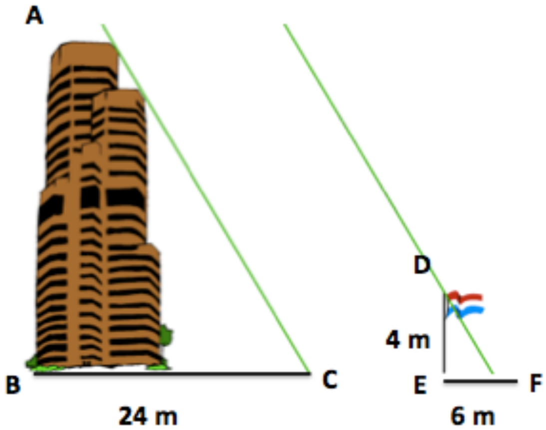
1. A flagpole 4 meters tall casts a 6-meter shadow. At the same time of day, a nearby building casts a 24-meter shadow. How tall is the building?

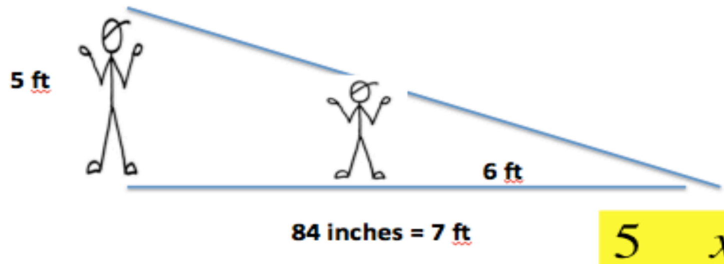


$$\frac{24}{6} = \frac{AB}{4}$$

$$4 = \frac{AB}{4}$$

$$AB = 16m$$

2. Five-foot-tall Melody casts an 84-inch shadow. How tall is her friend if, at the same time of day, his shadow is 1 foot shorter than hers?



$$\frac{5}{7} = \frac{x}{6}$$

$$7x = 30$$

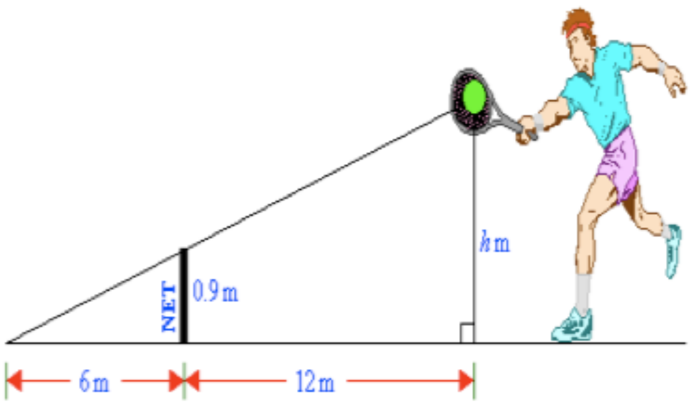
$$x = 4.29\,ft$$

3. Find the value of the height, *h* m, in the following diagram at which the tennis ball must be hit so that it will just pass over the net and land 6 meters away from the base of the net.

$$\frac{h}{18} = \frac{0.9}{6}$$

$$6h = 16.2$$

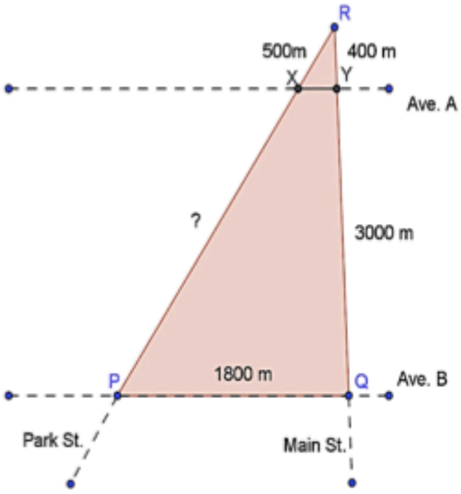
$$h = 2.7m$$



TRIANGLE PROPORTIONAL SEGMENTS THEOREM

A straight line drawn parallel to one side of a triangle divides the other two sides proportionally.

$$\frac{RX}{XP} = \frac{RY}{YQ}$$

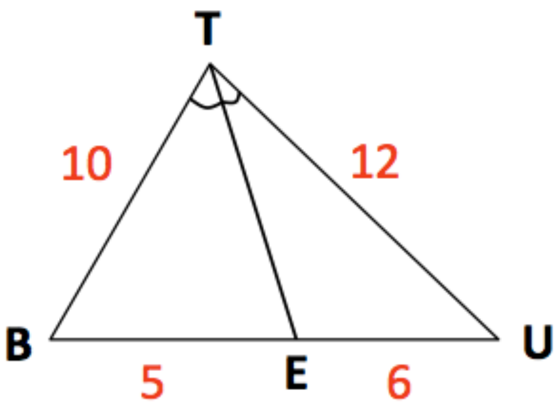


CONVERSE

If a line divides two sides of a triangle proportionally, then it is parallel to the third side.

