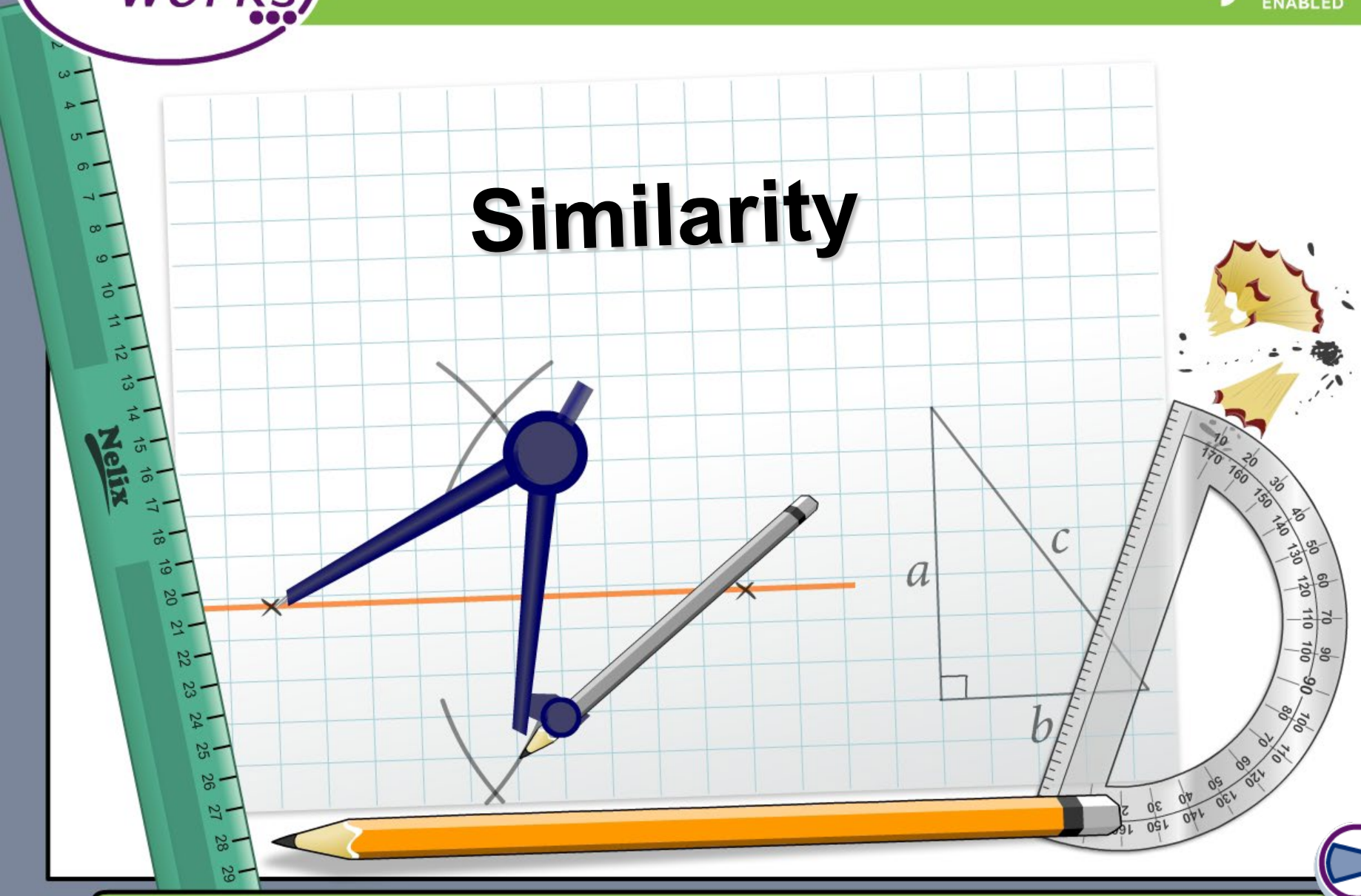
Similarity



Information

Common core icons

This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.

Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

These are:

1) Make sense of problems and persevere in solving them.

2) Reason abstractly and quantitatively.

3) Construct viable arguments and critique the reasoning of others.

4) Model with mathematics.

5) Use appropriate tools strategically.

6) Attend to precision.

7) Look for and make use of structure.

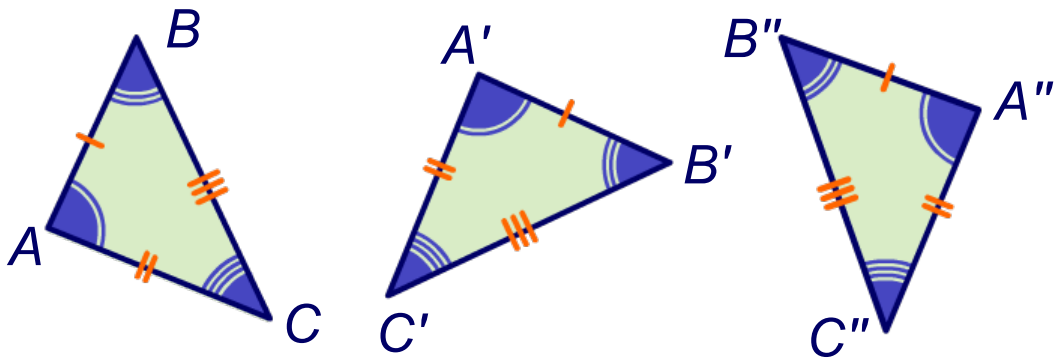
8) Look for and express regularity in repeated reasoning.

This icon indicates that the slide contains activities created in Flash. These activities are not editable.

This icon indicates teacher's notes in the Notes field.

Congruence vs. similarity

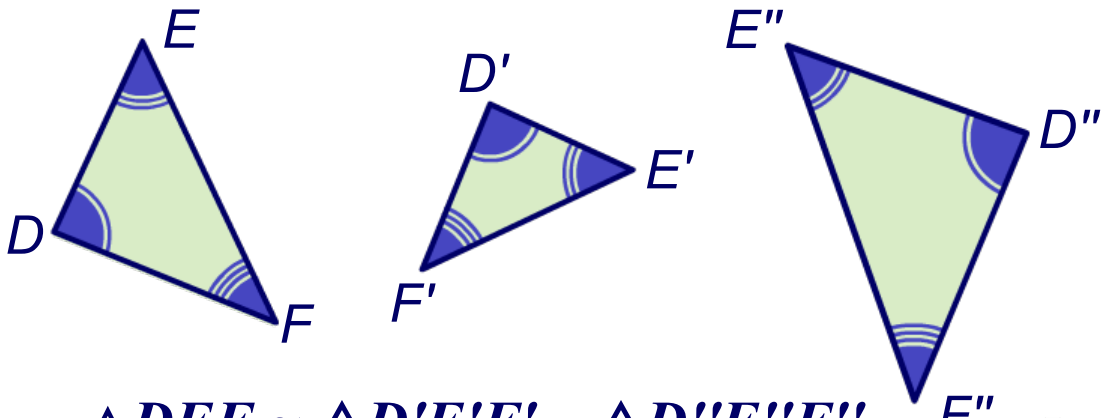
Remember that **congruent** figures are identical in both shape and size.



$\triangle ABC \cong \triangle A'B'C' \cong \triangle A''B''C''$

Two figures are called **similar** if they have the same shape, but not necessarily the same size.

Similar figures are indicated using ~ .

