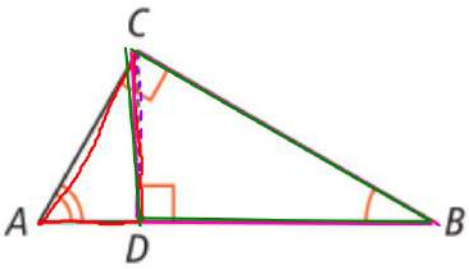
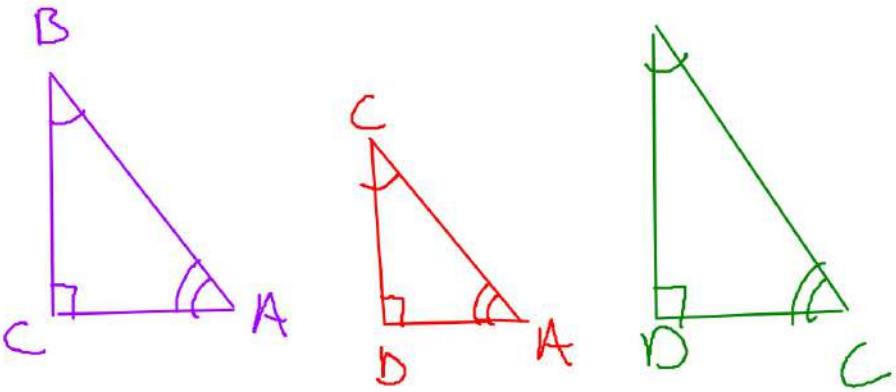
When you draw an altitude to the hypotenuse of a right triangle, you create three right triangles. How are the triangles related?

Altitude

Segment from a vertex ⊥ to the opposite side.

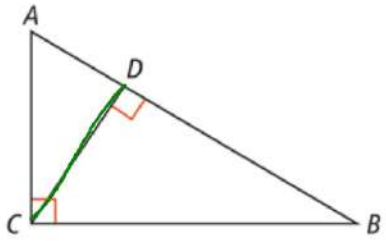




The altitude to the hypotenuse of a right triangle divides the triangle into two triangles that are similar to the original triangle and to each other.

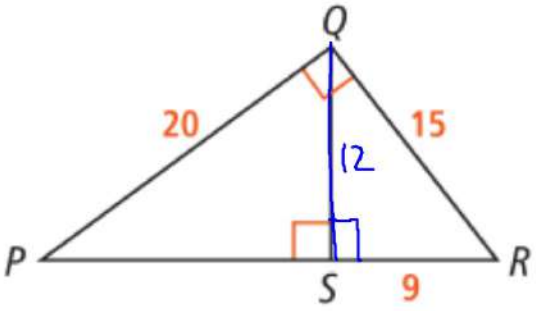
PROOF: SEE EXERCISE 14.

If...



Then... $\triangle CAB \sim \triangle DAC \sim \triangle DCB$

Given that $\triangle PQR \sim \triangle QSR$, what is QS?



$QS^2 + SR^2 = QR^2$

$x^2 + 9^2 = 15^2$

$x^2 + 81 = 225$

$x^2 = 144$

$x = 12$

What is *PS*?

