Similarity
Topic 2 Overview

How is *Similarity* organized?

In this topic, students investigate the fourth common transformation: dilation. They make connections between scale factors and dilation factors by examining worked examples of Euclidean dilations. They then define similar figures. Students dilate figures on the coordinate plane and generalize the coordinates of images formed from a dilation with a center at the origin. Throughout the topic, students relate dilations to scale factors and scaling up and down. Finally, students use dilations to map from a figure onto a similar figure, eventually verifying that two figures are similar by identifying a sequence of transformations that map one figure onto the other.

What is the entry point for students?

This topic connects students' prior knowledge of scale drawings with similarity. Students first review content about scale factors and determine that, after an enlargement or reduction, the ratios of corresponding side lengths are equal and the corresponding angles have the same measure. They use this prior knowledge to define the term *similar*. Students also connect any experience they have with enlarging and reducing images in common software programs to dilations and similarity.

How does a student demonstrate understanding?

Students will demonstrate understanding of the standards in this topic if they can:

- Define and identify dilations and similar figures.
- Identify the scale factor of a dilation.
- Dilate geometric figures on the coordinate plane with the origin as the center of the dilation.
- Describe the changes to the *x*- and *y*-coordinates of a figure after a dilation, including the use of an algebraic representation.
- Identify corresponding sides and corresponding angles of similar figures.
- Generalize that ratios of corresponding sides of similar figures are proportional and their corresponding angles are congruent.
- Explain how transformations can be used to prove that two figures are similar.
- Describe a sequence of transformations that determines whether two figures are similar.

Why is *Similarity* important?

Similarity continues the study of transformations, but with a transformation that preserves shape without preserving size. With dilations, students learn that similar figures have the same shape

and congruent angles, but proportional corresponding sides. The properties of similar figures are useful for solving real-world problems about scale factors. Similar triangles will also be used frequently in the next module to explain why the slope of a non-vertical line is the same between any two points. Because students will use similar triangles to develop an understanding of slope, students are expected to develop a strong understanding of similarity and properties of similar figures. In high school, students will continue to formalize their knowledge of similarity and use similarity to prove theorems about triangles and develop trigonometric ratios.

How do the activities in *Similarity* promote student expertise in the mathematical process standards?

All Carnegie Learning topics are written with the goal of creating mathematical thinkers who are active participants in class discourse, so elements of the mathematical process standards should be evident in all lessons. Students are expected to make sense of problems and work toward solutions, reason using concrete and abstract ideas, and communicate their thinking while providing a critical ear to the thinking of others.

As in the previous topic, the standards of this topic link directly to the process standards of reasoning about mathematics, making and testing conjectures, generalizing patterns, and practicing precision. After sufficient work with dilations with a center at the origin on the coordinate plane, students make generalizations about the coordinates of the images of a dilation. They use reasoning to make, test, and verify conjectures about similar figures. Students must analyze the structure of two figures to determine how specific sequences and order of transformations map from one figure onto a similar figure.

Materials Needed

- Centimeter ruler
- Protractor
- Patty paper

Learning Together

ELPS: 1.A, 1.C, 1.E, 1.F, 1.G, 2.C, 2.E, 2.I, 3.D, 3.E, 4.B, 4.C, 5.B, 5.F, 5.G

Lesson	Lesson Name	TEKS	Days	Highlights
1	Pinch-Zoom Geometry: Dilations of Figures	8.3A 8.10A	2	Students explore dilations on the plane. The terms *dilations, center of dilation, scale factor* or *dilation factor, enlargement,* and *reduction* are defined. Students dilate a variety of objects and figures using scale factors greater than and less than 1. They use a model to determine side lenths and angle measures after enlargements and reductions in order to verify similarity. Students connect dilations to changing image sizes in word processing and graphics software.
2	Running, Rising, Stepping, Scaling: Dilating Figures on the Coordinate Plane	8.3B 8.3C 8.10B 8.10D	2	Students build dilations on the coordinate plane as repeated geometric translations, using the origin as the center of dilation. Throughout, students create and modify conjectures about the effect of dilations with the origin as the center on the coorindates, perimeter, and area of a figure. They use dilations and transformations they learned previously to verify that two figures are similar.
3	From Here to There: Mapping Similar Figures Using Transformations	8.3C 8.10A 8.10B 8.10C	2	Students determine if figures are similar through transformations. They explore what is meant by "same shape" when referring to similar figures. Students determine similarity using a single dilation and verify similarity of a variety of figures through a sequence of transformations. They then explore the relationship between images of a common pre-image under different conditions and the relationship between figures that are similar. Finally, students summarize the relationships between transformations and congruent and similar figures.

Suggested Topic Plan

*1 Day Pacing = 45 min. Session

Day 1	Day 2	Day 3	Day 4	Day 5
TEKS: 8.3A, 8.10A **LESSON 1** **Pinch-Zoom Geometry** GETTING STARTED ACTIVITY 1	**LESSON 1** continued ACTIVITY 2 ACTIVITY 3 TALK THE TALK	TEKS: 8.3B, 8.3C, 8.10B, 8.10D **LESSON 2** **Running, Rising, Stepping, Scaling** GETTING STARTED ACTIVITY 1	**LESSON 2** continued ACTIVITY 2 TALK THE TALK	TEKS: 8.3C, 8.10A, 8.10B, 8.10C **LESSON 3** **From Here to There** GETTING STARTED ACTIVITY 1 ACTIVITY 2
Day 6	**Day 7**			
LESSON 3 continued ACTIVITY 3 TALK THE TALK	**END OF TOPIC ASSESSMENT**			

Assessments

There is one assessment aligned to this topic: End of Topic Assessment.