Learning Targets

10.2 Special Right Triangles

I can use the relationships among the side lengths of a 45-45-90 and 30-60-90 triangle to solve for unknown side lengths.

Pick up a the handout "Special Right Triangles Investigation"

Complete the investigation with your group.

Special Right Triangles Investigation

Suppose the triangle below is an **isosceles right triangle**. Answer each of the following questions.

n 45 x $n\sqrt{2}$
45
n
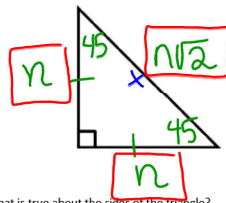
a.   What is true about the sides of the triangle?

The legs are $\cong$

b.   What are the angle measurements of the triangle? Label them on the triangle.

$45° - 45° - 90°$

c.   If we call the two congruent sides of the triangle "n", solve for the third side of the triangle using the Pythagorean Theorem. Your answer should be in terms of "n." Don't forget to simplify your solution if possible.

$$1n^2 + 1n^2 = x^2$$
$$\sqrt{2n^2} = \sqrt{x^2}$$
$$\sqrt{2} \cdot \sqrt{n^2} = x$$
$$n\sqrt{2} = x$$

Suppose the triangle below is an **equilateral triangle**. Answer each of the following questions.

$2n$ $\quad$ 60 $\quad$ $2n$

60 $\quad$ 60

a. What is true about the sides of the triangle?

They are equal

b. What are the angle measurements of the triangle? Label them on the triangle.

They are $\cong$; each $60°$

c. If we divide the equilateral triangle above into two triangles as shown below, which congruence theorem or postulate would prove that the two triangles are congruent?

H $\quad$ H

By HL
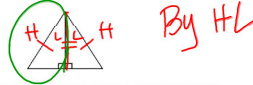
d. If we consider only half of the equilateral triangle above, what would be the angle measurements be in this triangle? Label them on the triangle.

If we call the hypotenuse of the triangle "2n", solve for the other two sides of the triangle.

$$x^2 + n^2 = (2n)^2$$
$$x^2 + n^2 = 4n^2$$
$$ - n^2 \quad -n^2$$
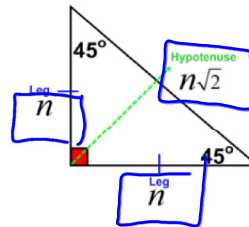$$\sqrt{x^2} = \sqrt{3n^2} \leftarrow \sqrt{3} \cdot \sqrt{n^2}$$
$$\boxed{x = n\sqrt{3}}$$

$2n$ $\quad$ $30°$ $\quad$ $\boxed{n\sqrt{3}}$

$60°$

$\boxed{n}$

Section 10.2
Special Right Triangles

45° – 45° – 90° Triangle Theorem

$45°$ $\quad$ Hypotenuse $\quad n\sqrt{2}$

Leg $\quad n$

Hypotenuse = Leg $\cdot \sqrt{2}$

$45°$

Leg $\quad n$

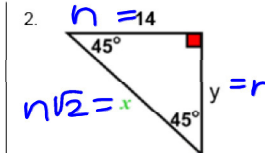*Examples*

Find the value of the missing variables. If necessary, leave your answer in simplest radical form.

1.
$n = 3$ $\quad$ $y = n$
$45°$ $\quad$ $45°$
$n\sqrt{2} = x$

$y = n$
$\boxed{y = 3}$

$x = n\sqrt{2}$
$\boxed{x = 3\sqrt{2}}$

2. $n = 14$
$45°$
$n\sqrt{2} = x$ $\quad$ $y = n$
$45°$

$\boxed{y = 14}$
$\boxed{x = 14\sqrt{2}}$
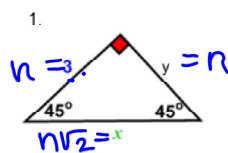
3. y
$45°$ $\quad$ $45°$
x $\quad$ 12

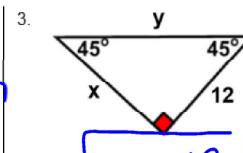$\boxed{x = 12}$
$\boxed{y = 12\sqrt{2}}$

Find the value of the missing variables. If necessary, leave your answer in simplest radical form.

4.

$n = x$ $y = n$

$45°$ $45°$

$n\sqrt{2} = \sqrt{2}$

$$\frac{n\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{\sqrt{2}}$$

$n = 1$

$x = 1$

5.

$n\sqrt{2} = 7\sqrt{2}$

$45°$

$y = n$

$45°$

$x = n$

$$\frac{n\sqrt{2}}{\sqrt{2}} = \frac{7\sqrt{2}}{\sqrt{2}}$$

$n = 7$

$x = 7$

$y = 1$ $y = 7$

6.

$= n$

x

$8\sqrt{2} = n\sqrt{2}$

$n = y$

$$\frac{8\sqrt{2}}{\sqrt{2}} = \frac{n\sqrt{2}}{\sqrt{2}}$$

$8 = n$

$x = 8$

$y = 8$

Find the value of the missing variables. If necessary, leave your answer in simplest radical form.

Note: In addition to removing any perfect squares, "simplest radical form" also means removing any radicals in the denominator of fractions.
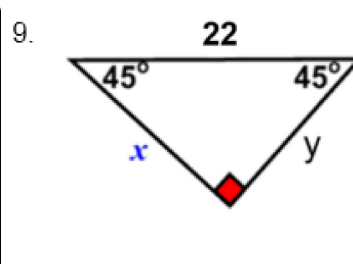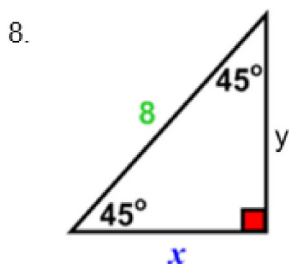
7.

$5 = n\sqrt{2}$

$45°$ $45°$

$n = x$ $y = n$

$$\frac{n\sqrt{2}}{\sqrt{2}} = \frac{5}{\sqrt{2}}$$

$$* \quad n = \frac{5}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{5\sqrt{2}}{2}$$

$$x = \frac{5\sqrt{2}}{2} \qquad y = \frac{5\sqrt{2}}{2}$$

Find the value of the missing variables. If necessary, leave your answer in simplest radical form.

Note: In addition to removing any perfect squares, "simplest radical form" also means removing any radicals in the denominator of fractions.

8.

9.

For # 10 – 11, use your Special Right Triangle Relationships to find the missing lengths. Leave your answers in simplest radical form.

10.   ABCD is a square with a perimeter of 24 inches. Find the length of segments BC and BD. Sketch and label a diagram.

BC = _____

BD = _____

For # 10 – 11, use your Special Right Triangle Relationships to find the missing lengths. Leave your answers in simplest radical form.

11.   A square piece of paper 17 cm on a side is folded along a diagonal. What is the length of the diagonal? Sketch and label a diagram.

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Homework - 10.2 Special Right Triangles Day 1 HW