

Chapter 7

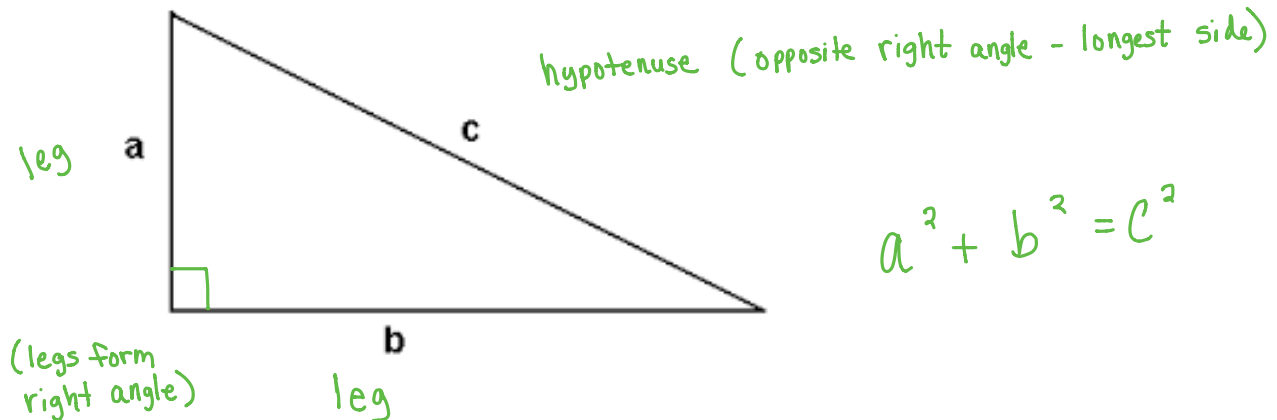
»» RIGHT TRIANGLES AND TRIGONOMETRY

7.1

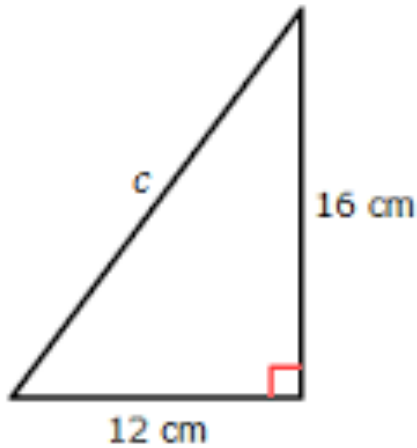
 PYTHAGOREAN THEOREM

Pythagorean Theorem

- ▶ In a right triangle, the Pythagorean Theorem says $a^2 + b^2 = c^2$, where c is the hypotenuse and a and b are the legs.



EX:



$$16^2 + 12^2 = c^2$$

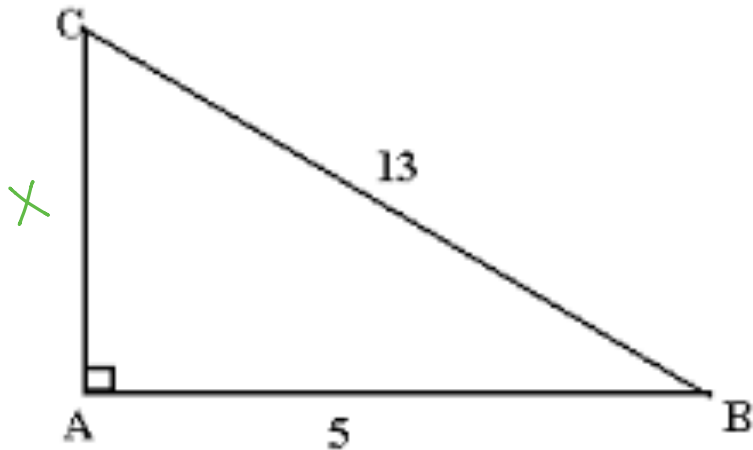
$$256 + 144 = c^2$$

$$\sqrt{400} = \sqrt{c^2}$$

$$c = 20$$

What is the length of the hypotenuse?