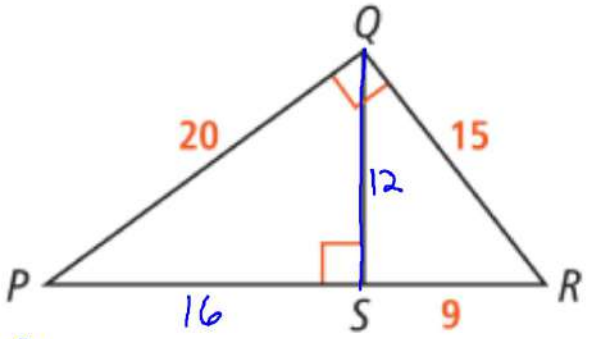
$PS^2 + QS^2 = PQ^2$

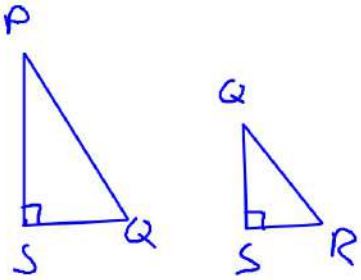
$x^2 + 12^2 = 20^2$

$x^2 + 144 = 400$

$x^2 = 256$

$x = 16$

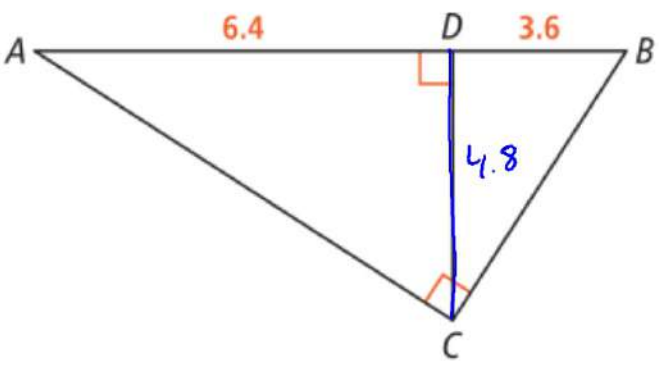


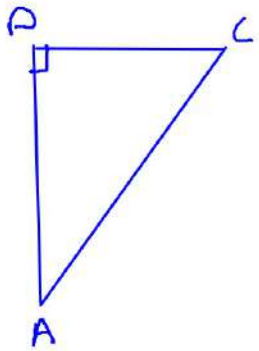


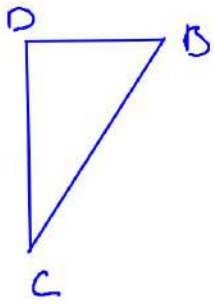
$\frac{PS}{QS} = \frac{QS}{SR}$

$\frac{16}{12} = \frac{12}{9}$

Given $\triangle ACB$, what is CD?







$$\frac{AD}{DC} = \frac{DC}{DB}$$

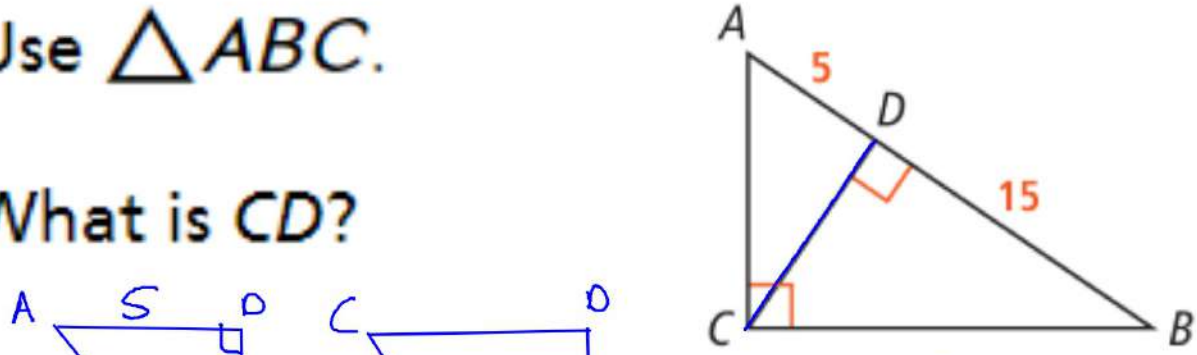
$$\frac{6.4}{x} = \frac{x}{3.6}$$

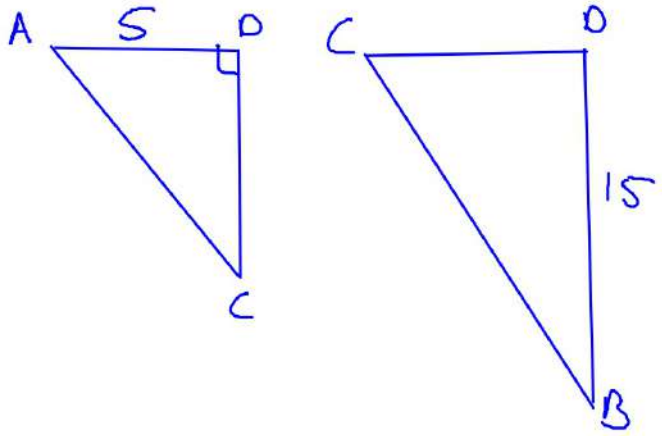
$$\sqrt{x^2} = \sqrt{23.04}$$

$$x = 4.8$$

Use $\triangle ABC$.

What is CD?





$\frac{DB}{CD} = \frac{CD}{AD}$

$\frac{15}{x} = \frac{x}{5}$

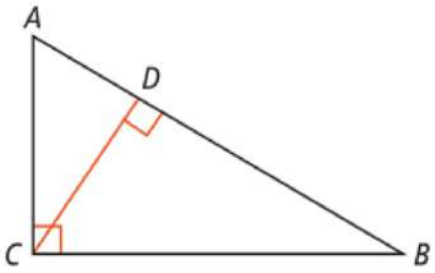
$\sqrt{x^2} = \sqrt{75}$

$x \approx 8.66$

The length of the altitude to the hypotenuse of a right triangle is the geometric mean of the lengths of the segments of the hypotenuse.

PROOF: SEE EXERCISE 14.

