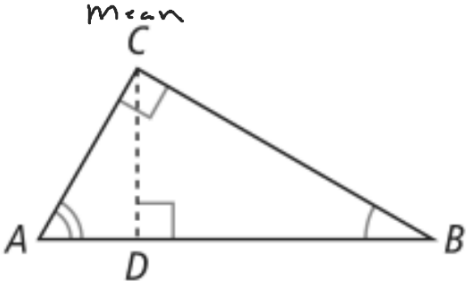
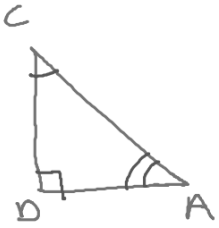
When you draw an altitude to the hypotenuse of a right triangle, you create three right triangles. How are the triangles related?

Altitude – Segment From a vertex ⊥ to opposite side

Geometric mean



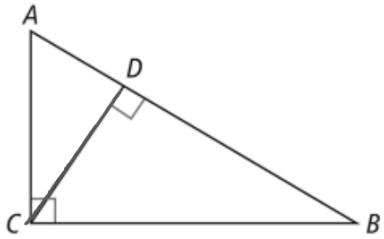
$\triangle ABC \sim \triangle ACD \sim \triangle CBD$



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.

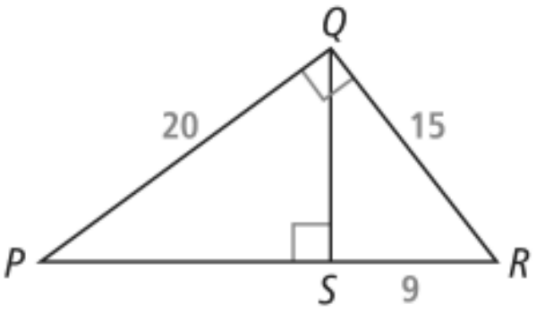
PROOF: SEE EXERCISE 14.

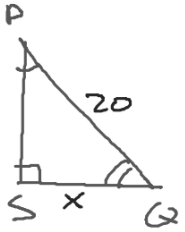
If...

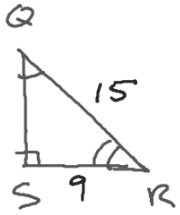


Then... $\triangle CAB \sim \triangle DAC \sim \triangle DCB$

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





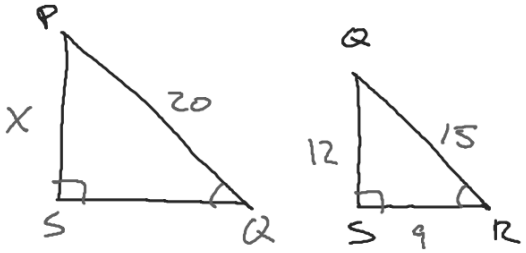


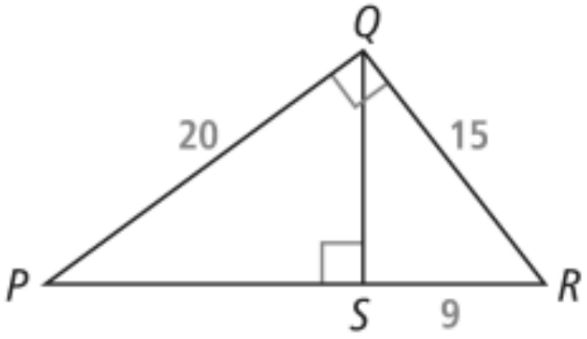
$$\frac{9}{x} = \frac{15}{20}$$

$$15x = 180$$

$$x = 12$$

What is *PS*?



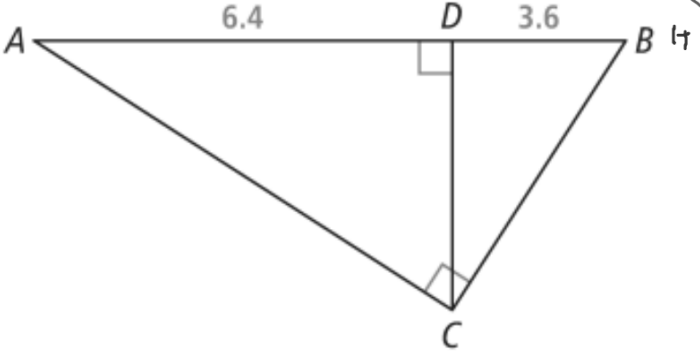


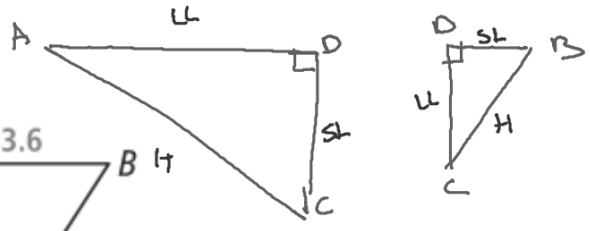
$$\frac{15}{20} = \frac{12}{x}$$

$$15x = 240$$

$$x = 16$$

Given $\triangle ACB$, what is CD?





