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# On Core Mathematics

Geometry

- Provides instruction for all Common Core State Standards
- Deepens understanding through real-world applications
- Promotes interest through interactive learning

**COMMON  
CORE**

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# Similarity

**Essential question:** *What does it mean for two figures to be similar?*

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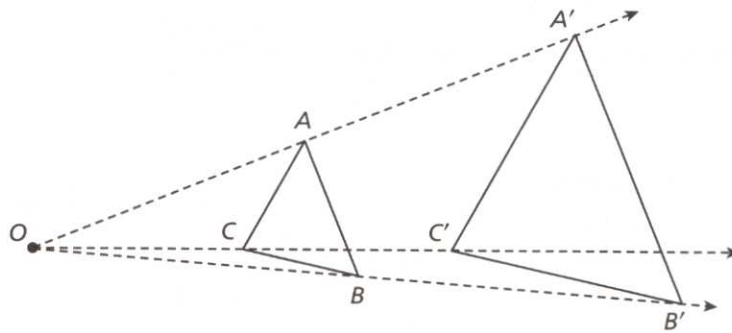
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## 1 ENGAGE Introducing Similarity

A **similarity transformation** is a transformation in which the image has the same shape as the pre-image. Specifically, the similarity transformations are the rigid motions (reflections, translations, and rotations) as well as dilations.

Two plane figures are **similar** if and only if one can be obtained from the other by similarity transformations (that is, by a sequence of reflections, translations, rotations, and/or dilations).

The symbol for similar is  $\sim$ . As with congruence, it is customary to write a similarity statement so that corresponding vertices of the figures are listed in the same order. In the figure below,  $\triangle A'B'C'$  is the image of  $\triangle ABC$  after a dilation with center  $O$  and scale factor 2. Since a dilation is a similarity transformation, the two triangles are similar and you write  $\triangle ABC \sim \triangle A'B'C'$ .



### REFLECT

**1a.** Explain why congruence can be considered a special case of similarity.

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**1b.** If you know that two figures are similar, can you conclude that corresponding angles are congruent? Why or why not?

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**1c.** Given that  $\triangle RST \sim \triangle R'S'T'$ , can you conclude that  $\overline{RS} \cong \overline{R'S'}$ ? Explain.

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# Similarity and Triangles

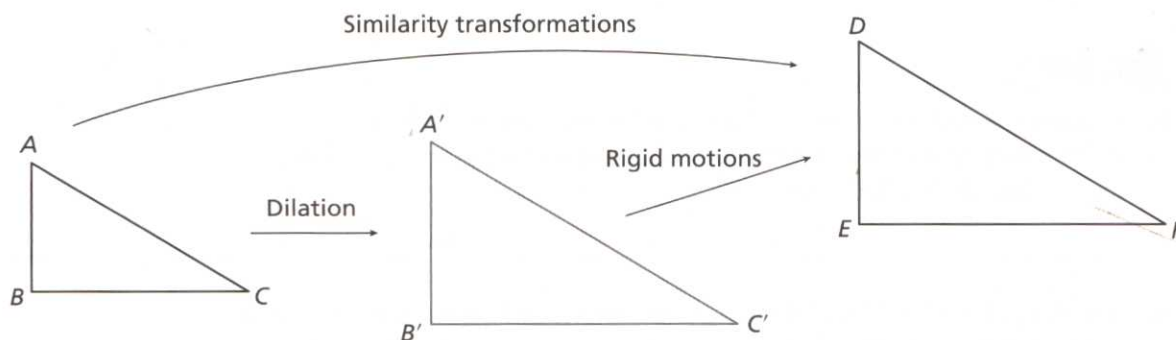
**Essential question:** *What can you conclude about similar triangles and how can you prove triangles are similar?*

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## 1 ENGAGE Applying Similarity to Triangles

Recall that when two figures are similar, there is a sequence of similarity transformations that maps one figure to the other. In particular, given  $\triangle ABC \sim \triangle DEF$ , you can first apply a dilation to  $\triangle ABC$  to make both triangles the same size. Then you can apply a sequence of rigid motions to the dilated image of  $\triangle ABC$  to map it to  $\triangle DEF$ .



Because the similarity transformations that map  $\triangle ABC$  to  $\triangle DEF$  preserve angle measure, you can say that corresponding angles are congruent. Thus,  $\triangle ABC \sim \triangle DEF$  implies  $\angle A \cong \angle D$ ,  $\angle B \cong \angle E$ , and  $\angle C \cong \angle F$ .

Also, the initial dilation that makes the two triangles the same size shows that each side of  $\triangle DEF$  is longer or shorter than the corresponding side of  $\triangle ABC$  by the ratio given by the scale factor. Assuming the dilation has scale factor  $k$ , this means that  $DE = k \cdot AB$ ,  $EF = k \cdot BC$ , and  $DF = k \cdot AC$ .

Solving for  $k$  in these equations gives  $k = \frac{DE}{AB}$ ,  $k = \frac{EF}{BC}$ , and  $k = \frac{DF}{AC}$ .

This shows that corresponding sides are proportional. That is,  $\frac{DE}{AB} = \frac{EF}{BC} = \frac{DF}{AC}$ .

### REFLECT

- 1a.** Is triangle similarity transitive? That is, if  $\triangle ABC \sim \triangle DEF$  and  $\triangle DEF \sim \triangle GHK$ , can you conclude that  $\triangle ABC \sim \triangle GHK$ ? Explain.

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