Mathematics Curriculum Guide

Honors Geometry

2017-18

Topic 6: Similarity

This unit expands on students' understanding and skills related to similarity. To begin this unit, students will form proportions based on known lengths of corresponding sides. Students will use ratios and proportions to prove whether two polygons are similar and to find unknown lengths. To help students find corresponding parts of similar triangles, students will learn to show triangles in like orientations. Students will then use the Angle-Angle Similarity Postulate, the Side-Angle-Side Similarity Theorem, and the Side-Side-Side Similarity Theorem to show that triangles are similar based on the relationship of two or three pairs of corresponding parts. At that point students will apply their knowledge of proportional segments to cases when two or more parallel lines intersect other lines.

Common Misconceptions and/or Errors:

- **Ratios and Proportions:** When two ratios are equal, $\frac{a}{b} = \frac{c}{d}$, their inverses are also equal, $\frac{b}{a} = \frac{d}{c}$. However, $\frac{a}{b} \neq \frac{d}{c}$.

- **Proving Similar Triangles:** If students are given similar triangles that are oriented in such a way that their corresponding sides are oriented differently, students may incorrectly conclude that the triangles are not similar based on incorrectly setting up the proportion. Students should always compare the longest side to the longest, the shortest side to the shortest, and the remaining sides.

Topic 6: Similarity

Transfer Goals	
1) Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution. 2) Effectively communicate orally, in writing, and using models (e.g., concrete, representational, abstract) for a given purpose and audience. 3) Construct viable arguments and critique the reasoning of others using precise mathematical language.	**Timeframe: 3 weeks/14 days** **Start Date: January 22, 2018** **Assessment Dates: Feb 7-8, 2018**

Standards

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 AA criterion for two triangles to be similar.

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 … similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Meaning-Making

Understandings
Students will understand that…
- In similar triangles all pairs of corresponding angles are equal and all pairs of corresponding sides are proportional.
- Triangles can be proven similar using AA similarity criterion.
- Similar triangles can be used to prove various theorems and solve problems.
- Similar triangles can be used to model real-world problems.
- Figures are similar if there is a similarity transformation that maps one to the other.

Essential Questions
Students will keep considering…
- How can you prove properties of similar triangles?
- How can similarity transformations be used to explain similarity of triangles?
- How so you determine whether two triangles are similar?

Acquisition

Knowledge
Students will know…

Vocabulary: similar, similarity transformation

- AA Similarity Postulate
- SSS Similarity Theorem
- SAS Similarity Theorem

Skills
Students will be skilled at and able to do the following…
- Explain that in similar triangles, corresponding angles are congruent and corresponding sides are proportional.
- Prove that two triangles are similar using the similarity criteria.
- Prove that a line parallel to one side of a triangle divides the other two proportionally.
- Prove the Pythagorean Theorem using similar triangles.
- Use similar triangles to solve problems.
- Model and solve real-world problems using similar figures.
- Identify similarity transformations.

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Transfer is a student's ability to independently apply understanding in a novel or unfamiliar situation. In mathematics, this requires that students use reasoning and strategy, not merely plug in numbers in a familiar-looking exercise, via a memorized algorithm.

Transfer goals highlight the effective uses of understanding, knowledge, and skills we seek in the long run – that is, what we want students to be able to do when they confront new challenges, both in and outside school, beyond the current lessons and unit. These goals were developed so all students can apply their learning to mathematical or real-world problems while simultaneously engaging in the Standards for Mathematical Practices. In the mathematics classroom, assessment opportunities should reflect student progress towards meeting the transfer goals.

With this in mind, the revised **PUSD transfer goals** are:

1) **Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution.**
2) **Effectively communicate orally, in writing, and by using models (e.g., concrete, representational, abstract) for a given purpose and audience.**
3) **Construct viable arguments and critique the reasoning of others using precise mathematical language.**

Multiple measures will be used to evaluate student acquisition, meaning-making and transfer. Formative and summative assessments play an important role in determining the extent to which students achieve the desired results in stage one.