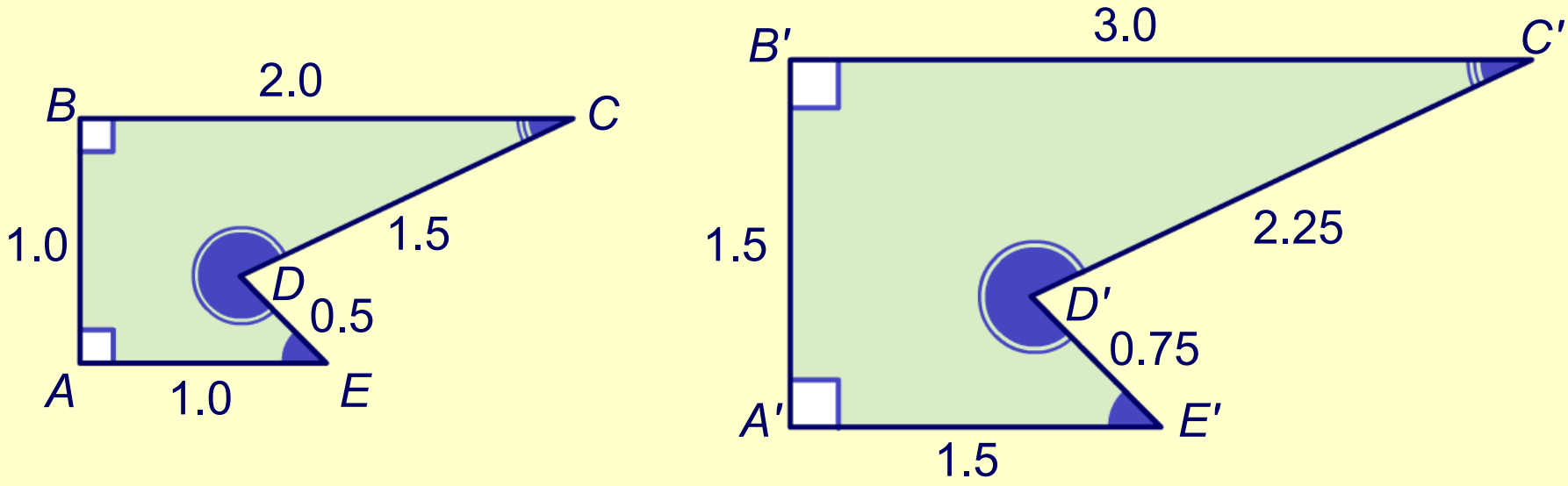


$\triangle DEF \sim \triangle D'E'F' \sim \triangle D''E''F''$

Dilation

A **dilation** changes the size of a figure, but not its shape.

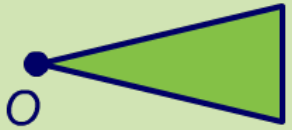
What observations can you make about the relationship between figures $ABCDE$ and $A'B'C'D'E'$?



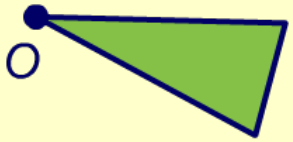
- The lengths of the sides of $A'B'C'D'E'$ are 1.5 times the length of the corresponding sides of $ABCDE$. 1.5 is called the **scale factor**.
- Corresponding angles are the same in both figures.

Similarity transformations

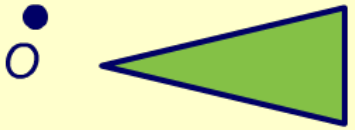
Does each of these transformations preserve similarity?



