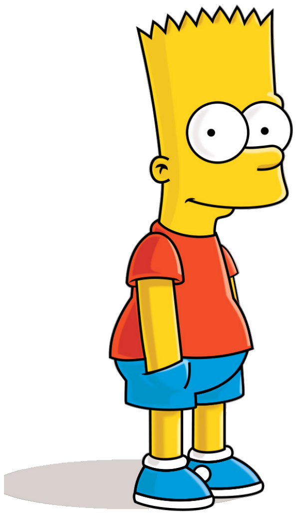
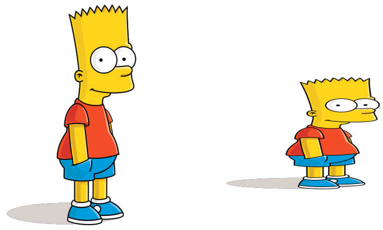
# 8.1: Similar Polygons

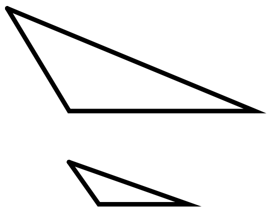
## Essential Question

***How are similar polygons related?***



Which Bart Simpson is similar to the other?





**Solve the proportion.**

**1.** $\frac{x}{4} = \frac{3}{8}$

**2.** $\frac{12}{x} = \frac{3}{5}$

**3.** $\frac{x}{9} = \frac{1}{x}$

**4.** $\frac{x+3}{2} = \frac{3}{5}$

**5.** $\frac{4-x}{12} = \frac{3}{-7}$

**6.** $\frac{1}{2x+1} = \frac{x-3}{9}$

## Core Concept

### Corresponding Parts of Similar Polygons

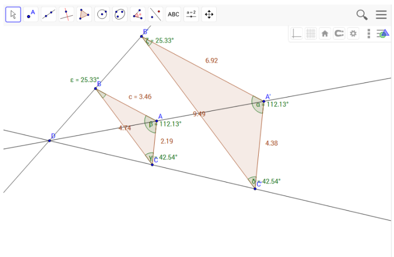
In the diagram below, $\triangle ABC$ is similar to $\triangle DEF$. You can write "$\triangle ABC$ is similar to $\triangle DEF$" as $\triangle ABC \sim \triangle DEF$. A similarity transformation preserves angle measure. So, corresponding angles are congruent. A similarity transformation also enlarges or reduces side lengths by a scale factor $k$. So, corresponding side lengths are proportional.


**Corresponding angles**

$\angle A \cong \angle D$, $\angle B \cong \angle E$, $\angle C \cong \angle F$

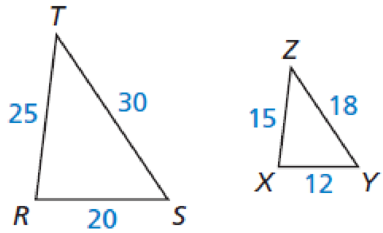
**Ratios of corresponding side lengths**

$$\frac{DE}{AB} = \frac{EF}{BC} = \frac{FD}{CA} = k$$



In the diagram, $\triangle RST \sim \triangle XYZ$.

**a.** Find the scale factor from $\triangle RST$ to $\triangle XYZ$.




**b.** List all pairs of congruent angles.

**c.** Write the ratios of the corresponding side lengths in a *statement of proportionality.*

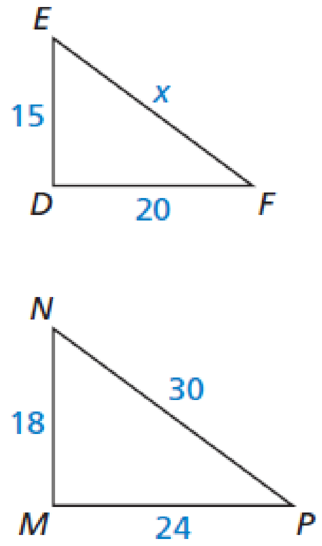
## Core Concept

**Corresponding Lengths in Similar Polygons**

If two polygons are similar, then the ratio of any two corresponding lengths in the polygons is equal to the scale factor of the similar polygons.

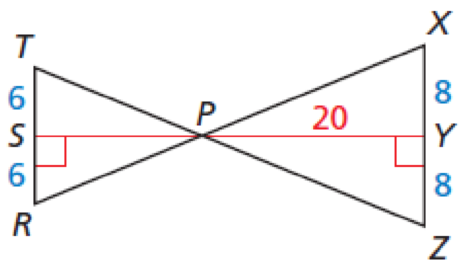
In the diagram, $\triangle DEF \sim \triangle MNP$.

Find the value of $x$.

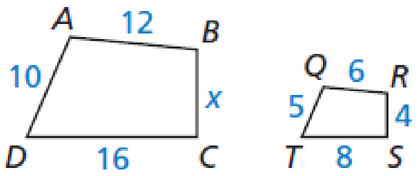



In the diagram, $\triangle TPR \sim \triangle XPZ$.

Find the length of the altitude $\overline{PS}$.

