Name_____ Date _____

11.2 Special Right Triangles

For use with Exploration 11.2

Essential Question What is the relationship among the side lengths of 45°-45°-90° triangles? 30°-60°-90° triangles?

1 EXPLORATION: Side Ratios of an Isosceles Right Triangle

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner.

a. Use dynamic geometry software to construct an isosceles right triangle with a leg length of 4 units.

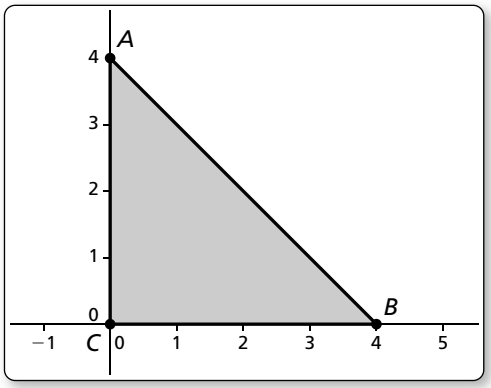
b. Find the acute angle measures. Explain why this triangle is called a 45°-45°-90° triangle.

c. Find the exact ratios of the side lengths (using square roots).

$\frac{AB}{AC} =$ _____

$\frac{AB}{BC} =$ _____

$\frac{AC}{BC} =$ _____



Sample
Points
$A(0, 4)$
$B(4, 0)$
$C(0, 0)$
Segments
$AB = 5.66$
$BC = 4$
$AC = 4$
Angles
$m\angle A = 45°$
$m\angle B = 45°$

d. Repeat parts (a) and (c) for several other isosceles right triangles. Use your results to write a conjecture about the ratios of the side lengths of an isosceles right triangle.

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2 EXPLORATION: Side Ratios of a 30°-60°-90° Triangle

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner.

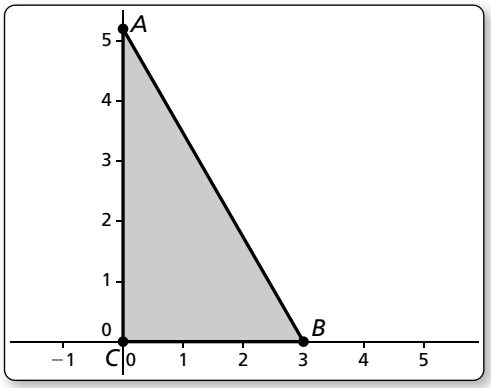
a. Use dynamic geometry software to construct a right triangle with acute angle measures of 30° and 60° (a 30°-60°-90° triangle), where the shorter leg length is 3 units.

b. Find the exact ratios of the side lengths (using square roots).

$\frac{AB}{AC} =$ _____

$\frac{AB}{BC} =$ _____

$\frac{AC}{BC} =$ _____



Sample
Points
$A(0, 5.20)$
$B(3, 0)$
$C(0, 0)$
Segments
$AB = 6$
$BC = 3$
$AC = 5.20$
Angles
$m\angle A = 30°$
$m\angle B = 60°$

c. Repeat parts (a) and (b) for several other 30°-60°-90° triangles. Use your results to write a conjecture about the ratios of the side lengths of a 30°-60°-90° triangle.

Communicate Your Answer

3. What is the relationship among the side lengths of 45°-45°-90° triangles? 30°-60°-90° triangles?

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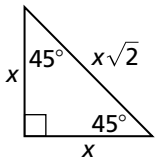
11.2 Practice
For use after Lesson 11.2

Theorems

45°-45°-90° Triangle Theorem

In a 45°-45°-90° triangle, the hypotenuse is $\sqrt{2}$ times as long as each leg.

Notes:

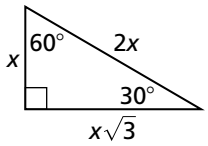


hypotenuse = leg • $\sqrt{2}$

30°-60°-90° Triangle Theorem

In a 30°-60°-90° triangle, the hypotenuse is twice as long as the shorter leg, and the longer leg is $\sqrt{3}$ times as long as the shorter leg.

Notes:



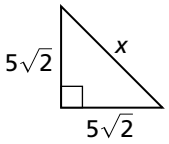
hypotenuse = shorter leg • 2

longer leg = shorter leg • $\sqrt{3}$

Worked-Out Examples

Example #1

Find the value of x. Write your answer in simplest form.



hypotenuse = leg • $\sqrt{2}$

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

$x = 5\sqrt{4}$

$x = 5 \cdot 2 = 10$

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11.2 Practice (continued)

Example #2

Find the values of x and y. Write your answers in simplest form.