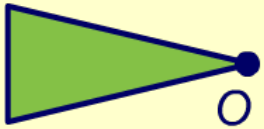
rotation ✓



translation ✓

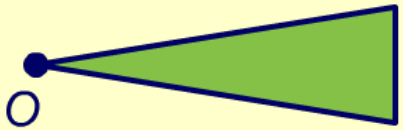


reflection ✓

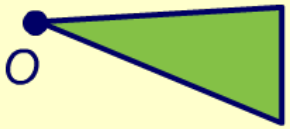


dilation ✓

stretch ✗



shear ✗



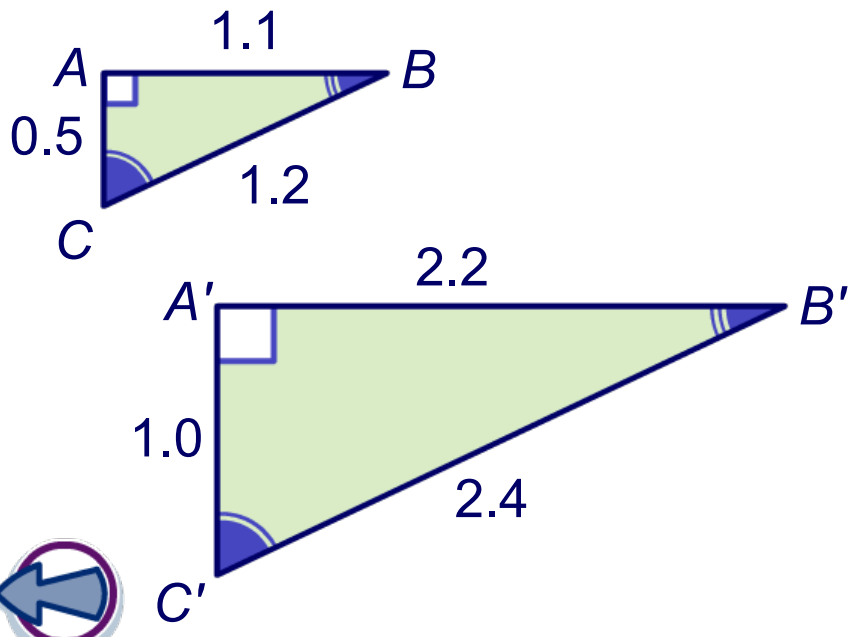
These are called **similarity transformations**.

Similarity ratio

The **similarity ratio** between two similar figures is the ratio of any pair of corresponding lengths on the figures.

$$\textit{similarity ratio} = \frac{\textit{length on dilated image}}{\textit{corresponding length on pre-image}}$$

What is the similarity ratio for this dilation?



$$\textit{sim. ratio} = \frac{A'B'}{AB} = \frac{B'C'}{BC} = \frac{A'C'}{AC}$$

substitute values:

$$\textit{sim. ratio} = \frac{2.2}{1.1} = \frac{2.4}{1.2} = \frac{1.0}{0.5}$$

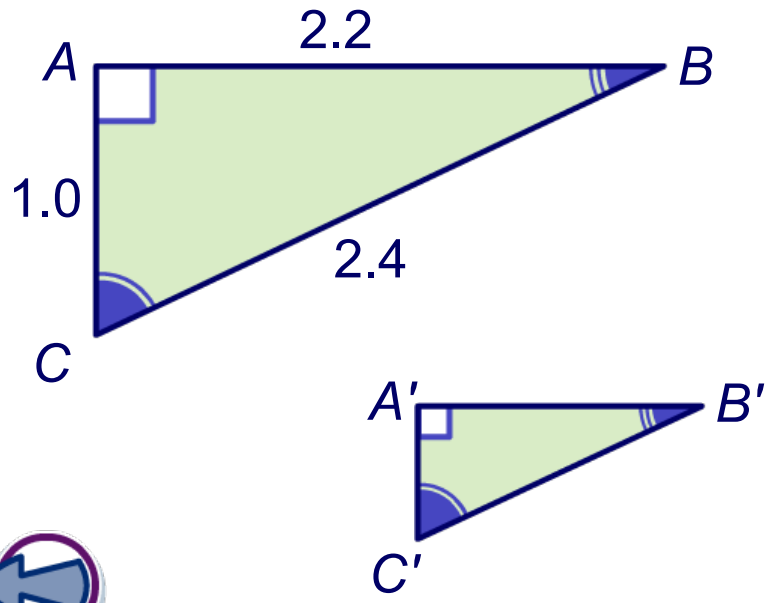
$$= \frac{2}{1} = 2$$

Scale factors between 0 and 1

What happens when the scale factor for a dilation is between 0 and 1?