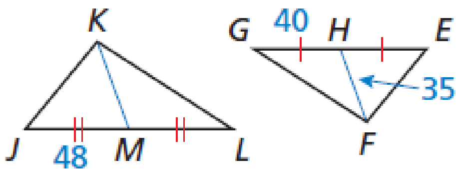


**2.** Find the value of *x*.




$ABCD \sim QRST$

**3.** Find *KM*.

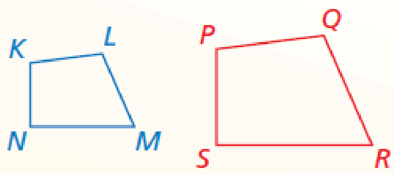



$\triangle JKL \sim \triangle EFG$

## Theorem

**Theorem 8.1 Perimeters of Similar Polygons**

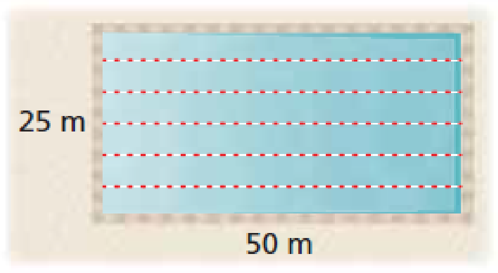
If two polygons are similar, then the ratio of their perimeters is equal to the ratios of their corresponding side lengths.



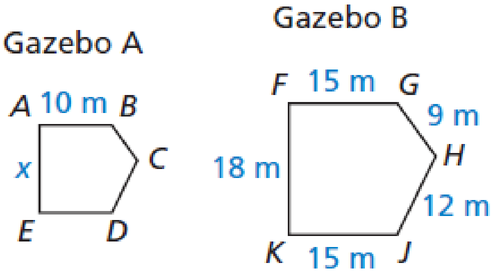

If $KLMN \sim PQRS$, then $\dfrac{PQ + QR + RS + SP}{KL + LM + MN + NK} = \dfrac{PQ}{KL} = \dfrac{QR}{LM} = \dfrac{RS}{MN} = \dfrac{SP}{NK}$.

*Proof* Ex. 52, p. 426; *BigIdeasMath.com*

A town plans to build a new swimming pool. An Olympic pool is rectangular with a length of 50 meters and a width of 25 meters. The new pool will be similar in shape to an Olympic pool but will have a length of 40 meters. Find the perimeters of an Olympic pool and the new pool.



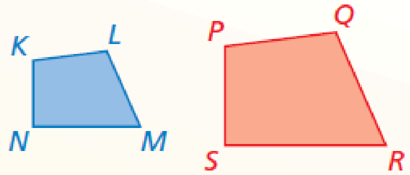

**4.** The two gazebos shown are similar pentagons. Find the perimeter of Gazebo A.



## Theorem

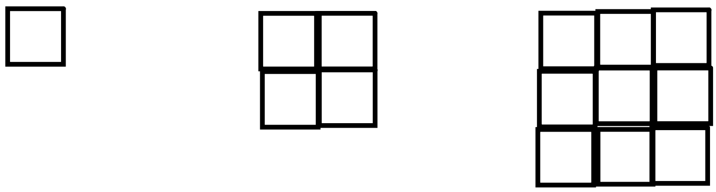
**Theorem 8.2 Areas of Similar Polygons**

If two polygons are similar, then the ratio of their areas is equal to the squares of the ratios of their corresponding side lengths.

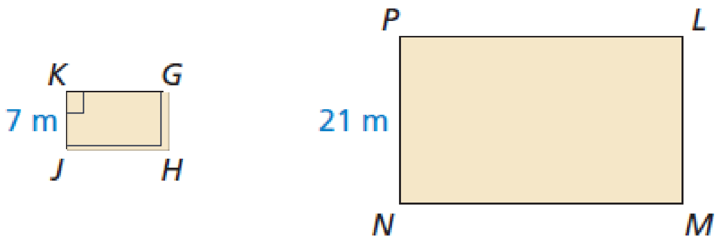



If $KLMN \sim PQRS$, then $\dfrac{\text{Area of } PQRS}{\text{Area of } KLMN} = \left(\dfrac{PQ}{KL}\right)^2 = \left(\dfrac{QR}{LM}\right)^2 = \left(\dfrac{RS}{MN}\right)^2 = \left(\dfrac{SP}{NK}\right)^2.$

*Proof* Ex. 53, p. 426; *BigIdeasMath.com*

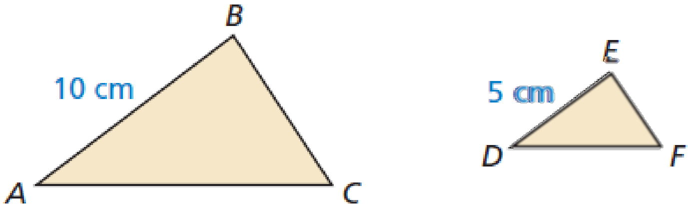


**5.** In the diagram, $GHJK \sim LMNP$. Find the area of $LMNP$.




Area of $GHJK$ = 84 $m^2$

In the diagram, $\triangle ABC \sim \triangle DEF$. Find the area of $\triangle DEF$.




Area of $\triangle ABC = 36\text{ cm}^2$

Decide whether *ABCDE* and *KLQRP* are similar. Explain your reasoning.