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

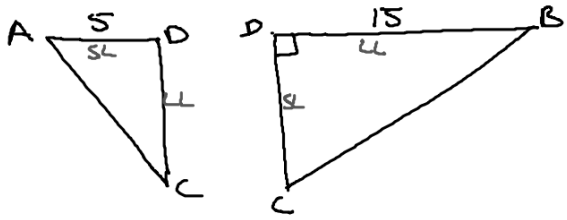
$$\frac{6.4}{X} = \frac{X}{3.6}$$

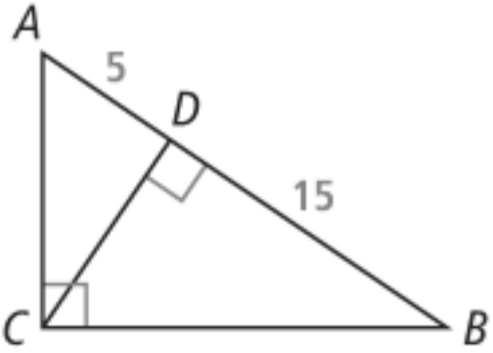
$$\sqrt{X^2} = \sqrt{23.04}$$

$$X = 4.8$$

Use $\triangle ABC$.

What is CD?





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

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

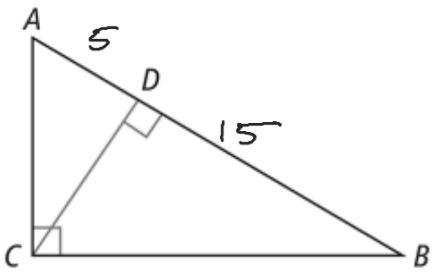
$$\sqrt{x^2} = \sqrt{75}$$

$$x = 8.6$$

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.

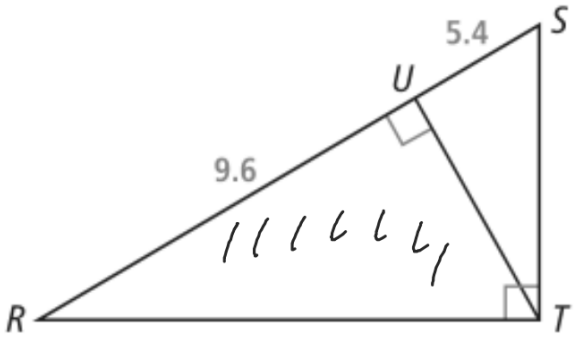
PROOF: SEE EXERCISE 14.

If...



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

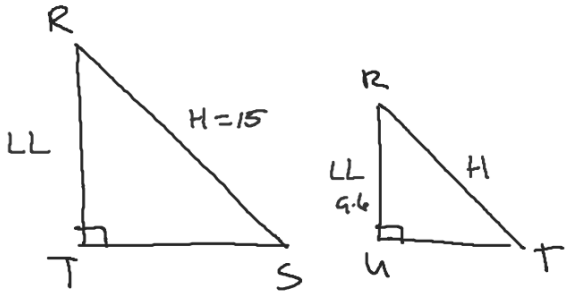
Given $\triangle RST$, what is RT?



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

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

$$x = 7.2$$



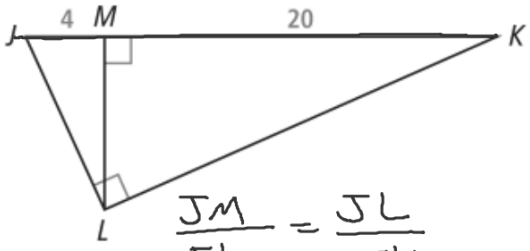
$$\frac{RU}{RT} = \frac{RT}{RS}$$

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

$$x^2 = 144$$

$$x = 12$$

4. Use $\triangle JKL$.



a. What is JL?

Enter your answer.

CHECK ANSWER

$$\frac{JM}{JL} = \frac{JL}{JK}$$

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

$$\sqrt{x^2} = \sqrt{96}$$

$$x = 9.79$$

b. What is KL?

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

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

$$x^2 = 480$$

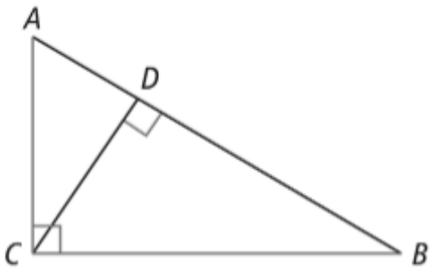
$$x = 21.9$$

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.

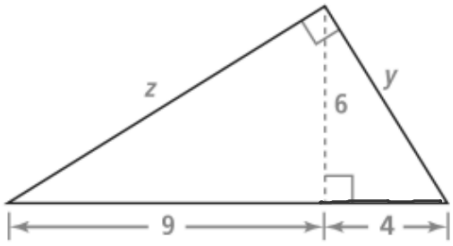
PROOF: SEE EXERCISE 14.

If...



