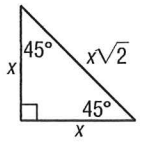
NAME Key DATE _____ PERIOD ____

8-3 Study Guide and Intervention

Special Right Triangles

Properties of 45°-45°-90° Triangles The sides of a 45°-45°-90° right triangle have a special relationship.

Example 1 **If the leg of a 45°-45°-90° right triangle is x units, show that the hypotenuse is $x\sqrt{2}$ units.**



Using the Pythagorean Theorem with $a = b = x$, then

$$\begin{aligned} c^2 &= a^2 + b^2 \\ &= x^2 + x^2 \\ &= 2x^2 \\ c &= \sqrt{2x^2} \\ &= x\sqrt{2} \end{aligned}$$

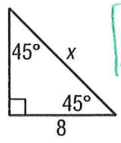
Example 2 **In a 45°-45°-90° right triangle the hypotenuse is $\sqrt{2}$ times the leg. If the hypotenuse is 6 units, find the length of each leg.**

The hypotenuse is $\sqrt{2}$ times the leg, so divide the length of the hypotenuse by $\sqrt{2}$.

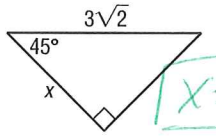
$$\begin{aligned} a &= \frac{6}{\sqrt{2}} \\ &= \frac{6\sqrt{2}}{\sqrt{2}\sqrt{2}} \\ &= \frac{6\sqrt{2}}{2} \\ &= 3\sqrt{2} \text{ units} \end{aligned}$$

Exercises

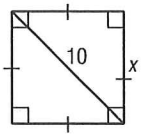
Find x.

1. 

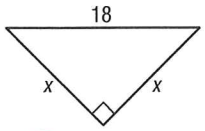
$x = 8\sqrt{2}$

2. 

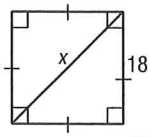
$x = 3$

3. 

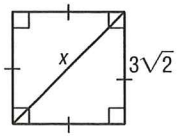
$10 = x\sqrt{2}$
$5\sqrt{2} = x$

4. 

$18 = x\sqrt{2}$
$9\sqrt{2} = x$

5. 

$x = 18\sqrt{2}$

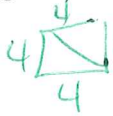
6. 

$x = 3\sqrt{2} \cdot \sqrt{2}$
$x = 3 \cdot 2$
$x = 6$

7. Find the perimeter of a square with diagonal 12 centimeters.

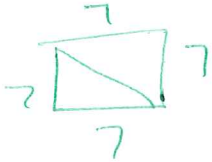
$x = 6\sqrt{2}$ $4(6\sqrt{2}) = 24\sqrt{2}$ cm

8. Find the diagonal of a square with perimeter 20 inches.



$d = 4\sqrt{2}$ in

9. Find the diagonal of a square with perimeter 28 meters.



$d = 7\sqrt{2}$ m

Lesson 8-3

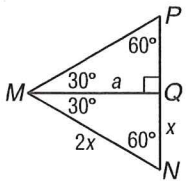
NAME Key DATE _____ PERIOD ____

8-3 Study Guide and Intervention *(continued)*

Special Right Triangles

Properties of 30°-60°-90° Triangles The sides of a 30°-60°-90° right triangle also have a special relationship.

Example 1 **In a 30°-60°-90° right triangle, show that the hypotenuse is twice the shorter leg and the longer leg is $\sqrt{3}$ times the shorter leg.**



$\triangle MNQ$ is a 30°-60°-90° right triangle, and the length of the hypotenuse $\overline{MN}$ is two times the length of the shorter side $\overline{NQ}$. Using the Pythagorean Theorem,

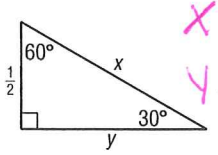
$$\begin{aligned} a^2 &= (2x)^2 - x^2 \\ &= 4x^2 - x^2 \\ &= 3x^2 \\ a &= \sqrt{3x^2} \\ &= x\sqrt{3} \end{aligned}$$

Example 2 **In a 30°-60°-90° right triangle, the hypotenuse is 5 centimeters. Find the lengths of the other two sides of the triangle.**

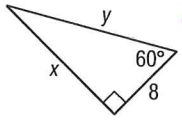
If the hypotenuse of a 30°-60°-90° right triangle is 5 centimeters, then the length of the shorter leg is half of 5 or 2.5 centimeters. The length of the longer leg is $\sqrt{3}$ times the length of the shorter leg, or $(2.5)(\sqrt{3})$ centimeters.

