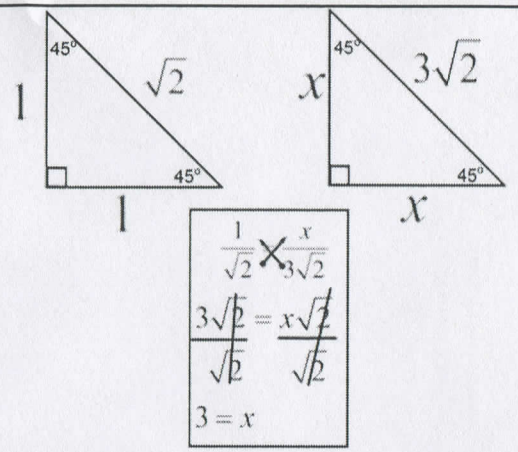
**Lesson Title 9.2 Special Right Triangles NOTES** **HGEO** **Date** _____

## OBJECTIVE 1: 45° - 45° - 90° Triangle Theorem

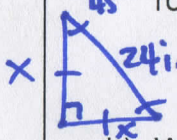
*This special triangle can be solved with Pythagorean theorem OR the proportion.*

- The original triangle or formula for a 45-45-90 is always 1, 1, $\sqrt{2}$.
- Set up a proportion using the original and the sides you are looking for in your new triangle.
- Remember all proportions are solved using cross multiplication.




TASK 1: Solve the following triangles using Pythagorean Theorem or the new proportion from the right.

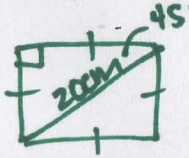
a) The length of the hypotenuse of an isosceles right triangle is 24 inches. What is the length of one of the legs, round to the nearest tenth of an inch. (HINT: draw your triangle)

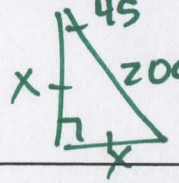



$x^2 + x^2 = 24^2$ OR $\frac{1}{x} = \frac{\sqrt{2}}{24} \Rightarrow \frac{24}{\sqrt{2}} = \frac{x\sqrt{2}}{\sqrt{2}} \Rightarrow x = \frac{24}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{24\sqrt{2}}{2} = 12\sqrt{2}$

$12\sqrt{2} \approx 16.971$ **17in**

b) What is the perimeter of a square with a diagonal of 20 cm? (HINT: draw and label your square!)




$\frac{1}{x} = \frac{\sqrt{2}}{20} \Rightarrow \frac{x\sqrt{2}}{\sqrt{2}} = \frac{20}{\sqrt{2}}$

$x^2 + x^2 = 20^2$

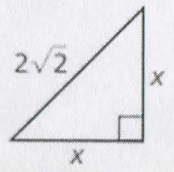
$x = \frac{20\sqrt{2}}{2} = 10\sqrt{2}$

$P = 4x$

$= 4(10\sqrt{2})$

$= 40\sqrt{2}$ cm

c)



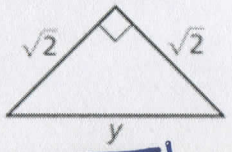

$x^2 + x^2 = (2\sqrt{2})^2$

$\frac{2x^2}{2} = \frac{4 \cdot 2}{2}$

$x^2 = 4$ $x = \pm 2$

$x = 2$

d)




$(\sqrt{2})^2 + (\sqrt{2})^2 = y^2$

$2 + 2 = y^2$

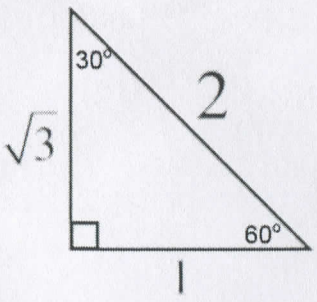
$\sqrt{4} = \sqrt{y^2}$

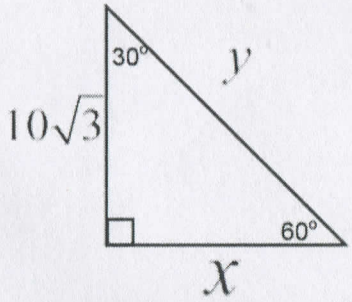
$\pm 2 = y$

$y = 2$

**OBJECTIVE 2: 30° – 60° – 90° Triangle Theorem**
*This special right triangle MUST be understood or memorized, Pythagorean Theorem will NOT work!*

- The original triangle or formula for a 30-60-90 is always 1, $\sqrt{3}$, 2.
- Set up a proportion using the original and the sides you are looking for in your new triangle.
- Remember all proportions are solved using cross multiplication.
- 30° across from the short leg
- 60° across from the long leg
- 90° across from the hypotenuse



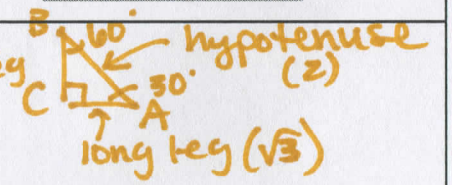




$$\frac{1}{\sqrt{3}} \times \frac{x}{10\sqrt{3}}$$
$$10\sqrt{3} = x$$

$$\frac{10\sqrt{3}}{y} \times \frac{\sqrt{3}}{2}$$
$$\frac{20\sqrt{3}}{\sqrt{3}} = \frac{y\sqrt{3}}{\sqrt{3}}$$
$$20 = y$$

TASK 2: Answer the following questions using the proportion from above.

a) In Δ ABC, $\overline{AB}$ is the hypotenuse and $\overline{BC}$ is the short leg. Draw and label this triangle.

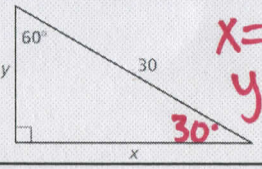



b) Always opposite the sixty degree angle is the long leg.

c) The "short-leg" is always across from the 30 degree angle because it is the smallest angle and always across from the shortest side.

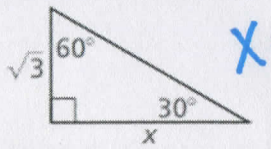
TASK 3: Set up your proportions and solve the triangles.

a)



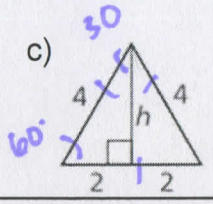

$2x = 30\sqrt{3}$
$x = 15\sqrt{3}$
$2y = 30$
$y = 15$

b)




$x = 3$

c)




$h = 2\sqrt{3}$

**Still need help with:**

$$\frac{1}{y} = \frac{\sqrt{3}}{x} = \frac{2}{30}$$

$$\frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{x}$$
$$\sqrt{9} = x$$

$$\frac{1}{2} = \frac{\sqrt{3}}{h} = \frac{2}{4}$$
$h = 2\sqrt{3}$

$$\frac{2 \cdot 4\sqrt{3}}{4} = \frac{2h}{2}$$