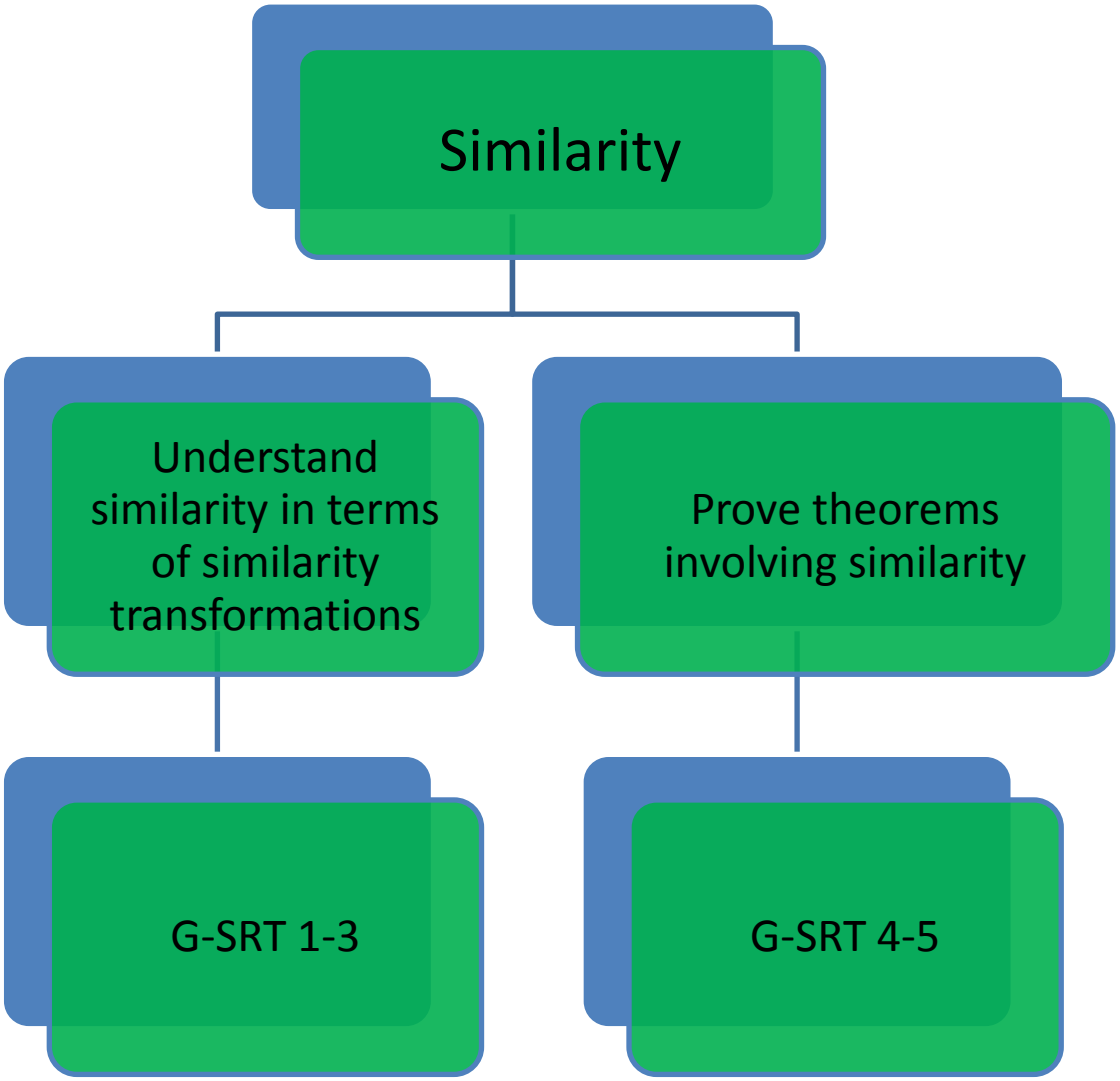
High School Geometry
Unit 2

G-MG 1-3: Modeling with Geometry: Apply geometric concepts in modeling situations



Key: Major Clusters; Supporting Clusters; Additional Clusters

Geometry – UNIT 2

Similarity, Right Triangles, and Trigonometry

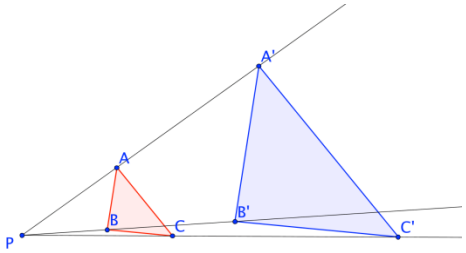
Critical Area: Students investigate triangles and decide when they are similar. A more precise mathematical definition of similarity is given; the new definition taken for two objects being similar is that there is a sequence of similarity transformations that maps one exactly onto the other. Students explore the consequences of two triangles being similar: that they have congruent angles and that their side lengths are in the same proportion. Students prove the Pythagorean Theorem using triangle similarity.