Exercises

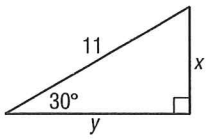
Find x and y.

1. 

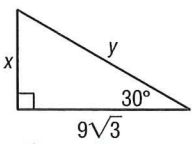
$x = 1$, $y = \frac{\sqrt{3}}{2}$

2. 

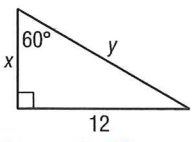
$x = 8\sqrt{3}$, $y = 16$

3. 

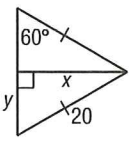
$x = 5.5$, $y = 5.5\sqrt{3}$

4. 

$x = 9$, $y = 18$

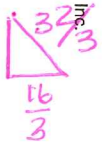
5. 

$x = 4\sqrt{3}$, $y = 8\sqrt{3}$

6. 

$y = 10$, $x = 10\sqrt{3}$

7. The perimeter of an equilateral triangle is 32 centimeters. Find the length of an altitude of the triangle to the nearest tenth of a centimeter. $a = \frac{16\sqrt{3}}{3}$



8. An altitude of an equilateral triangle is 8.3 meters. Find the perimeter of the triangle to the nearest tenth of a meter.

$3\left(\frac{16.6\sqrt{3}}{3}\right)$ $\frac{8.3\sqrt{3}}{3} \cdot 2$

$P = 16.6\sqrt{3}$

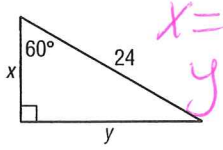
NAME Key DATE _____ PERIOD ____

8-3 Skills Practice

Special Right Triangles

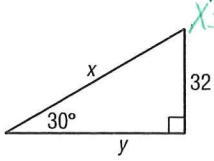
Find the exact values of x and y.

1.



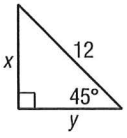
$x = 12$
$y = 12\sqrt{3}$

2.



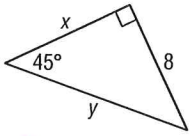
$x = 64$
$y = 32\sqrt{3}$

3.



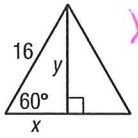
$x = 6\sqrt{2}$
$y = 6\sqrt{2}$

4.



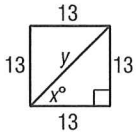
$x = 8$
$y = 8\sqrt{2}$

5.



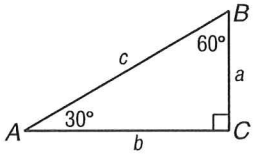
$x = 8$
$y = 8\sqrt{3}$

6.



$x = 45°$
$y = 13\sqrt{2}$

For Exercises 7–9, use the figure at the right.



7. If $a = 11$, find b and c.

$b = 11\sqrt{3}$ $c = 22$

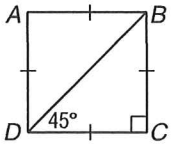
8. If $b = 15$, find a and c.

$a = 5\sqrt{3}$ $c = 10\sqrt{3}$

9. If $c = 9$, find a and b.

$a = 4.5$ $b = 4.5\sqrt{3}$

For Exercises 10 and 11, use the figure at the right.



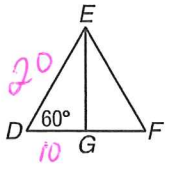
10. The perimeter of the square is 30 inches. Find the length of $\overline{BC}$.

$BC = 7.5$ in

11. Find the length of the diagonal $\overline{BD}$.

$BD = 7.5\sqrt{2}$

12. The perimeter of the equilateral triangle is 60 meters. Find the length of an altitude.



$EG = 10\sqrt{3}$

13. $\triangle GEC$ is a 30°-60°-90° triangle with right angle at E, and $\overline{EC}$ is the longer leg. Find the coordinates of G in Quadrant I for $E(1, 1)$ and $C(4, 1)$.

Skip

Lesson 8-3