TRIANGLE ANGLE BISECTOR THEOREM

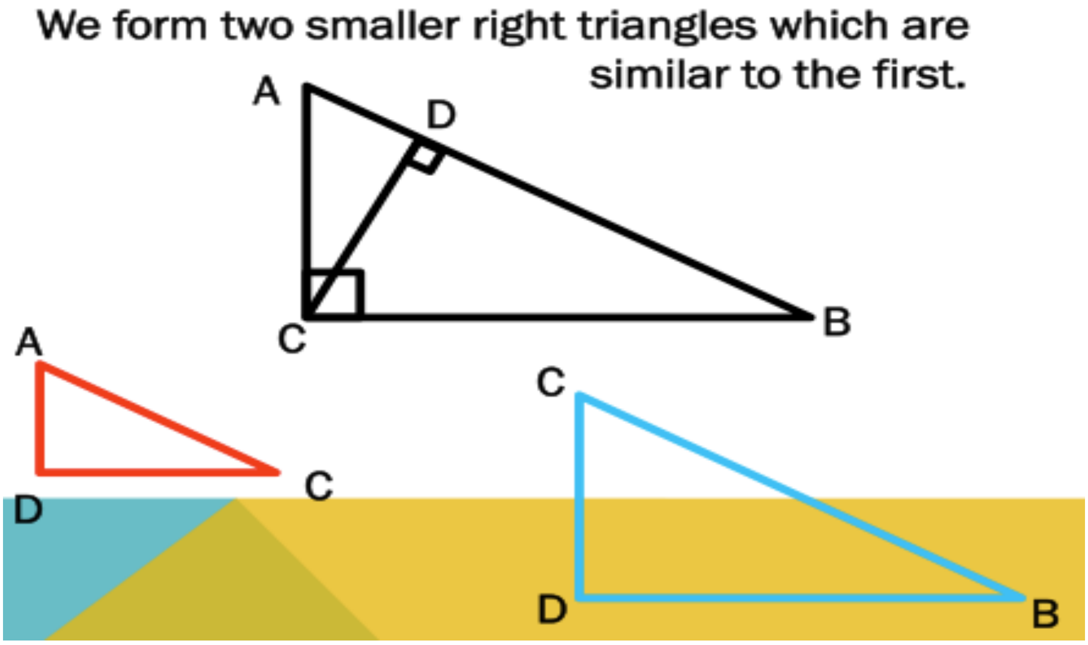
If a segment bisects an angle of a triangle, then it divides the opposite side into two segments that are proportional to the other two sides of the triangle.

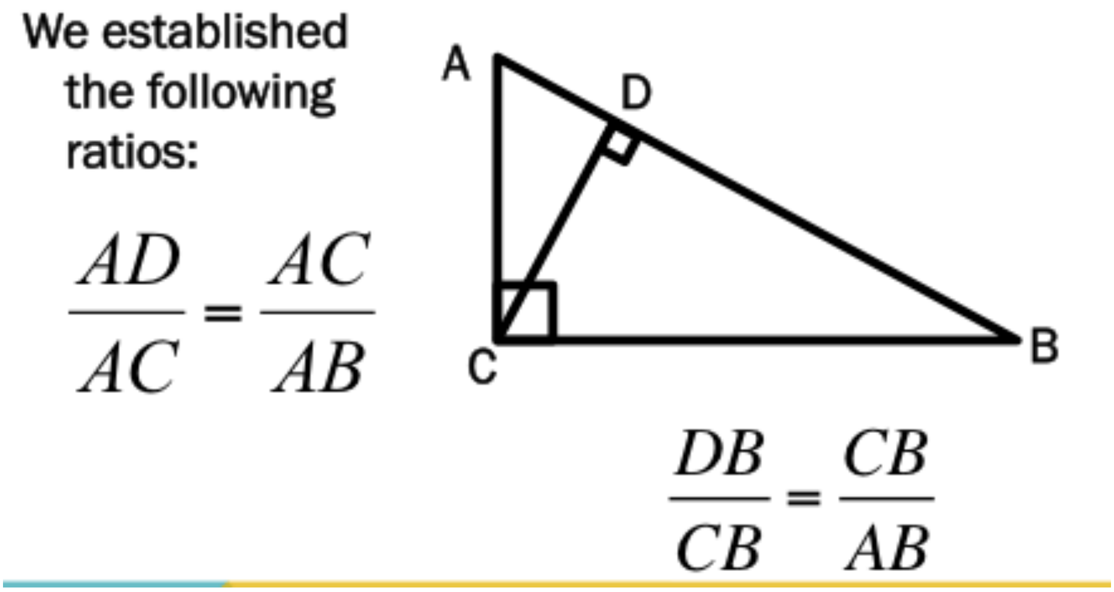


$$\frac{5}{6} = \frac{10}{12}$$

SIMILAR RIGHT TRIANGLES THEOREM

The altitude to the hypotenuse of a right triangle divides the triangle into two triangles that are similar to the original triangle and to each other.