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

5. Use the geometric mean to find each unknown.



a. Find the value of *y*.

Enter your answer.

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

$\sqrt{y^2} = \sqrt{52}$

$y = 7.2$

CHECK ANSWER

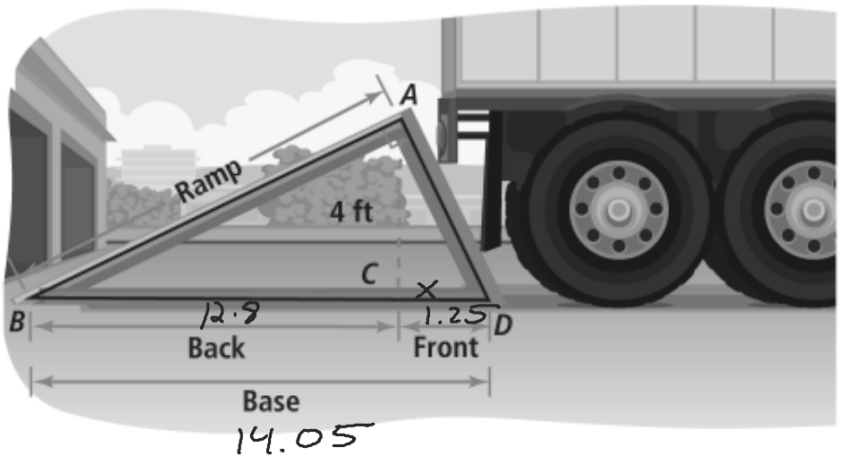
b. Find the value of *z*.

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

$\sqrt{z^2} = \sqrt{117}$

$z = 10.8$

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?



14.05

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

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

$$\frac{12.8x}{12.8} = \frac{16}{12.8}$$

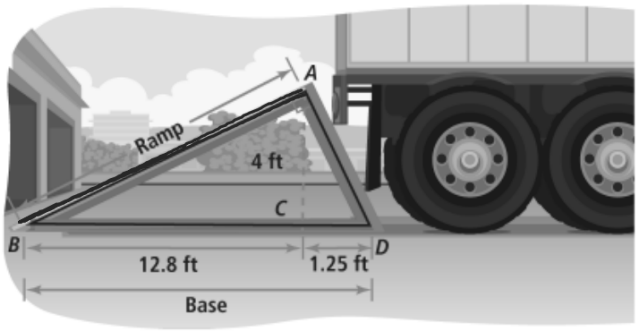
$$x = 1.25$$

6. How long should Zhang make the ramp?

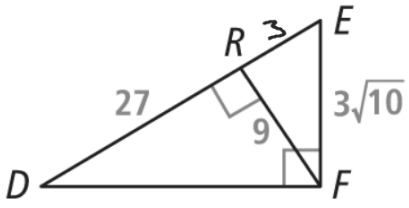
$4^2 + 12.8^2 = (AB)^2$ or $\frac{12.8}{x} = \frac{x}{14.05}$

13.4 ft

CHECK ANSWER



Use $\triangle DEF$ to find ER.



$\frac{ER}{9} = \frac{9}{27}$

$(ER)^2 + (9)^2 = (3\sqrt{10})^2$

$(ER)^2 + 81 = 90$

$ER^2 = 9$

$ER = 3$

Use $\triangle DEF$ to find DF.

$27^2 + 9^2 = DF^2$ $\quad \frac{27}{DF} = \frac{DF}{30}$

28.4

Use $\triangle DEF$ to find DE.

30

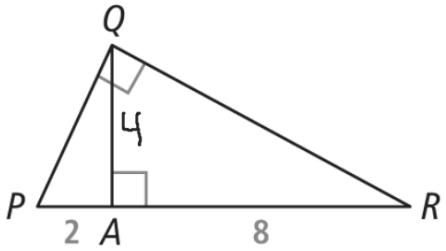
Use $\triangle PQR$ to find QA.

Enter your answer.

$\frac{2}{QA} = \frac{QA}{8}$

$QA^2 = 16$

$QA = 4$



Use $\triangle PQR$ to find QR.

$4^2 + 8^2 = QR^2$ $\quad \frac{8}{QR} = \frac{QR}{10}$

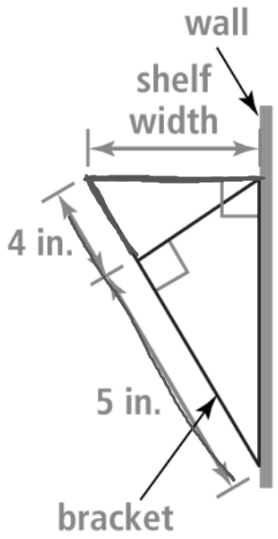
8.9

Use $\triangle PQR$ to find PQ.

$2^2 + 4^2 = PQ^2$ $\quad \frac{2}{PQ} = \frac{PQ}{10}$

4.4

10. Deshawn installs a shelf bracket. What is the widest shelf that will fit without overhang? Explain.



Enter your answer.

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

$x^2 = 36$

$x = 6$ in

CHECK ANSWER