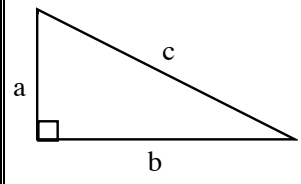
PYTHAGOREAN THEOREM #5



Any triangle that has a right angle is called a **RIGHT TRIANGLE**. The two sides that form the right angle, a and b, are called **LEGS**, and the side opposite (that is, across the triangle from) the right angle, c, is called the **HYPOTENUSE**.

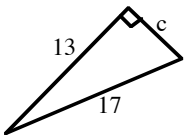
For any right triangle, the sum of the squares of the legs of the triangle is equal to the square of the hypotenuse, that is, $a^2 + b^2 = c^2$. This relationship is known as the **PYTHAGOREAN THEOREM**. In words, the theorem states that:

$$(\text{leg})^2 + (\text{leg})^2 = (\text{hypotenuse})^2.$$

Example

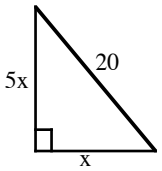
Draw a diagram, then use the Pythagorean Theorem to write an equation to solve each problem.

a) Solve for the missing side.



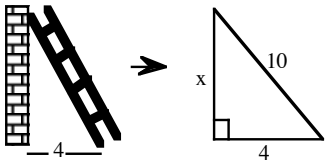
$$\begin{aligned} c^2 + 13^2 &= 17^2 \\ c^2 + 169 &= 289 \\ c^2 &= 120 \\ c &= \sqrt{120} \\ c &= 2\sqrt{30} \\ c &\approx 10.95 \end{aligned}$$

b) Find x to the nearest tenth:



$$\begin{aligned} (5x)^2 + x^2 &= 20^2 \\ 25x^2 + x^2 &= 400 \\ 26x^2 &= 400 \\ x^2 &\approx 15.4 \\ x &\approx \sqrt{15.4} \\ x &\approx 3.9 \end{aligned}$$

c) One end of a ten foot ladder is four feet from the base of a wall. How high on the wall does the top of the ladder touch?



$$\begin{aligned} x^2 + 4^2 &= 10^2 \\ x^2 + 16 &= 100 \\ x^2 &= 84 \\ x &\approx 9.2 \end{aligned}$$

The ladder touches the wall about 9.2 feet above the ground.

d) Could 3, 6 and 8 represent the lengths of the sides of a right triangle? Explain.

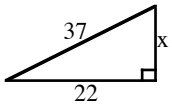
$$3^2 + 6^2 \stackrel{?}{=} 8^2$$

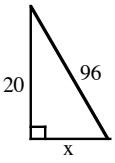
$$9 + 36 \stackrel{?}{=} 64$$

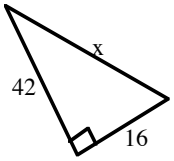
$$45 \neq 64$$

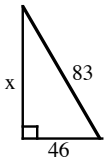
Since the Pythagorean Theorem relationship is not true for these lengths, they cannot be the side lengths of a right triangle.

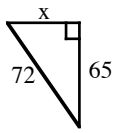
Use the Pythagorean Theorem to find the value of x. Round answers to the nearest tenth.

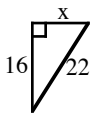
1. 

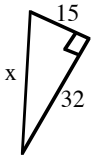
2. 

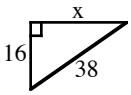
3. 

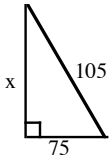
4. 

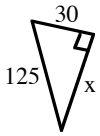
5. 

6. 

7. 

8. 

9. 

10. 

Solve the following problems.

11. A 12 foot ladder is six feet from a wall. How high on the wall does the ladder touch?
12. A 15 foot ladder is five feet from a wall. How high on the wall does the ladder touch?
13. A 9 foot ladder is three feet from a wall. How high on the wall does the ladder touch?
14. A 12 foot ladder is three and a half feet from a wall. How high on the wall does the ladder touch?
15. A 6 foot ladder is one and a half feet from a wall. How high on the wall does the ladder touch?
16. Could 2, 3, and 6 represent the lengths of sides of a right angle triangle? Justify your answer.
17. Could 8, 12, and 13 represent the lengths of sides of a right triangle? Justify your answer.
18. Could 5, 12, and 13 represent the lengths of sides of a right triangle? Justify your answer.
19. Could 9, 12, and 15 represent the lengths of sides of a right triangle? Justify your answer.
20. Could 10, 15, and 20 represent the lengths of sides of a right triangle? Justify your answer.

Answers

1. 29.7	2. 93.9	3. 44.9	4. 69.1	5. 31.0
6. 15.1	7. 35.3	8. 34.5	9. 73.5	10. 121.3
11. 10.4 ft	12. 14.1 ft	13. 8.5 ft	14. 11.5 ft	15. 5.8 ft
16. no	17. no	18. yes	19. yes	20. no