Grade 4 Math Unit 7-Geometry

UNIT OVERVIEW

In Grade 4, instructional time should focus on three critical areas. This unit addresses Critical Focus Area #3,**Understanding that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures and symmetry.** (See Connections for explanation)

This unit addresses the following clusters:
- Geometric measurement: understand concepts of angle and measure angles.
- Draw and identify lines and angles, and classify shapes by properties of their lines and angles

STANDARDS

CC_Common Core State Standards - Mathematics (2010) - Grade 4
Domain 4.MD Measurement and Data
Cluster Statement Geometric measurement: understand concepts of angle and measure angles.
Standard 4.MD.5 Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:
4.MD.5.a An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles
4.MD.5.b An angle that turns through n one-degree angles is said to have an angle measure of n degrees.
Standard 4.MD.6 Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.
Standard 4.MD.7 Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.
Domain 4.G Geometry
Cluster Statement Draw and identify lines and angles, and classify shapes by properties of their lines and angles.
Standard 4.G.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.
Standard 4.G.2 Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.
Standard 4.G.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

CONTENT ELABORATIONS

4.MD.5	**4.MD.5** calls for students to explore the connection between angles (measure of rotation) and circular measurement (360 degrees). Students explore an angle as a series of "one degree turns." A water sprinkler rotates one-degree at each interval. If the sprinkler rotates a total of 100 degrees, how many one-degree turns has the sprinkler made? **MP.5, MP.6, MP.7** should be emphasized.

4.MD.6	Before students begin measuring angles with protractors, they need to have some experiences with benchmark angles. They transfer their understanding that a 360 degree rotation about a point makes a complete circle to recognize and sketch angles that measure approximately 90 degrees and 180 degrees. They extend and recognize and sketch angles that measure approximately 45 degrees and 30 degrees. They use appropriate terminology (acute, right, and obtuse) to describe angles and rays (perpendicular). Students should estimate angles, measure angles and sketch angles. They need to experience measuring angles using an angle ruler as well as a protractor. (The angle ruler allows them to "see" the turns or rotations). **MP.2, MP.5, MP.6** should be emphasized.
4.MD.7	**4.MD.7** addresses the idea of decomposing an angle into smaller parts. *Example:* A lawn water sprinkler rotates 65 degrees and then pauses. It then rotates an additional 25 degrees. What is the total degree of the water sprinkler rotation? To cover a full 360 degrees, how many times will the water sprinkler need to be moved? If the water sprinkler rotates a total of 25 degrees then pauses. How many 25 degree cycles will it go through for the rotation to reach at least 90 degrees? **MP.1, MP.2, MP.4, MP.6** should be emphasized.
4.G.1	**4.G.1** asks students to draw two-dimensional geometric objects and to also identify them in two-dimensional figures. This is the first time that students are exposed to rays, angles, and perpendicular and parallel lines. Students can use the corner of a sheet of paper as a benchmark for a right angle. They can use a right angle to determine relationships of other angles. When introducing line of symmetry, provide examples of geometric shapes with and without lines of symmetry. Shapes can be classified by the existence of lines of symmetry in sorting activities. This can be done informally by folding paper, tracing, creating designs with tiles or investigating reflections in mirrors. With the use of a dynamic geometric program, students can easily construct points, lines and geometric figures. They can also draw lines perpendicular or parallel to other line segments. Two-dimensional shapes are classified based on relationships by the angles and sides. Students can determine if the sides are parallel or perpendicular, and classify accordingly. Characteristics of rectangles (including squares) are used to develop the concept of parallel and perpendicular lines. The characteristics and understanding of parallel and perpendicular lines are used to draw rectangles. Repeated experiences in comparing and contrasting shapes enable students to gain a deeper understanding about shapes and their properties.Informal understanding of the characteristics of triangles is developed through angle measures and side length relationships. Triangles are named according to their angle measures (right, acute or obtuse) and side lengths (scalene, isosceles or equilateral). These characteristics are used to draw triangles. **MP.5, MP.6** should be emphasized.
4.G.2	Two dimensional figures may be classified using different characteristics such as, parallel or perpendicular lines or by angle measurement. Parallel or Perpendicular Lines: Students should become familiar with the concept of parallel and perpendicular lines. Two lines are parallel if they never intersect and are always equidistant. Two lines are perpendicular if they intersect in right angles. This standard calls for students to sort objects based on parallelism, perpendicularity and angle types. *Examples:* - Sort figures into categories: at least one set of parallel sides, at least one right angle or both - Draw and name a figure that has two parallel sides and exactly 2 right angles. - For each of the following, sketch an example if it is possible. If it is impossible, say so, and explain why or show a counter example: a parallelogram with exactly one right angle, an isosceles right triangle, a rectangle that is not a parallelogram (impossible) - Identify which of these shapes have perpendicular or parallel sides and justify your selection. **MP.5, MP.6** should be emphasized.
4.G.3	Students need experiences with figures which are symmetrical and non-symmetrical. Figures include both regular and non-regular polygons. Folding cut-out figures will help students determine whether a figure has one or more lines of symmetry. This standard only includes line symmetry not rotational symmetry. **MP.4, MP.5, MP.6, MP.7** should be emphasized.