When the scale factor is between 0 and 1, the dilation will be smaller than the original object.

These figures have similarity ratio ½. What is $B'C'$?



$$similarity\ ratio = \frac{B'C'}{BC}$$

substitute values:

$$\tfrac{1}{2} = \frac{B'C'}{BC} = \frac{B'C'}{2.4}$$

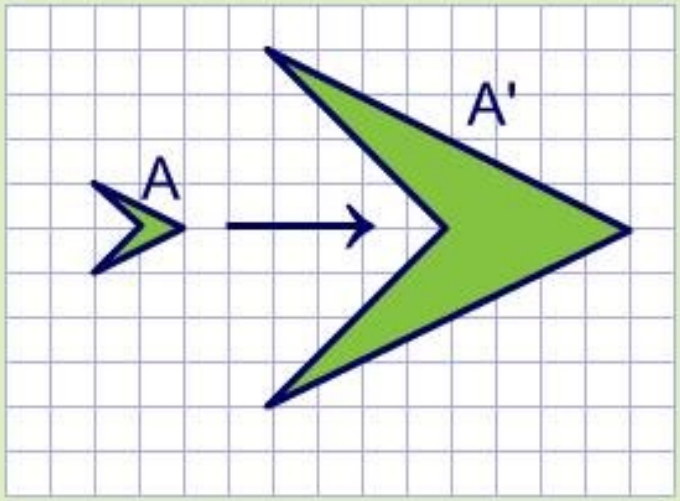
solve for $B'C'$:

$$B'C' = \tfrac{1}{2} \times 2.4 = \mathbf{1.2}$$

Find the similarity ratio

What is the similarity ratio?

Question: 1/6



Type the similarity ratio between A' and A as a decimal on the dotted line below.

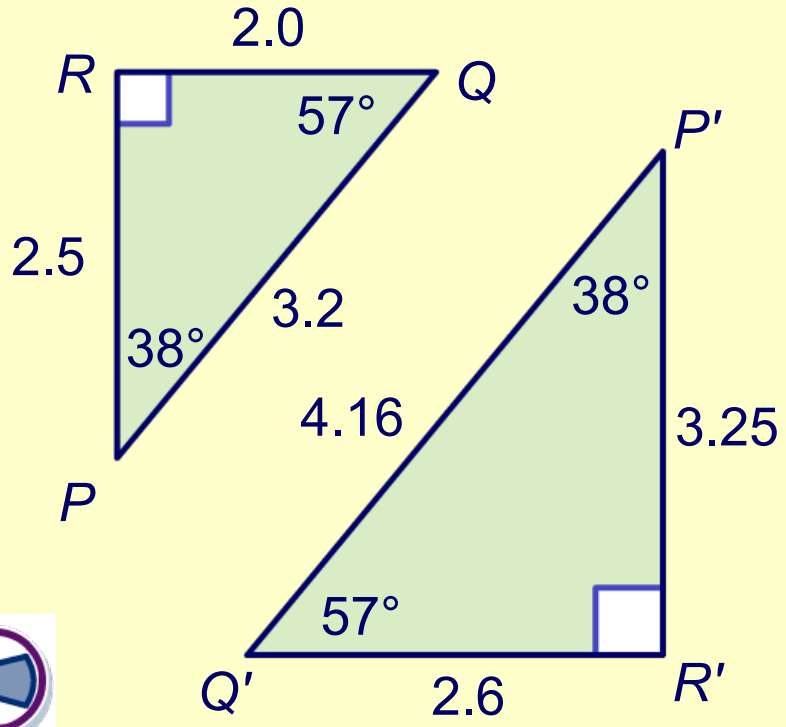
_____

Proving shapes similar

To prove shapes similar, it must be shown that the figures are related by similarity transformations.