EX: Find the unknown side.



$$X^2 + 5^2 = 13^2$$

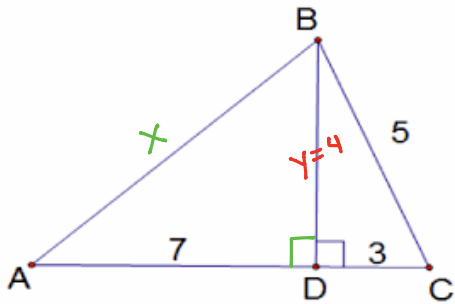
$$X^2 + 25 = 169$$

$$\begin{array}{r} -25 \\ -25 \end{array}$$

$$\sqrt{X^2} = \sqrt{144}$$

$$X = 12$$

EX: Find AB.



* Find y first:

$$y^2 + 3^2 = 5^2$$

$$y^2 + 9 = 25$$

$$\sqrt{y^2} = \sqrt{16}$$

$$y = 4$$

* Find x (AB) first:

$$7^2 + 4^2 = x^2$$

$$49 + 16 = x^2$$

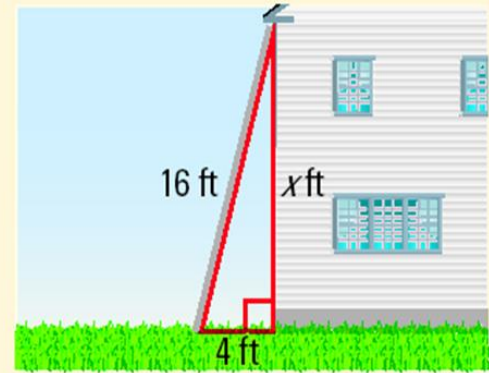
$$\sqrt{65} = \sqrt{x^2}$$

$$x = 8.1 = AB$$

EX: Standardized Test Practice

A 16 foot ladder rests against the side of the house, and the base of the ladder is 4 feet away. Approximately how high above the ground is the top of the ladder?

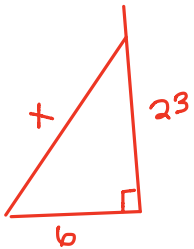
- (A) 240 feet (B) 20 feet
(C) 16.5 feet (D) 15.5 feet



$$\begin{aligned} 4^2 + x^2 &= 16^2 \\ 16 + x^2 &= 256 \\ -16 &\quad -16 \\ \hline x^2 &= 240 \\ x &= 15.5 \end{aligned}$$

EX:

- ▶ The top of a ladder rests against a wall, 23 feet above the ground. The base of the ladder is 6 feet away from the wall. What is the length of the ladder?



$$6^2 + 23^2 = x^2$$

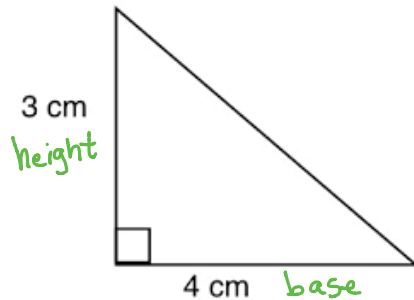
$$36 + 529 = x^2$$

$$\sqrt{565} = \sqrt{x^2}$$

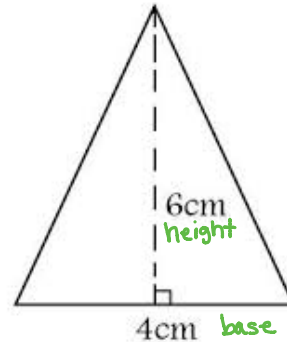
$$x = 23.8 \text{ feet}$$

Area of a Triangle

- ▶ Area = $\frac{1}{2}bh$
- ▶ b = base of the triangle
- ▶ h = height of the triangle (perpendicular distance)



