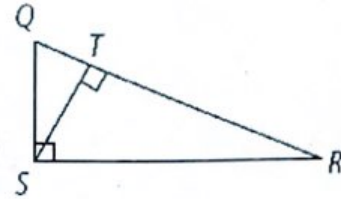


Similarity of Right Triangles and The Pythagorean Theorem

Vocabulary: Identify the following in $\triangle QRS$

- The hypotenuse \overline{QR}
- The altitude \overline{ST}
- The Legs of $\triangle QRS$
 \overline{QS} and \overline{SR}



Prove: Proving the Pythagorean Theorem Using Similarity:

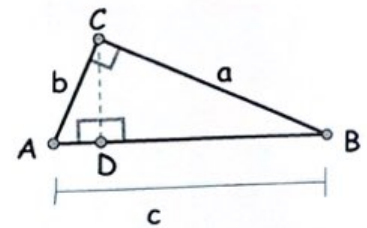
4. Recall that corresponding sides of similar triangles are proportional.

a. What is $\frac{c}{b}$ equal to? (hint: use $\triangle ACD$)

$\frac{c}{b} = \frac{b}{AD}$ similar \triangle 's are proportional.

b. What is $\frac{c}{a}$ equal to? (hint: use $\triangle CBD$)

$\frac{c}{a} = \frac{a}{DB}$ similar \triangle 's are proportional.



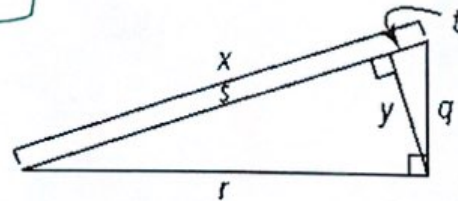
c. Simplify the two above equations by using cross multiplication.

~~$\frac{c}{b} = \frac{b}{AD}$~~ $c(AD) = b^2$ $\frac{c}{a} = \frac{a}{DB}$ $c(DB) = a^2$

d. Use the above information to **prove the Pythagorean theorem**

$c(AD) = b^2$
 $+ c(DB) = a^2$
 } add two equations
 $c(AD) + c(DB) = b^2 + a^2$
 $c(AD + DB) = b^2 + a^2$
 $c(c) = b^2 + a^2$ $c^2 = b^2 + a^2$

5. Use the figure on the right to complete each proportion:



a) $\frac{q}{r} = \frac{t}{y}$

b) $\frac{s}{y} = \frac{y}{t}$

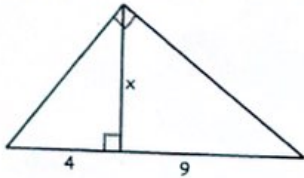
c) $\frac{t}{q} = \frac{q}{x}$

d) $\frac{q}{x} = \frac{t}{q}$

e) $\frac{s}{r} = \frac{y}{q}$

Solve: Solve for the value of the variables in each right triangle.

6.

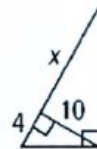


$$\frac{4}{x} = \frac{x}{9}$$

$$\sqrt{36} = \sqrt{x^2}$$

$$\boxed{6 = x}$$

7.

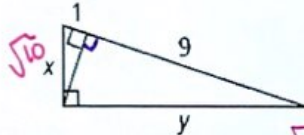


$$\frac{4}{10} = \frac{10}{x}$$

$$\boxed{x = 25}$$

$$\frac{4x}{4} = \frac{100}{4}$$

8.



$$\frac{1}{9} = \frac{y}{10}$$

$$\sqrt{90} = \sqrt{y^2}$$

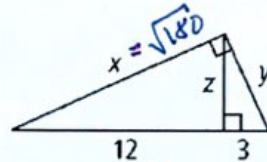
$$\boxed{y = \sqrt{90}}$$

$$\frac{x}{1} = \frac{10}{x}$$

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

$$\boxed{x = \sqrt{10}}$$

9.



$$\frac{x}{15} = \frac{12}{x}$$

$$\sqrt{x^2} = \sqrt{180}$$

$$\boxed{x = \sqrt{180}}$$

$$\frac{y}{3} = \frac{15}{y}$$

$$\sqrt{y^2} = \sqrt{45}$$

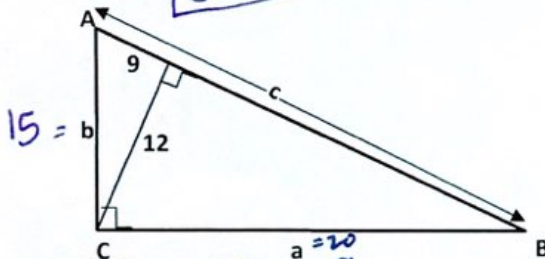
$$\boxed{y = \sqrt{45}}$$

$$\frac{z}{12} = \frac{3}{z}$$

$$\sqrt{z^2} = \sqrt{36}$$

$$\boxed{z = 6}$$

10.



$$9^2 + 12^2 = b^2$$

$$225 = b^2$$

$$\boxed{15 = b}$$

$$\frac{15}{a} = \frac{9}{12}$$

$$180 = 9a$$

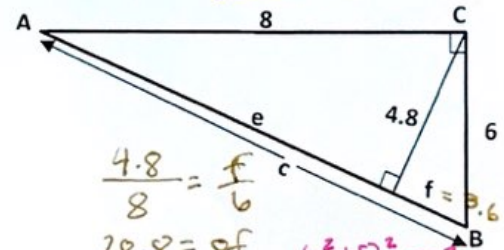
$$\boxed{a = 20}$$

$$15^2 + 20^2 = c^2$$

$$\sqrt{625} = \sqrt{c^2}$$

$$\boxed{c = 25}$$

11.



$$\frac{4.8}{8} = \frac{f}{6}$$

$$\frac{28.8}{8} = \frac{8f}{8}$$

$$\boxed{f = 3.6}$$

$$6^2 + 8^2 = c^2$$

$$\sqrt{100} = \sqrt{c^2}$$

$$\boxed{c = 10}$$

$$10 - 3.6 = e$$

$$\boxed{e = 6.4}$$

Application Problems:

12. A bridge is needed to cross over a canyon. The dotted line segment connecting points S and R represents the bridge. The distance from point P to point S is 45 yards. The distance from point Q to point S is 130 feet. How long is the bridge?

*Note: the picture may not be drawn to scale.

$$45 \text{ yards} = 135 \text{ ft}$$

$$\frac{x}{130} = \frac{130}{135}$$

$$\frac{135x}{135} = \frac{16900}{135}$$

$$\boxed{x = 125.2 \text{ ft}}$$



13. Lucia needs to buy a ladder to reach her roof. The edge of the roof is 21.125 feet high. To use a ladder safely, the base of a ladder should be 1 foot away from a building for every 3.25 feet of building height. The ladder should extend 3 feet longer than the edge of the roof. How long does the ladder need to be?



$$(21.125)^2 + (6.5)^2 = x^2$$

$$\frac{21.125}{3.25} = 6.5$$

$$x = 22.1$$

The ladder should be 22.1 ft long