Formative Assessment	Summative Assessment
Aligning Assessment to Stage One	
- What constitutes evidence of understanding for this lesson? - Through what other evidence during the lesson (e.g. response to questions, observations, journals, etc.) will students demonstrate achievement of the desired results? - How will students reflect upon, self-assess, and set goals for their future learning?	- What evidence must be collected and assessed, given the desired results defined in stage one? - What is evidence of understanding (as opposed to recall)? - Through what task(s) will students demonstrate the desired understandings?
Opportunities	
- Discussions and student presentations - Checking for understanding (using response boards) - Ticket out the door, Cornell note summary, and error analysis *Performance Tasks* within a Unit - Teacher-created assessments/quizzes	- Unit assessments - Teacher-created quizzes and/or mid-unit assessments *Illustrative Mathematics* tasks (https://www.illustrativemathematics.org/) - Performance tasks

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The following pages address how a given skill may be assessed. Assessment guidelines, examples and possible question types have been provided to assist teachers in developing formative and summative assessments that reflect the rigor of the standards. *These exact examples cannot be used for instruction or assessment, but can be modified by teachers.*

Unit Skills	SBAC Targets (DOK)	Standards	Examples
• Explain that in similar triangles, corresponding angles are congruent and corresponding sides are proportional. • Prove that two triangles are similar using the similarity criteria. • Prove that a line parallel to one side of a triangle divides the other two proportionally. • Prove the Pythagorean Theorem using similar triangles. • Use similar triangles to solve problems. • Model and solve real-world problems using similar figures. • Identify similarity transformations.	Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. (3,4) State logical assumptions being used. (2,3) Distinguish correct logic or reasoning from that which is flawed and – if there is a flaw in the argument – explain what it is. (2,3,4) Base arguments on concrete referents such as objects, drawings, diagrams, and actions. (2,3) Determine conditions under which an argument does and does not apply. (3,4)	**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 AA criterion for two triangles to be similar. **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 … similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	**G.SRT.A.3 Item 2** Segments DE, FG, and BC are parallel. Using AA criterion for similarity, solve for measures of segments AE, AG, and AC. 1. The figure shows △ABC ~ △DEF with side lengths as indicated. What is the value of *x*? **G.SRT.B.5 Item 1** Duane wants to know if the following pair of triangles is similar? What criteria can he used to justify his answer?

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Transfer Goals
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3) Construct viable arguments and critique the reasoning of others using precise mathematical language.

Essential Questions:	Standards: G-SRT 2, G-SRT 3, G-SRT 4, G-SRT 5
• How can you prove properties of similar triangles? • How can similarity transformations be used to explain similarity of triangles? • How so you determine whether two triangles are similar?	Suggested Timeframe: 3 weeks/14 days Start Date: January 22, 2018 Assessment Dates: February 7-8, 2018

Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Resources
2 days (Jan. 23-24)	**Lesson 9-7: Similarity Transformations** SMP 1, 2, 3, 4 (pp. 594-600) G-SRT-2	**Focus Questions:** • What does it mean for figures to be similar? **Inquiry Question:** 9-7 Solve It! Pg 594	• Figures are similar if all pairs of corresponding angles are ≅ and the lengths of corresponding sides are proportional • Figures are similar if there is a similarity transformation that maps one to the other.	**Vocabulary:** similar, similarity transformation, dilation **Concepts:** similar figures	• Identify similarity transformations • Graph similarity transformations in the coordinate plane	**Common Core Problems:** **9.7:** #3,4,16,17, 18, 25, 29
1 day (Jan. 25)	**Lesson 7.1: Ratios and Proportions** SMP 1, 3, 4, 6, 7 (pp. 432-438) G-SRT-5	**Focus Question:** • How do you solve a proportion? **Inquiry Question:** 7-1 Solve It! Pg 432	• Students will know how to write and solve a proportion.	**Vocabulary:** ratio, proportion, extended ratio, extremes, means **Concepts:** Cross-Product Property, Properties of Proportions	• Set up and solve proportions • Use ratios to represent quantities and find equivalent ratios	Students may see problems that require them to convert between units **Common Core Problems:** **7-1:** #5,6,7,37, 45, 46, 47, 48