What are two ways you can prove two polygons similar?

by similarity transformations: $P'Q'R'$ is PQR rotated by 180° and dilated by 13/10, so they are similar.



by proving corresponding angles congruent and corresponding lengths to be the same ratio:

$$\frac{P'Q'}{PQ} = \frac{Q'R'}{QR} = \frac{R'P'}{RP} = 13/10$$

$$m\angle P = m\angle P' \Rightarrow \angle P \cong \angle P'$$
$$m\angle Q = m\angle Q' \Rightarrow \angle Q \cong \angle Q'$$
$$m\angle R = m\angle R' \Rightarrow \angle R \cong \angle R'$$

Similar shapes

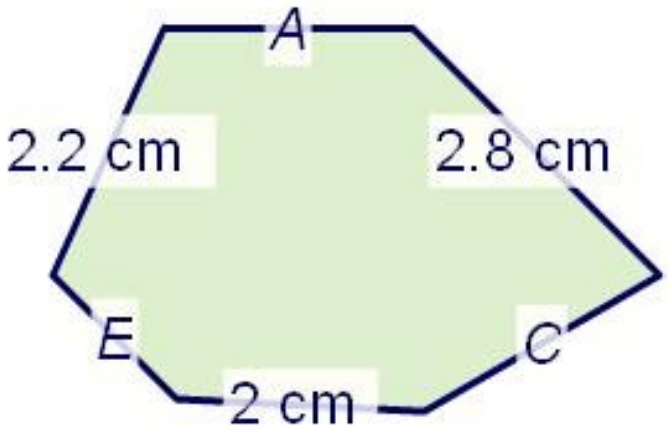
Are these sets of shapes always similar?

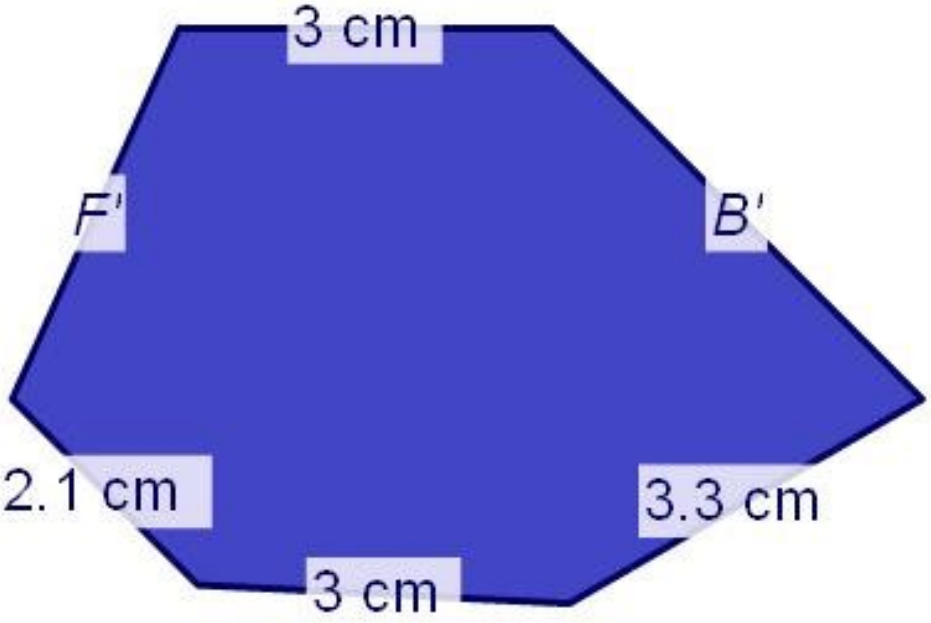
always similar	not always similar

any two squares

Finding lengths in two similar shapes

Find the scale factor and missing side lengths using similarity.





scale factor

Summary activity

Question: 1/5

Draw a triangle that includes the height of the cactus and the length of the shadow.

show answer