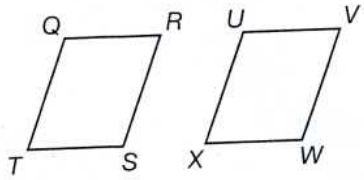
Lesson

10 Similar Figures

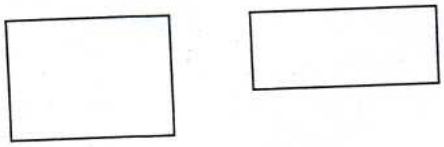
MA.7.A.1.3

Getting the Idea

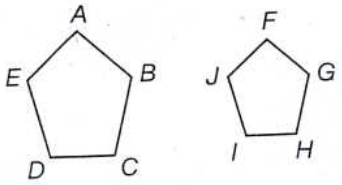
Figures that have the same shape and size are **congruent**. Figures that have the same shape but have different sizes are **similar**. All congruent figures are also similar. It does not matter if the figures have been turned or flipped. Parallelograms *QRST* and *UVWX* below are congruent because they have the same shape and size.



Similar figures have congruent angle measures, but having congruent angle measures does not necessarily make figures similar. For example, these two rectangles are not similar because they have different shapes.



The sides of similar figures are proportional. The ratio between **corresponding sides** of similar figures is equal. Pentagons *ABCDE* and *FGHIJ* below are similar because they have the same shape but different sizes. Their **corresponding angles** are congruent. The symbol ≅ means congruent. For these two similar pentagons, $\angle A \cong \angle F$, $\angle B \cong \angle G$, $\angle C \cong \angle H$, $\angle D \cong \angle I$, and $\angle E \cong \angle J$.



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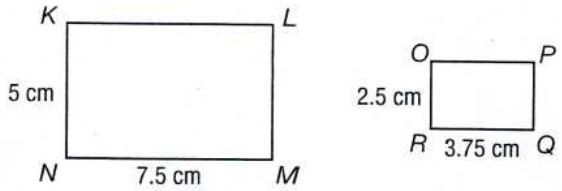
EXAMPLE 1

Are rectangles *KLMN* and *OPQR* similar?



STRATEGY **Determine if the rectangles' corresponding sides have the same ratio.**

STEP 1 Check the corresponding lengths.

$7.5 \div 3.75 = 2$

The length of *KLMN* is twice the length of *OPQR*.

STEP 2 Check the corresponding widths.

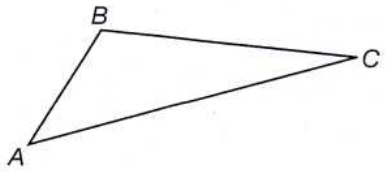
$5 \div 2.5 = 2$

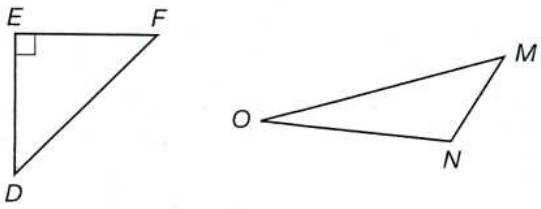
The width of *KLMN* is twice the width of *OPQR*.

SOLUTION **The rectangles are similar.**

EXAMPLE 2

Which triangle is similar to $\triangle ABC$?





STRATEGY **Compare the triangles with $\triangle ABC$.**

STEP 1 Think about the properties of similar figures.

Similar figures are the same shape but not necessarily the same size

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STEP 2 Look at triangle *DEF*.

$\triangle DEF$ is not the same shape. $\triangle DEF$ has different angle measures.

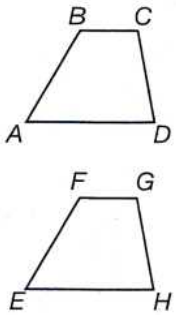
STEP 3 Look at triangle *MNO*.

$\triangle MNO$ appears to be a smaller triangle and a rotation of $\triangle ABC$.

SOLUTION **$\triangle MNO$ is similar to $\triangle ABC$.**

EXAMPLE 3

These two quadrilaterals are similar. If $\angle A$ has a measure of 60°, what is the measure of $\angle E$?



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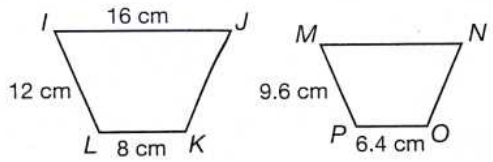
EXAMPLE 4

Trapezoid *IJKL* is similar to trapezoid *MNOP*. What is the length of $\overline{MN}$?



STRATEGY **Find the ratio between two known corresponding sides. Then write a proportion.**

STEP 1 Pick corresponding sides in which the side lengths are known.

The length of $\overline{KL}$ is 8 cm.

The length of $\overline{OP}$ is 6.4 cm.

STEP 2 Write a proportion using the known side lengths and the corresponding side to $\overline{MN}$.

$$\frac{8}{6.4} = \frac{16}{x}$$

STEP 3 Cross-multiply.

$$8 \times x = 6.4 \times 16$$

$$8x = 102.4$$

STEP 4 Divide by 8 to isolate the variable.

$$\frac{8x}{8} = \frac{102.4}{8}$$

$$x = 12.8$$

SOLUTION **The length of $\overline{MN}$ is 12.8 cm.**

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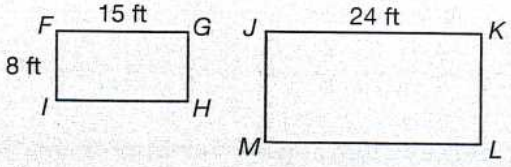
COACHED EXAMPLE

Rectangles *FGHI* and *JKLM* are similar.



What is the length of $\overline{JM}$?

THINKING IT THROUGH

Side _____ corresponds to $\overline{JM}$.

The length of that side is _____.

Write a proportion to find the length of $\overline{JM}$. _____ = _____

Cross-multiply.

_____ × _____ = _____ × _____

_____ = _____

Divide both sides of the equation by _____ to isolate the variable.

The length of $\overline{JM}$ is _____.