Common Core Practices

☐ Instruction in the Standards for Mathematical Practices   ☐ Use of Manipulatives   ☐ Project-based Learning

☐ Use of Talk Moves   ☐ Use of Technology   ☐ Thinking Maps

☐ Note-taking   ☐ Use of Real-world Scenarios

Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
2 Days (Jan. 26-27)	**Lesson 7-2: Similar Polygons** SMP: 1,3,4,6 (pp. 440-447) **G-SRT 5**	**Focus Question:** • How can you determine if two figures are similar? • How can you find missing side lengths of similar figures? **Inquiry Question:** 7-2 Solve It! Pg 440	• Ratios and proportions can be used to decide whether two polygons are similar and to find unknown side lengths of similar figures.	**Vocabulary:** Scale factor, scale drawing, scale **Concepts:** Similar Polygons	• Use side lengths to decide if given figures are similar. • Write similarity statements with the proper notation. • Find missing side lengths of similar figures.	**Common Core Problems:** 7-2: #5,6,7,32,33,34,36
1 day (Jan. 30)		**Review Lesson 9.7, 7.1, and 7-2 Concepts & Skills** Use Textbook Resources and/or Teacher Created Items				
3 days (Jan. 31, Feb. 1-2)	**Lesson 7-3: Similar Polygons and Triangles** SMP: 1,3,4 (pp. 450-458) **G-SRT 3**, **G-SRT 5**	**Focus Questions:** • How can you prove triangles are similar? **Inquiry Question:** 7-3 Solve It! Pg 450	• Triangles can be proven similar by AA, SAS, and SSS Similarity • Similar triangles can be used to find unknown measurements	**Vocabulary:** Indirect measurement **Concepts:** AA Postulate, SAS Theorem, SSS Theorem	• Use the properties of similarity transformations to establish AA~ criterion for two triangles to be similar. • Prove triangles are similar. • Use indirect measurement to solve problems.	LearnZillion lesson LZ2361 has short video (>3 min) using transformations to establish AA~ www.learnzillion.com **Common Core Problems:** 7.3: #4,5,6,22,29,31,32-35
1 day (Feb. 3)	**Lesson 7-5: Proportions in Triangles** SMP: 1,3,4 (pp. 471-478) **G-SRT 4**	**Focus Questions:** • How can you use similar triangles to show that a line parallel to one side of a triangle divides the other two proportionally? **Inquiry Question:** 7-5 Solve It! Pg 471	• A line parallel to one side of a triangle divides the other two sides proportionally	**Vocabulary/Concepts:** Parallel, corresponding angles, proportion **Concepts:** Side-Splitter Theorem, Corollary to the Side-Splitter Theorem, Triangle-Angle-Bisector Theorem	• Prove the Side-Splitter Theorem (Pg 472) • Use Side-Splitter Theorem to solve problems.	**Common Core Problems:** 7.5: #6,7,8,23, 36, 37, 42, 43, 46, 47

Common Core Practices

☐ Instruction in the Standards for Mathematical Practices
☐ Use of Talk Moves
☐ Note-taking

☐ Use of Manipulatives
☐ Use of Technology
☐ Use of Real-world Scenarios

☐ Project-based Learning
☐ Thinking Maps

Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
2 Days (Feb. 6-7)	**Review Topic 6 Concepts & Skills** Use Textbook Resources and/or Teacher Created Items					
2 Days (Feb. 8-9)	**Topic 6 Assessment** (Created and provided by PUSD)					

Common Core Practices

☐ Instruction in the Standards for Mathematical Practices   ☐ Use of Manipulatives   ☐ Project-based Learning

☐ Use of Talk Moves   ☐ Use of Technology   ☐ Thinking Maps

☐ Note-taking   ☐ Use of Real-world Scenarios

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