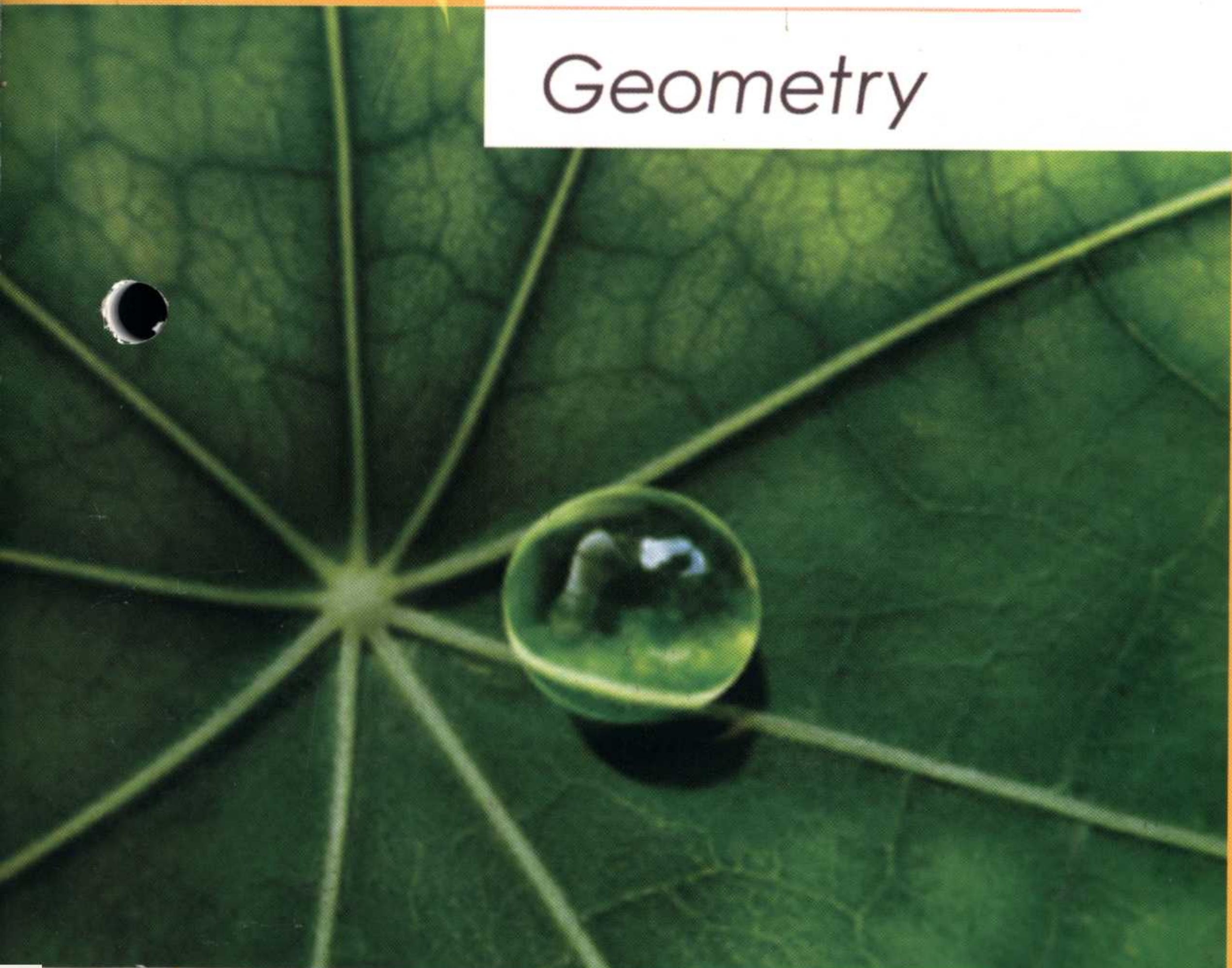
Houghton Mifflin Harcourt

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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Name ______________________ Class ______________ Date __________

5-3

Similarity

COMMON CORE

CC.9-12.G.SRT.2, CC.9-12.G.C.1

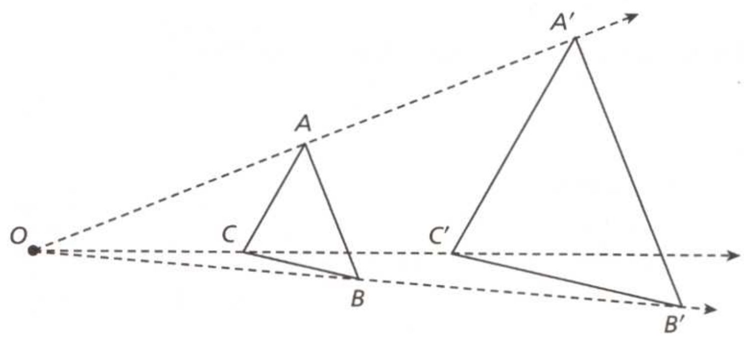
Essential question: *What does it mean for two figures to be similar?*

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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Name ______________ Class __________ Date __________

5-4

Similarity and Triangles

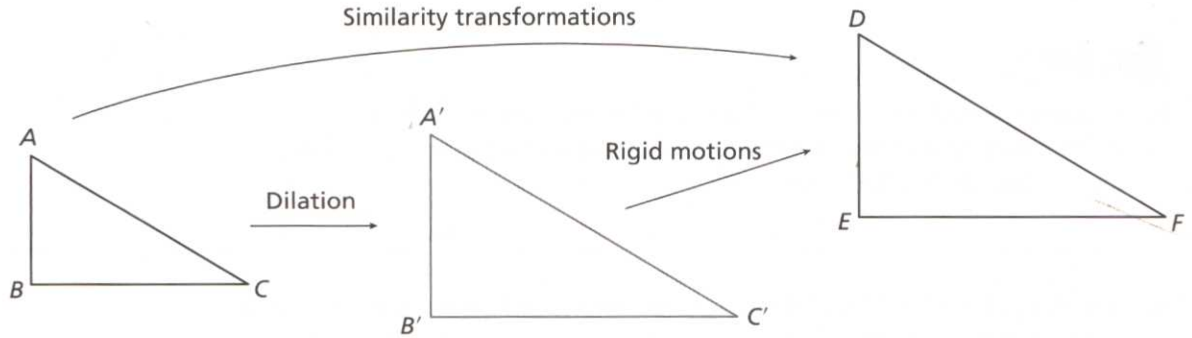
COMMON CORE

CC.9-12.G.SRT.2, CC.9-12.G.SRT.3

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

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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