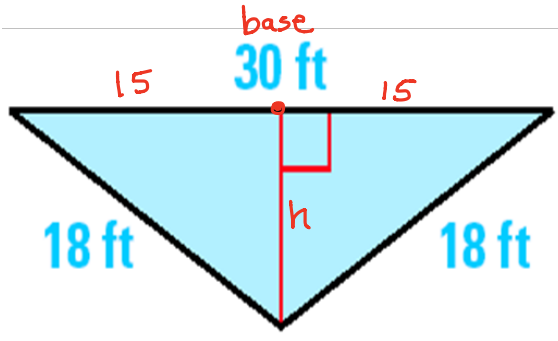
$$\begin{aligned}A &= \frac{1}{2}bh \\A &= \frac{1}{2}(4)(3) \\A &= 2(3) \\A &= 6 \text{ cm}^2\end{aligned}$$



$$\begin{aligned}A &= \frac{1}{2}bh \\A &= \frac{1}{2}(4)(6) \\A &= 2(6) \\A &= 12 \text{ cm}^2\end{aligned}$$

EX:

Find the area of the triangle.



* Find height first:

$$\begin{aligned}15^2 + h^2 &= 18^2 \\225 + h^2 &= 324 \\-225 &\quad -225 \\ \hline h^2 &= 99 \\ h &= 9.9\end{aligned}$$

* Find area:

$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2}(30)(9.9)$$

$$A = 15(9.9)$$

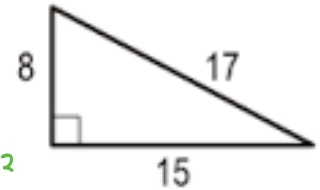
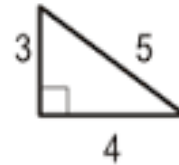
$$A = 149.2 \text{ ft}^2$$

Pythagorean Triples

- ▶ A set of 3 whole numbers that makes $a^2 + b^2 = c^2$ true.

Pythagorean Triples

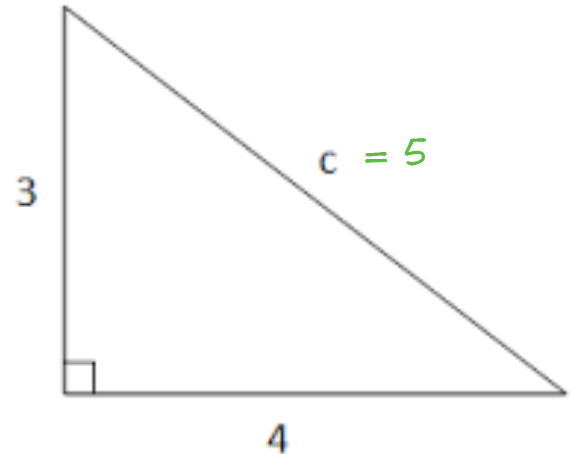
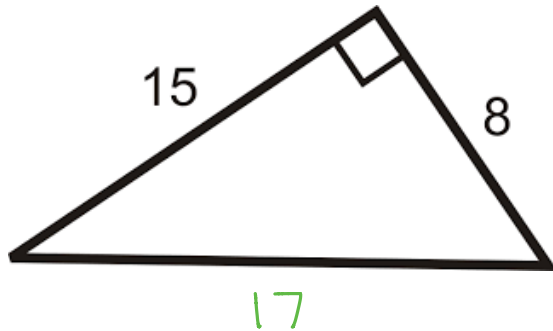
<u>(3, 4, 5)</u>	(5, 12, 13)	(7, 24, 25)	<u>(8, 15, 17)</u>
(9, 40, 41)	(11, 60, 61)	(12, 35, 37)	(13, 84, 85)
(16, 63, 65)	(20, 21, 29)	(28, 45, 53)	(33, 56, 65)
(36, 77, 85)	(39, 80, 89)	(48, 55, 73)	(65, 72, 97)



$$\begin{aligned} \text{Ex: } 3^2 + 4^2 &= 5^2 \\ 9 + 16 &= 25 \\ 25 &= 25 \quad \text{True} \checkmark \end{aligned}$$

(If true - triangle is a right triangle)

EX: Use Pythagorean Triples to find the missing side.



* See above table.