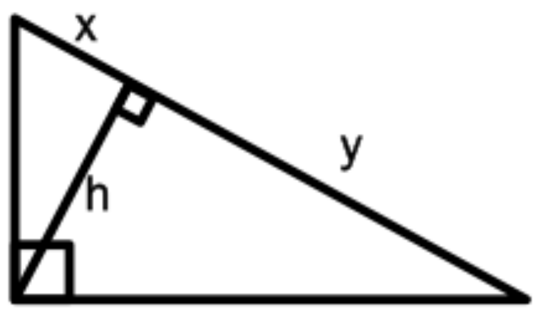


COROLLARY 1.

In a right Δ, the altitude to the hypotenuse divides the hypotenuse into two segments.

The length of the altitude is the Geometric mean of the lengths of the two pieces of the hypotenuse.

$$\frac{x}{h} = \frac{h}{y}$$



$$\frac{side1}{altitude} = \frac{altitude}{side2}$$

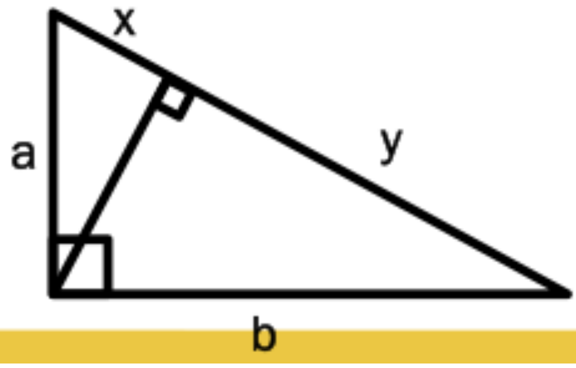
COROLLARY 2.

In a right Δ, the altitude to the hypotenuse divides the hypotenuse into two segments.

The length of each leg is the geometric mean of the hypotenuse and the segment of the hypotenuse that is adjacent (closest) to the leg.

$$\frac{x}{a} = \frac{a}{x+y}$$

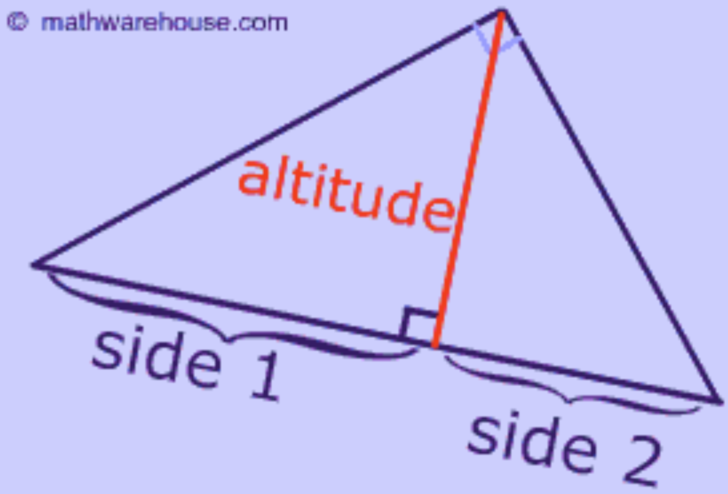
$$\frac{y}{b} = \frac{b}{x+y}$$



$$\frac{side}{leg} = \frac{leg}{hypotenuse}$$

Problem Type #1) The altitude and hypotenuse

As you can see in the picture below, this problem type involves the altitude and 2 sides of the inner **triangle** s (these are just the two parts of the large outer triangle's **hypotenuse**) . This lets us set up a mean proportion involving the altitude and those two sides (see demonstration above if you need to be convinced that these are indeed corresponding sides of **similar triangles** .)

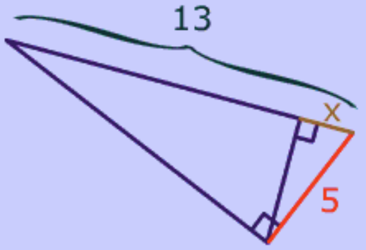


$$\frac{\text{side 1}}{\text{altitude}} = \frac{\text{altitude}}{\text{side 2}}$$

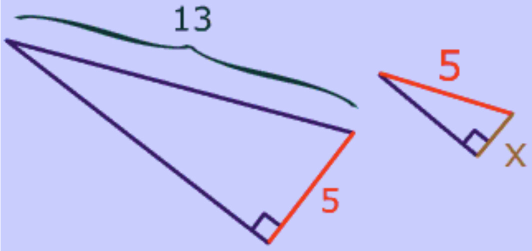
Problem Type #2) hypotenuse, Leg and Side

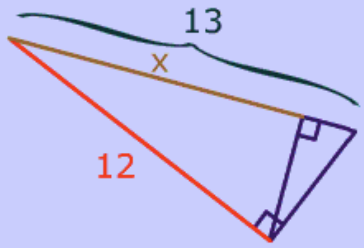
Involves the **hypotenuse** of the large outer triangle, one its legs and a side from one of the inner triangles.

$$\frac{\text{Hyp}}{\text{Leg}} = \frac{\text{Leg}}{\text{Side}}$$



$$\frac{13}{5} = \frac{5}{x}$$





$$\frac{13}{12} = \frac{12}{x}$$