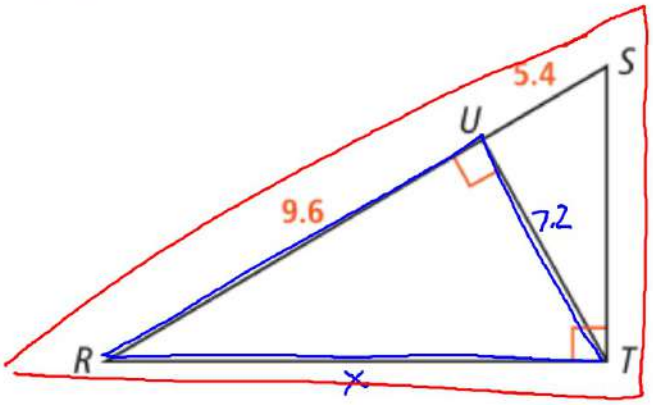
If...



Then... $\frac{AD}{CD} = \frac{CD}{DB}$

$\frac{a}{x} = \frac{x}{b}$

Given $\triangle RST$, what is RT?



$$\frac{9.6}{UT} = \frac{UT}{5.4}$$

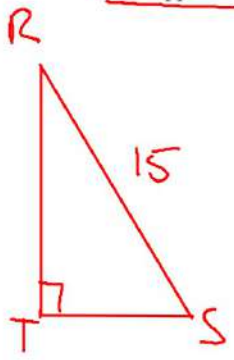
$$\sqrt{x^2} = \sqrt{51.84}$$

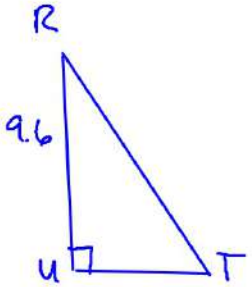
$$TU = 7.2$$

$$RU^2 + TU^2 = RT^2$$

$$9.6^2 + 7.2^2 = x^2$$

$$x = 12$$





$$\frac{RU}{RT} = \frac{RT}{RS}$$

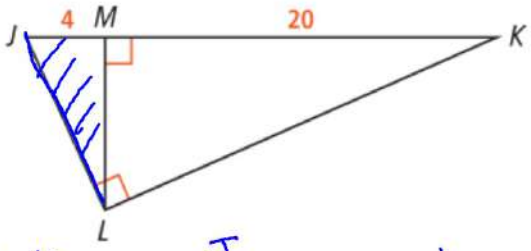
$$\frac{9.6}{RT} = \frac{RT}{15}$$

$$\frac{9.6}{x} = \frac{x}{15}$$

$$x^2 = 144$$

$$x = 12$$

4. Use $\triangle JKL$.



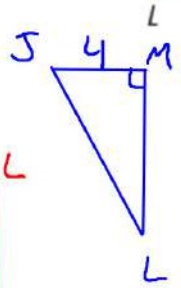
a. What is JL?

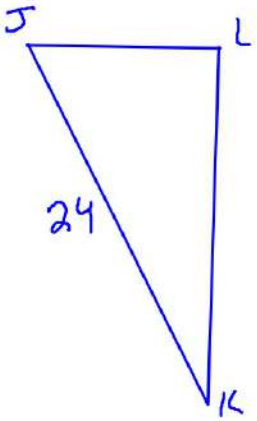
$\frac{JM}{JL} = \frac{JL}{JK}$ $\quad X = 9.79$

$\frac{4}{x} = \frac{x}{24}$

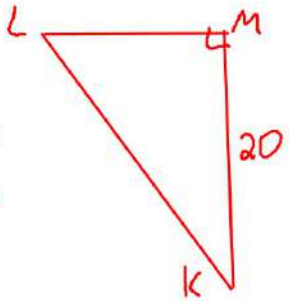
$x^2 = 96$

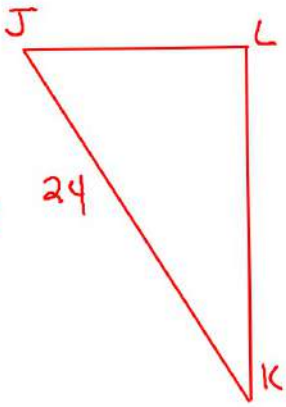
CHECK ANSWER





b. What is KL?





$\frac{KM}{KL} = \frac{KL}{JK}$

$\frac{20}{x} = \frac{x}{24}$

$x^2 = 480$

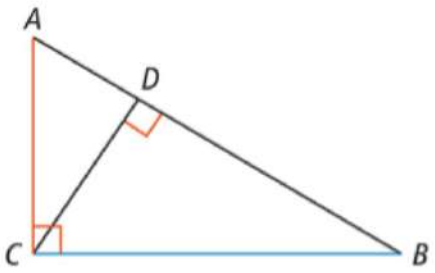
$x = 21.9$

COROLLARY 2 TO THEOREM 7-4

The altitude to the hypotenuse of a right triangle divides the hypotenuse so that the length of a given leg is the geometric mean of the length of the hypotenuse and the length of the segment of the hypotenuse that is adjacent to the leg.