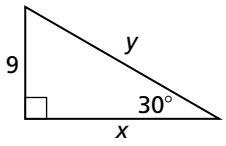
longer leg = shorter leg • $\sqrt{3}$

$x = 9\sqrt{3}$

hypotenuse = 2 • shorter leg

$y = 2 \cdot 9$

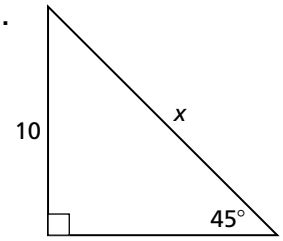
$y = 18$



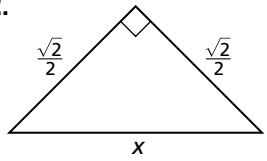
Practice A

In Exercises 1–4, find the value of *x*. Write your answer in simplest form.

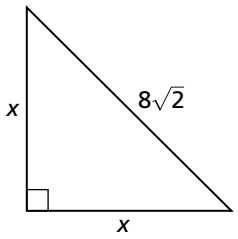
1.



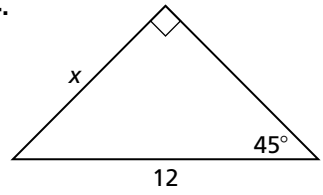
2.



3.

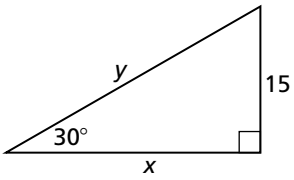


4.

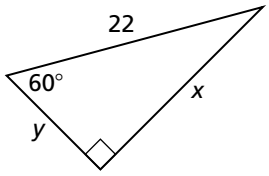


In Exercises 5–7, find the values of *x* and *y*. Write your answers in simplest form.

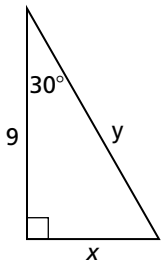
5.



6.



7.



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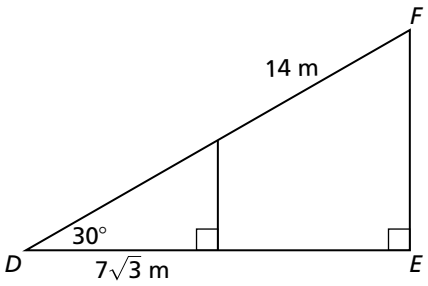
11.2 Practice (continued)

In Exercises 8 and 9, sketch the figure that is described. Find the indicated length. Round decimal answers to the nearest tenth.

8. The length of a diagonal in a square is 32 inches. Find the perimeter of the square.

9. An isosceles triangle with $30°$ base angles has an altitude of $\sqrt{3}$ meters. Find the length of the base of the isosceles triangle.

10. Find the area of $\triangle DEF$. Round decimal answers to the nearest tenth.



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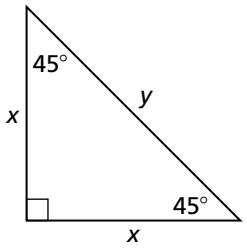
Practice B

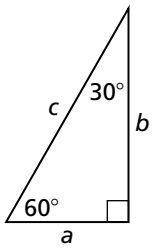
In Exercises 1 and 2, copy and complete the table. Write your answers in simplest form.

1.



x	5		$\sqrt{2}$	
y		$4\sqrt{2}$		24

2.



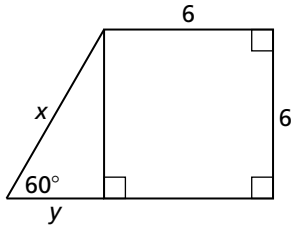
a	11			
b		9		$5\sqrt{3}$
c			16	

3. The side lengths of a triangle are given. Determine whether each triangle is a *45°-45°-90° triangle*, a *30°-60°-90° triangle*, or *neither*.

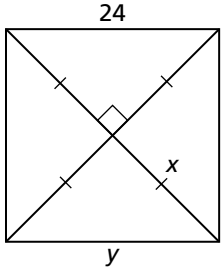
a. 5, 10, $5\sqrt{3}$ **b.** 7, 7, $7\sqrt{3}$ **c.** 6, 6, $6\sqrt{2}$

In Exercises 4–6, find the values of the variables. Write your answers in simplest form.

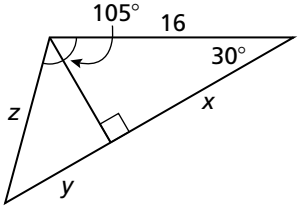
4.



5.



6.



7. You build a two-person tent, as shown. How many square feet of material is needed to make the tent, assuming the tent has a floor?