

## Unit 3 Similarity and Trigonometry

### Geometry

#### Unit Description:

Students will develop similarity rules for triangles and other polygons. Additionally, students will expand their knowledge of right triangles through the use of the Pythagorean Theorem. Students will study special right triangles and right triangle trigonometry including trigonometric ratios.

#### Standards for Mathematical Practice

- 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.

#### Louisiana Student Standards for Mathematics (LSSM)

Parts of standards that are addressed in later units have been ~~crossed out~~.

| <b>G-SRT: Similarity, Right Triangles, and Trigonometry</b>            |  |
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| <b>A. Understand similarity in terms of similarity transformations</b> |  |
| G-SRT.A.1  | Verify experimentally the properties of dilations given by a center and a scale factor. <i>Include centers not at the origin.</i><br><b>a.</b> A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.<br><b>b.</b> The dilation of a line segment is longer or shorter in the ratio given by the scale factor. |
| G-SRT.A.2  | Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.   |
| G-SRT.A.3  | Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.  |
| <b>B. Prove and apply theorems involving similarity.</b>               |  |
| G-SRT.B.4  | Prove and apply theorems about triangles. <i>Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity; SAS similarity criteria, SSS similarity criteria, AA similarity criteria.</i>   |

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| G-SRT.B.5  | Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.  |
| <b>C. Define trigonometric ratios and solve problems involving right triangles.</b>  |  |
| G-SRT.C.6  | Understand that by similarity, side ratios in right triangles, including special right triangles (30-60-90 and 45-45-90), are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.   |
| G-SRT.C.7  | Explain and use the relationship between the sine and cosine of complementary angles.  |
| G-SRT.C.8  | Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. *   |
| <b>G-MG: Modeling with Geometry</b>  |  |
| <b>A. Apply geometric concepts in modeling situations.</b>   |  |
| G-MG.A.1   | Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). *   |
| G-MG.A.3   | Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). *   |
| <b>G-CO: Congruence</b>  |  |
| <b>A. Experiment with transformations in the plane.</b>  |  |
| G-CO.A.2   | Represent transformations in the plane using, e.g. transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).<br>-Within this unit add the concept of similarity versus congruence as set forth in Unit 1. |
| <b>Additional Standards for Honors Classes</b>   |  |
| <b>G-SRT.D.10 (+)</b> Prove the Laws of Sines and Cosines and use them to solve problems.  |  |
| <b>G-SRT.D.11 (+)</b> Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). |  |

**\*As defined by LSSM, the basic modeling cycle involves:**

1. identifying variables in the situation and selecting those that represent essential features,
2. formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables,
3. analyzing and performing operations on these relationships to draw conclusions,
4. interpreting the results of the mathematics in terms of the original situation,
5. validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable,
6. reporting on the conclusions and the reasoning behind them.

*Choices, assumptions, and approximations are present throughout this cycle.*

### **Enduring Understandings:**

- \*Proportional relationships express how quantities change in relationship to each other.
- \*Similarity can be demonstrated using logical reasoning.
- \*Similarity in polygons has real-life application in a variety of areas including art, architecture, and sciences.
- \*Triangles are fundamental aesthetic, structural elements that are useful in many disciplines such as art, architecture, and engineering.
- \*Developing techniques for measuring indirectly is useful in many aspects of daily life.
- \*Trigonometry can help us solve real world problems that involve triangles.

### **Essential Questions:**

- \*How does my understanding of algebraic principles help me solve geometric problems?
- \*How are the concepts of similarity and congruence related to each other?
- \*What special relationships occur between congruent triangles and similar triangles?
- \*How can proportions be used to solve problem involving similarity?
- \*What special properties exist in a right triangle that make it unique?