

# Module 3: Investigating Proportionality

## TOPIC 1: SIMILARITY

This topic begins with a review of what students already know about dilations from their experience in middle school. Students relate dilating figures to the familiar “pinch and zoom” feature that touchscreen technology uses to enlarge and reduce images while maintaining ratios of the dimensions. They learn that dilations are non-rigid motion transformations that preserve shape but not necessarily size, and that triangle similarity can be proven using as few as two or three pairs of corresponding parts. With a repertoire of triangle proportionality theorems to use, students solve indirect measurement problems using similarity and right triangles.

## Where have we been?

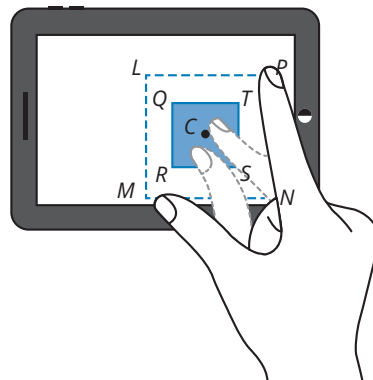
In middle school, students developed their understanding of proportional reasoning through explorations of multiplicative relationships. Students have used scale factors to solve problems. They have informally investigated dilations, describing their effect on two-dimensional figures using coordinates, and they have learned that two figures are similar if one can be mapped onto the other by a sequence of rotations, reflections, translations, and dilations.

## Where are we going?

Understanding similarity further develops proportional reasoning, which began in grade 6 and continues throughout high school mathematics. It provides the opportunity for students to connect spatial and numeric reasoning and lays the groundwork for understanding trigonometric ratios, which students will explore in the next topic.

## Dilating to Create Similar Figures

A dilation can produce an enlargement, a reduction, or a congruent figure. For example, when you pinch and zoom on a tablet computer, you can create dilations.



## Puppet Masters

Making hand shadow puppets has a long history, which goes back to ancient China and India. Before the invention of television, or even radio, hand shadows were used to entertain people by telling stories.

Today, you can find tutorials online that will show you how to create really complicated and interesting shadow puppets.

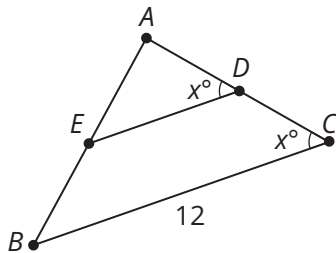
Groups of people can get together and create entire landscapes and scenes—all with the shadows made by their hands!



## Talking Points

It can be helpful to understand geometric similarity for college admissions tests.

Here is an example of a sample question:



**In the figure above, if  $AE = EB$ , what is the length of  $\overline{ED}$ ?**

You can notice that corresponding angles are congruent, so  $\overline{ED}$  and  $\overline{BC}$  are parallel. Since  $AE = EB$  and  $\overline{ED}$  and  $\overline{BC}$  are parallel, line segment  $ED$  is a midsegment of  $\triangle ABC$ . Since it is a midsegment, the Triangle Midsegment Theorem tells us that it is half the length of  $\overline{BC}$ . So,  $m\overline{ED} = 6$ .

## Key Terms

### Triangle Proportionality Theorem

The Triangle Proportionality Theorem states that if a line parallel to one side of a triangle intersects the other two sides, then it divides the two sides proportionally.

### Triangle Midsegment Theorem

The Triangle Midsegment Theorem states that the midsegment of a triangle is parallel to the third side of the triangle and is half the measure of the third side of the triangle.

### indirect measurement

Indirect measurement is a technique that uses proportions to determine measurements.