PROOF: SEE EXERCISE 14.

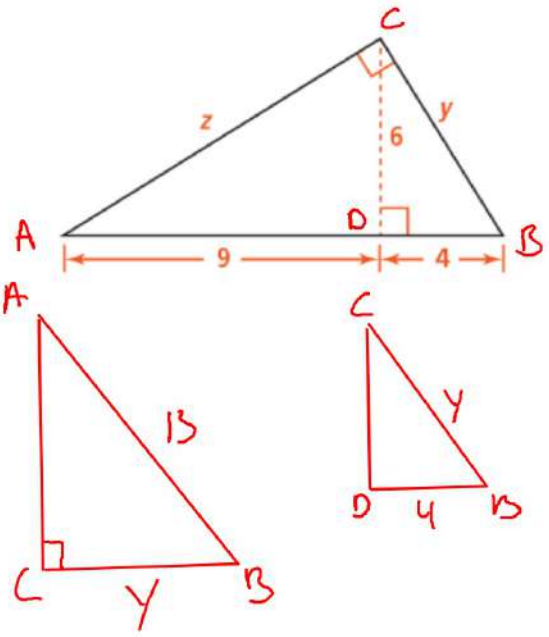
If...



Then... $\frac{AB}{AC} = \frac{AC}{AD}$ and $\frac{AB}{CB} = \frac{CB}{DB}$

5. Use the geometric mean to find each unknown.

$y = 7.21$ $z = 10.81$



a. Find the value of *y*.

Enter your answer.

$\frac{4}{y} = \frac{y}{13}$

$y^2 = 52$

$y = 7.21$ CHECK ANSWER

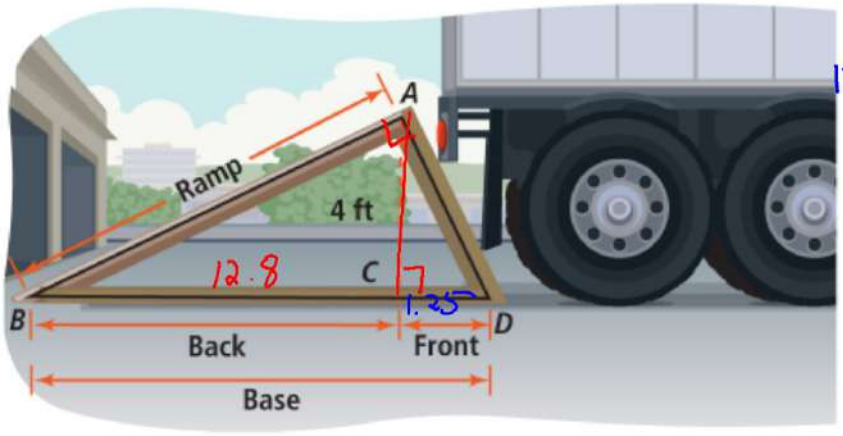
b. Find the value of *z*.

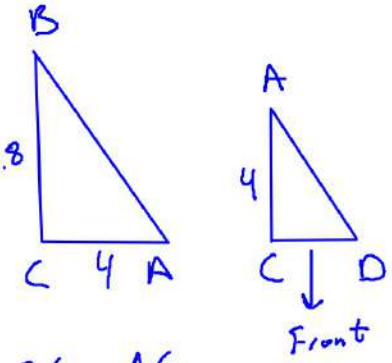
$\frac{9}{z} = \frac{z}{13}$

$z^2 = 117$

$z = 10.81$

Zhang is constructing a 4-ft high loading ramp. The length of the back of the base must be 12.8 ft. How long must the entire base be?





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

$\frac{12.8}{4} = \frac{4}{x}$

$12.8x = 16$

$x = 1.25$

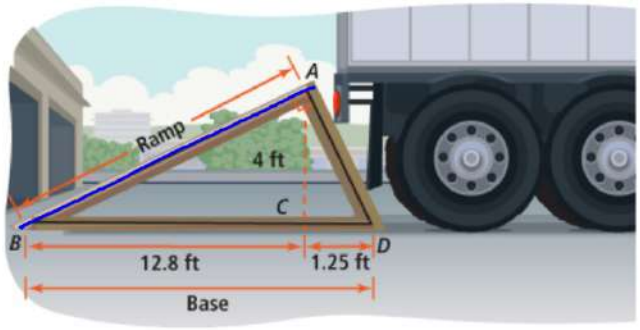
$12.8 + 1.25$

14.05 ft

6. How long should Zhang make the ramp?

Enter your answer.

CHECK ANSWER



$$\frac{12.8}{X} = \frac{X}{14.05}$$

$$X^2 = 179.84$$

$$X = 13.41$$