CLUSTERS	COMMON CORE STATE STANDARDS
Understand similarity in terms of similarity transformations	**Geometry - Similarity, Right Triangles, and Trigonometry** **G-SRT.1**. Verify experimentally the properties of dilations given by a center and a scale factor: a. 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. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. **G-SRT.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.3**. Use the properties of similarity transformations to establish the Angle-Angle (AA) criterion for two triangles to be similar.
Prove theorems involving similarity **Apply geometric concepts in modeling situations**	**Geometry - Similarity, Right Triangles, and Trigonometry** **G-SRT.4**. Prove theorems about triangles. 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. **G-SRT.5**. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures Supporting clusters: **G-MG 1-3**: Modeling with Geometry: Apply geometric concepts in modeling situations
MATHEMATICAL PRACTICES	
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.**	Emphasize Mathematical Practices 1, 2, 3, 4, 4, 5, and 6 in this unit.

7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS	KEY VOCABULARY
• Sequence of similarity transformation of two objects that maps one exactly onto the other is defined. • Similarity of two objects using their given ratio by a scale factor is proved; such as: using the dilation of a line segment in ratio given by the scale factor. • Similar triangles have corresponding pairs of angles and proportional pairs of sides (AA, SAS, SSS). • Prove Theorems about triangles; such as "a line parallel to one side of a triangle divides the other two proportionately and conversely." • Triangle similarity is used to prove the Pythagorean Theorem. • Congruence and similarity criteria for triangles are used to solve problems and prove relationships of geometric figures.	• What is the difference between similarity and congruence? • How can you show that it is not possible to prove similarity by showing three angles in proportion to one another? • How do you construct a viable argument for congruency and/or similarity of two triangles? • How do you construct a viable argument for the similarity of geometric figures? • Are all congruent triangles similar and is the converse true also?	• congruency • corresponding • criterion • derive • dilation • dilation of scale factor • parallel lines • proportionality • reflection • rigid motion • rotation • scale factor • sequence • similar • similarity transformation • transversal • triangle relationships

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT
LAUSD Adopted Textbooks and Programs • Big Ideas Learning - Houghton Mifflin Harcourt, 2015: Big Ideas Geometry • College Preparatory Mathematics, 2013: Core Connections, Geometry • The College Board, 2014:Springboard Geometry **Mathematics Assessment Project (MARS Tasks)** Hopwell Geometry – G.SRT.5 http://map.mathshell.org/materials/download.ph	• Provide students the opportunities to experiment with dilations and determine how they affect planar objects. Have them explore the properties of dilations in more detail and develop an understanding of the notion of scale factor (G-SRT.1). Students first make sense of the definition of a dilation of scale factor $k>0$ with center P as the transformation that moves a point A along the ray $\overrightarrow{PA}$ to a new point A', so that $\left\|\overrightarrow{PA'}\right\| = k \cdot \left\|\overrightarrow{PA}\right\|$ • For example, students apply the dilation of scale factor 2.5 with center P to the points A, B, and C	**Formative Assessment**

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT
p?fileid=499 Inscribing and Circumscribing Right Triangles – G.SRT: http://map.mathshell.org/materials/lessons.php?taskid=403&subpage=problem **Illustrative Mathematics** Similar Triangles : G-SRT.3 http://www.illustrativemathematics.org/illustrations/1422 Pythagorean Theorem : G-SRT.4 http://www.illustrativemathematics.org/illustrations/1568 Joining two midpoints of sides of a triangle : G-SRT.4 http://www.illustrativemathematics.org/illustrations/1095	illustrated using a ruler. Once they've done so, they consider the two triangles ΔABC and $\Delta A'B'C'$. What they discover is that the lengths of the corresponding sides of the triangles have the same ratio as dictated by the scale factor. Students learn that parallel lines are taken to parallel lines by dilations; thus corresponding segments of ΔABC and ΔA'B'C' are parallel. After students have proved results about parallel lines intersected by a transversal, they can deduce that the angles of the triangles are congruent.  Through experimentation, they see that the congruence of corresponding angles is a necessary and sufficient condition for the triangles to be similar, leading to the AA criterion for triangle similarity. (G.SRT.3.) For a simple investigation, students can observe how the distance at which a projector is placed from a screen affects the size of the image on the screen. (MP.4) • Have students use geometric shapes, their measures, and their properties to describe objects including two- and three-dimensional shapes.	**LAUSD Assessments** The district will be using the SMARTER Balanced Interim Assessments. Teachers would use the Interim Assessment Blocks (IAB) to monitor the progress of students. Each IAB can be given twice to show growth over time. **State Assessments** California will be administering the SMARTER Balance Assessment as the end of course for grades 3-8 and 11. There is no assessment for Algebra 1. The 11th grade assessment will include ítems from Algebra 1, Geometry, and Algebra 2 standards. For examples, visit the SMARTER Balance Assessment at: http://www.smarterbalanced.org/ Sample Smarter Balanced Items: http://sampleitems.smarterbalanced.org/itempreview/sbac/index.htm

LANGUAGE GOALS for **low achieving, high achieving, students with disabilities and English Language Learners**

- Students will be able to articulate orally and in writing the differences between similarity and congruence.
- Students will be able to affirm the veracity of mathematical statements.
- Students will be able to articulate the process of constructing viable arguments.
- Students will be able to describe in writing the definition of similarity in terms of similarity transformations and decide if they are similar.
- Students will explain in writing and orally similarity transformations and the meaning of similarity for triangles as the equality of all corresponding pairs of angles.