UNIT VOCABULARY

point	angle	obtuse triangle
line	degree	parallelogram
ray	one-degree angle	rectangle
endpoint	right angle	rhombus
line segment	acute angle	square
parallel	obtuse angle	trapezoid
intersecting	right triangle	line symmetry
perpendicular	acute triangle	line of symmetry

BIG IDEAS

ENDURING UNDERSTANDINGS

● The measure of an angle does not depend on the lengths of its sides.
● Angle measurement can be thought of as a measure of rotation.
• Two-Dimensional figures are classified by their properties.
• Two-Dimensional figures can fit into more than one category.

ESSENTIALS QUESTIONS
Choose a few questions based on the needs of your students

• How can plane figures be categorized and classified?
• What is a quadrilateral?
• What are the properties of quadrilaterals?
• How can you classify different types of quadrilaterals?
• How are quadrilaterals alike and different?
• Where is geometry found in your everyday world?
• What careers involve the use of geometry?
• Why are some quadrilaterals classified as parallelograms?
• Why are kites not classified as parallelograms?
• Why is a square always a rectangle?   ● How are a circle and an angle related?
● How are the angles of a triangle related?
● How can angles be combined to create other angles?
● How can we measure angles using wedges of a circle? ● How can we use angle measures to draw reflex angles?
● How can we use the relationship of angle measures of a triangle to solve problems?
● How does a circle help with measurement?
● How does a turn relate to an angle?
● How is a circle like a ruler?
● What are benchmark angles and how can they be useful in estimating angle measures?

CONNECTIONS

In Critical Focus Area #3, students describe, analyze, compare and classify two-dimensional shapes. Through building, drawing, and analyzing two-dimensional shapes, students deepen their understanding of properties of two-dimensional objects and the use of them to solve problems involving symmetry.

The work in this unit is connected to **4.MD.3**
Symmetry can be related to experience in art
Engineering uses geometric terms as evidenced in various constructions.

Standards for Mathematical Practice (SMP)
MP.1 Make sense of problems and persevere in solving them
MP.2 Reason abstractly and quantitatively
MP.3 Construct viable arguments and critique the reasoning of others
MP.4 Model with mathematics
MP.5 Use appropriate tools strategically
MP.6 Attend to precision
MP.7 Look for and make use of structure (Deductive reasoning)
MP.8 Look for and express regularity in repeated reasoning (Inductive Reasoning)

GEOMETRIC MEASUREMENT: UNDERSTAND CONCEPTS OF ANGLE AND MEASURE ANGLES		
	CONTENT	**SKILLS**
A.	Understand concepts of angle measurement.	Understand concepts of angle measurement. 1. Define angle. 2. Recognize a circle as a geometric figure that has 360 degrees. 3. Recognize and identify an angle as a geometric shape formed from 2 rays with a common endpoint. 4. Recognize that an angle is a fraction of a 360 degree circle. 5. Explain the angle measurement in terms of degrees. 6. Compare angles to circles with the angles point at the center of the circle to determine the measure of the angle. 7. Calculate angle measurement using the 360 degrees of a circle.
B.	Measure angles in whole-number degrees using a protractor.	Measure angles in whole-number degrees using a protractor. 1. Recognize that angles are measured in degrees (°). 2. Determine which scale on the protractor to use, based on the direction the angle is open. 3. Determine the kind of angle based on the specified measure to decide reasonableness of the sketch. 4. Measure angles in whole-number degrees using a protractor. 5. Sketch angles of specified measure.
C.	Recognize angle measure as additive.	Recognize angle measure as additive. 1. Recognize that an angle can be divided into smaller angles. 2. Solve addition and subtraction equations to find unknown angle measurements on a diagram. 3. Find an angle measure by adding the measurements of the smaller angles that make up the larger angle. 4. Find an angle measure by subtracting the measurements of the smaller angle from the larger angle.
DRAW AND IDENTIFY LINES AND ANGLES, AND CLASSIFY SHAPES BY PROPERTIES OF THEIR LINES AND ANGLES		

A.	Draw points, lines, line segments, rays, angles and parallel and perpendicular lines.	Draw points, lines, line segments, rays, angles and parallel and perpendicular lines. 1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. 2. Analyze two-dimensional figures to identify points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines.
B.	Classify two-dimensional figures based on the presence or absence of parallel and perpendicular lines, or presence or absence of angles of a specified size.	Classify two-dimensional figures based on the presence or absence of parallel and perpendicular lines, or presence or absence of angles of a specified size. 1. Identify parallel or perpendicular lines in two dimensional figures. 2. Recognize acute, obtuse, and right angles. 3. Identify right triangles. 4. Classify two-dimensional figures based on parallel or perpendicular lines and size of angles. 5. Classify triangles as right triangles or not right.
C.	Recognize a line of symmetry in two-dimensional shapes.	Recognize a line of symmetry in two-dimensional shapes. 1. Recognize a line of symmetry as a line across a figure that when folded along creates matching parts. 2. Draw lines of symmetry for two-dimensional figures. 3. Identify line-symmetric figures.

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Common Core Model Curriculum

McGraw-Hill, **My Math** Chapter 14

Georgia Math frameworks, Grade 4 Units 6-7

Manipulatives: cardboard cut in strips to make an angle explorer, protractor, angle ruler, mirrors, geoboards

Smart Board resources

Discovery Video

http://mathbits.com/MathBits/TeacherResources/Geometry/Geometry.htm

http://www.brightstorm.com/math/geometry/geometry-building-blocks/line-segments/

http://www.figurethis.org/challenges/c10/challenge.htm

http://www.geogebra.org/cms/en/ (a free software for learning and teaching)

Possible Literature:

Dividing the Cheese

Sir Cumference and the Great Knight of Anglehead

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