)

Performance Task: Create a Design (1 days)

End-of-Unit Test (2 days including review)

**Common Core Standards**

*Mathematical Practices #1 and #3* *describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. Practices in bold are to be emphasized in the unit.*

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.

3. **Construct viable arguments and critique the reasoning of others.**

4. Model with mathematics.

5. **Use appropriate tools strategically.**

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

**Standards Overview**

* Understand congruence in terms of rigid motions
* Prove geometric theorems
* Make geometric constructions

**Standards**

G-CO.6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

G-CO.7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

G-CO.8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

G-CO.9. Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment’s endpoints.*

G-CO.10. Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*

G-CO.12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*

**Vocabulary**

$≅$ (symbol for congruence)

alternate interior angles (formed by two lines and a transversal)

bisect

compass

congruent

consecutive (sides, angles)

construction (with compass and straightedge)

convex (polygon)

corresponding angles (formed by two lines and a transversal)

corresponding parts (of congruent polygons)

dart

equilateral triangle

interior angle of a polygon

isosceles triangle

kite

linear pair of angles

non-convex (polygon)

perpendicular bisector

polygon

proof

straightedge

transversal

vertical angles

**Assessment Strategies**

**Performance Task**

Students will use compass and straightedge to create a design and list the steps used in the construction.

**Other Evidence (Formative and Summative Assessments)**

* Exit slips
* Class work
* Homework assignments
* Math journals
* End of Unit test