PERFORMANCE TASKS

Illustrative Mathematics

Dilating a Line : G-SRT.1 http://www.illustrativemathematics.org/illustrations/602

Are they Similar ?: G-SRT.2 http://www.illustrativemathematics.org/illustrations/603

Folding a Square into Thirds : G-SRT.5 http://www.illustrativemathematics.org/illustrations/1572

LAUSD Concept Lessons – http://math.lausd.net

Squaring Triangles

Mathematics Assessment Project (MARS Tasks):

Geometry Problems: Circles and Triangles – G-SRT http://map.mathshell.org/materials/lessons.php?taskid=222#task222

Inscribing and Circumscribing Right Triangles - http://map.mathshell.org/materials/lessons.php?taskid=403&subpage=problem

Modeling: Rolling Cups- http://map.mathshell.org/materials/lessons.php?taskid=428&subpage=problem

Solving Geometry Problems: Floodlights – G-SRT.5, G-MG.1-3 http://map.mathshell.org/materials/lessons.php?taskid=429&subpage=problem

Analyzing Congruence Proofs – G-CO.6-8 http://map.mathshell.org/materials/lessons.php?taskid=452&subpage=concept

Calculating Volumes of Compound Objects – G-MD http://map.mathshell.org/materials/lessons.php?taskid=216&subpage=concept

Proofs of the Pythagorean Theorem http://map.mathshell.org/materials/lessons.php?taskid=419&subpage=concept

DIFFERENTIATION

UDL/FRONT LOADING	ACCELERATION	INTERVENTION
Prerequisites: • •Assessment tasks can be given a day prior in class or as homework to find out the difficulties students have prior to the lessons. Clarify the objectives in student friendly language and communicate the learning expectations by the end of the concept development tasks to lower the	• Advanced students should have access to bank of more challenging problems for extension • Gifted and advanced student can use alternate projects, to meet their unique needs. • Use of technology and software to enhance student learning and explore further.	Multiple entry points for problems should be planned and taught in each lesson. When the lesson is reviewed or retaught, use a different entry point or a different method. Illicit more information about students' misconceptions or misunderstandings before choosing

students' anxiety.		or recommending strategies aligned with math goals and students' abilities. Use higher order questions and effective questioning techniques to enhance learning; analyze skills and evaluate students' understanding. To increase active participation, students should be expected to work collaboratively to promote authentic conversation, increase opportunities for asking questions, and peers support. Use visual tools, academic language, graphic organizers, manipulatives, and engaging and real world examples. Make clear connections to prior grade concepts See "Common Issues" of each Mars Tasks

References:

1. National Governors Association Center for Best Practices, Council of Chief State School Officers. (2010). *Common Core State Standards (Mathematics)*. Washington D.C.: National Governors Association Center for Best Practices, Council of Chief State School Officers.
2. McCallum, W., Zimba, J., Daro, P. (2011, December 26 Draft). *Progressions for the Common Core State Standards in Mathematics*. Cathy Kessel (Ed.). Retrieved from http://ime.math.arizona.edu/progressions/#committee.
3. Engage NY. (2012). New York Common Core Mathematics Curriculum. Retrieved from http://engageny.org/sites/default/files/resource/attachments/a-story-of-ratios-a-curriculum-overview-for-grades-6-8.pdf.
4. Mathematics Assessment Resource Service, University of Nottingham. (2007 - 2012). Mathematics Assessment Project. Retrieved from http://map.mathshell.org/materials/index.php.
5. Smarter Balanced Assessment Consortium. (2012). Smarter Balanced Assessments. Retrieved from http://www.smarterbalanced.org/.
6. Partnership for Assessment of Readiness for College and Career. (2012). PARCC Assessments. Retrieved from http://www.parcconline.org/parcc-assessment.
7. California Department of Education. (2013). Draft Mathematics Framework Chapters. Retrieved from http://www.cde.ca.gov/be/cc/cd/draftmathfwchapters.asp.
8. National Council of Teachers of Mathematics (NCTM) Illuminations. (2013). Retrieved from http://illuminations.nctm.org/Weblinks.aspx.
9. The University of Arizona. (2011-12). Progressions Documents for the Common Core Math Standards. Retrieved from http://ime.math.arizona.edu/progressions.