Know-Understand-Do (KUD)

Grade: 8 **Unit:** It's All the Same & Going the Distance

Critical Area of Focus and/or Parts of Narrative:

In Grade 8, instructional time should focus on this critical areas: (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

3. Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

Standards for Mathematical Practice:

1. Make sense of problems & persevere in solving them.
2. Reason abstractly & 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.

By the end of this unit, students will…

UNDERSTAND:

Geometric relationships are used to find unknown measurements and solve real-world problems.

KNOW:	DO:
New Knowledge: • Reflections, rotations, and translations are rigid transformations and maintain congruence (do not change the size and shape of the object being transformed). • Congruent figures have the same size and shape. • Dilations may change the size of the object being transformed, but not the shape. • If figures are similar, their corresponding sides have the same ratio (scale factor) and corresponding angles are equal. (corresponding sides are proportional). • Multiplication factors (scale factors) larger than 1 enlarge a figure. • Multiplication factors (scale factors) less than 1 shrink a figure. • A Multiplication factors (scale factors) of exactly 1 maintains congruence. • Two triangles are similar if at least two pairs corresponding angles are congruent (AA postulate for	**Geometry 8.G** **Understand congruence and similarity using physical models, transparencies, or geometry software.** 1. Verify experimentally the properties of rotations, reflections, and translations: **CC.8.G.1** a. Lines are taken to lines, and line segments to line segments of the same length. **CC.8.G.1a** b. Angles are taken to angles of the same measure. **CC.8.G.1b** c. Parallel lines are taken to parallel lines. **CC.8.G.1c** -Students begin with an informal definition of congruency which leads to a more formalized definition. 2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. **CC.8.G.2** 3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. **CC.8.G.3** -Use a multiplication factor to find lengths of similar figures. 4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. **CC.8.G.4** 5. Use informal arguments to establish facts about the angle sum and

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similarity)
- If figures are similar, their corresponding sides have the same ratio (scale factor) and corresponding angles are equal. (corresponding sides are proportional).
- Symbols for congruency and similarity ($\cong$ and ~)
- The square root of the area of a square represents the side length of the square (Ex: A square with an area of 9 cm^2 has a side length of $\sqrt{9}$ = 3cm).
- There is a special relationship between the side lengths of a right triangle that states that the sums of the squares of the legs equal the square of the hypotenuse. This relationship is called the Pythagorean Theorem.
- Slope can be used to help justify parallel and perpendicular lines.
- The coordinate system can be used as a tool for justifying geometric relationships.

Extended Knowledge:
- Sum of the angles in a triangles is 180 degrees.
- Numbers that have two identical factors are called perfect squares. (Ex: 16 is a square number because 4 * 4 = 16), so the square root (as a side length) of these numbers are whole numbers ($\sqrt{16}$ = 4).
- Estimating can help to assess the reasonableness of a square root calculation (Ex: $\sqrt{15}$ is between 3 and 4, but closer to 4 because $\sqrt{9}$=3 and $\sqrt{16}$=4 and 15 is between 9 and 16, but closer to 16).
- Slope can be used to describe the steepness of a line.

exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.* **CC.8.G.5**

-Know and use formal properties of straight lines in a coordinate system.

-Understand the relationships between angles & parallel lines.

-Use tessellations to explore intersecting families of parallel lines and find corresponding and alternate interior angles are equal in size and vice versa.

-Use properties of similar triangles and parallel lines to solve problems.

Understand and apply the Pythagorean Theorem.

-Estimate the dimensions of a square and a rectangle when given the area.

-Use the relationship between the area of a square and its side lengths to find distances on a map.

-Estimate the values of square roots of whole numbers (8.EE.2)

-Investigate the Pythagorean theorem by comparing the areas of the 3 squares made from the 3 sides of a right triangle.

6. Explain a proof of the Pythagorean Theorem and its converse. **CC.8.G.6**
7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. **CC.8.G.7**

   -Distinguish right triangles from non-right triangles using the relationship among the side lengths (Pythagorean Theorem)
8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. **CC.8.G.8**

Expressions and Equations 8.EE

Understand the connections between proportional relationships, lines, and linear equations.

6. Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at *b*. **CC.8.EE.6**

Vocabulary:
Mathematically proficient students acquire precision in the use of mathematical language by engaging in discussion with others and by giving voice to their own reasoning. By the time they reach high school they have learned to examine claims, formulate definitions, and make explicit use of those definitions. The terms students should learn to use with increasing precision in this unit are: **Congruent, Tessellation, Parallel, Enlargement factor, reduction factor, multiplication factor, corresponding sides, corresponding angles, Pythagorean Theorem, Slope, parallel, perpendicular, distance, line segment, diagonal, rhombus, opposite, reciprocal**

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Connections: