Name ____________________ Date ____________

LESSON 11.3

Study Guide

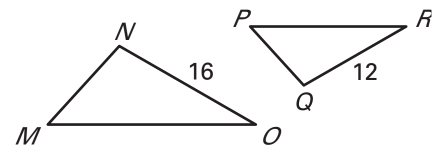
For use with pages 737–743

GOAL **Use ratios to find areas of similar figures.**

> **Vocabulary**
>
> **Theorem 11.7 Areas of Similar Polygons:** If two polygons are similar with the lengths of corresponding sides in the ratio $a:b$, then the ratio of their areas is $a^2:b^2$.

EXAMPLE 1 Find ratios of similar polygons

In the diagram, $\triangle MNO \sim \triangle PQR$. Find the ratio ($\triangle MNO$ to $\triangle PQR$) of the perimeters and the ratio ($\triangle MNO$ to $\triangle PQR$) of the areas.



Solution

The ratio of the lengths of corresponding sides is $\frac{16}{12} = \frac{4}{3}$, or $4:3$.

By Theorem 6.1 on page 374, the ratio of the perimeters is $4:3$.

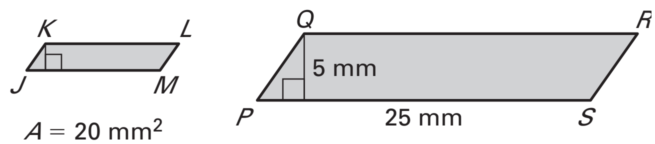
By Theorem 11.7, the ratio of the areas is $4^2:3^2$, or $16:9$.

Exercise for Example 1

1. The perimeter of $\triangle ABC$ is 24 feet, and its area is 24 square feet. The perimeter of $\triangle JKL$ is 36 feet. Given $\triangle ABC \sim \triangle JKL$, find the ratio of the area of $\triangle ABC$ to the area of $\triangle JKL$. Then find the area of $\triangle JKL$.

EXAMPLE 2 Use a ratio of areas

In the diagram, $\square JKLM \sim \square PQRS$. Find the height of $\square JLKM$.



Solution

The area of $\square PQRS$ is $A = (25)(5) = 125 \text{ mm}^2$. Then use Theorem 11.7. If the area ratio is $a^2:b^2$, then the length ratio is $a:b$.

$\frac{\text{Area of } JKLM}{\text{Area of } PQRS} = \frac{20}{125} = \frac{4}{25}$ Write ratio of known areas. Then simplify.

$\frac{\text{Length in } JKLM}{\text{Length in } PQRS} = \frac{2}{5}$ Find square root of area ratio.

Any length in $\square JKLM$ is $\frac{2}{5}$, or 0.4, of the corresponding length in $\square PQRS$.

So, the height of $\square JKLM$ *is* $0.4(5 \text{ mm}) = 2 \text{ mm}$.

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LESSON 11.3

Study Guide *continued*

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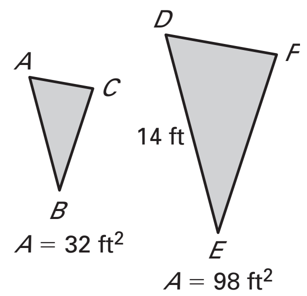
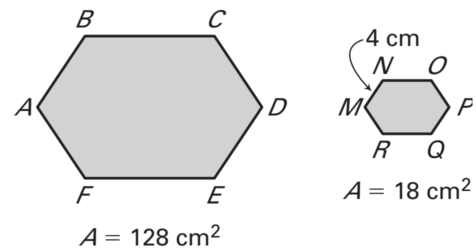
Exercises for Example 2

Use the given area to find *AB*.

2. $\triangle ABC \sim \triangle DEF$



3. $ABCDEF \sim MNOPQR$



EXAMPLE 3

Solve a multi-step problem

Hexagons Regular hexagon I has a side length of 5 feet and an area of about 65 square feet. Regular hexagon II has a perimeter of 18 inches. Find the area of hexagon II to the nearest tenth of a square inch.

Solution

All regular polygons are similar, so hexagon I is similar to hexagon II.

STEP 1 **Find** the ratio of the lengths of the hexagons by finding the ratio of the perimeters. Use the same units for both lengths in the ratio.

$$\frac{\text{Perimeter of hexagon I}}{\text{Perimeter of hexagon II}} = \frac{6(5\text{ ft})}{18\text{ in.}} = \frac{30\text{ ft}}{18\text{ in.}} = \frac{360\text{ in.}}{18\text{ in.}} = \frac{20}{1}$$

STEP 2 **Calculate** the area of hexagon II. Let x be this area.

$$\frac{(\text{Length of hexagon I})^2}{(\text{Length of hexagon II})^2} = \frac{\text{Area of hexagon I}}{\text{Area of hexagon II}}$$ Theorem 11.7

$$\frac{20^2}{1^2} = \frac{65}{x}$$ Substitute.

$$x \approx 0.1625\text{ ft}^2$$ Solve for x.

STEP 3 **Convert** the area to square inches.

$$0.1625\text{ ft}^2 \cdot \frac{144\text{ in.}^2}{1\text{ ft}^2} \approx 23.4\text{ in.}^2$$

The area of hexagon II is about 23.4 square inches.

Exercise for Example 3

4. The ratio of the areas of two regular octagons is 18 : 125. What is the ratio of their corresponding side lengths in simplest radical form?