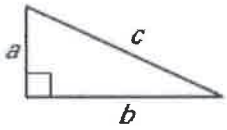
Geometry H
7.1 – Pythagorean Theorem

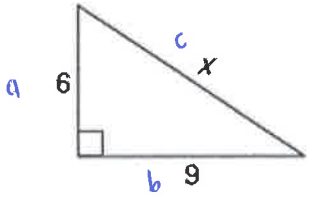
Name: Key
Date: _____ Period: _____

- I can use the Pythagorean Theorem to find side lengths in triangles.
- I can identify if sides of a right triangle form a Pythagorean Triple.

Pythagorean Theorem	In a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the legs.	 $c^2 = a^2 + b^2$
Pythagorean Triple	A Pythagorean triple is a set of three positive integers *a*, *b*, and *c* that satisfy the equation of $c^2 = a^2 + b^2$	**Examples of Pythagorean Triples:** 3, 4, 5; 5, 12, 13 8, 15, 17 7, 24, 25 **Examples of non-Pythagorean Triples:** $\sqrt{3}$, 1, 4 2.5, 3.5, 18.5 not integers

Example 1: Use Pythagorean Theorem to find length of missing side of a right triangle.

a) Solve for x.



$a^2 + b^2 = c^2$

$6^2 + 9^2 = c^2$

$36 + 81 = c^2$

$117 = c^2$

$c = \sqrt{117}$

$c = \sqrt{9}\sqrt{13} \Rightarrow \boxed{c = 3\sqrt{13}}$

Example 2: Use Pythagorean Theorem to solve real-world problems.

a) A ladder rests against a house. The foot of the ladder is 8 feet from the house. The top of the ladder rests 15 feet above the ground. What is the length of the ladder?

$a^2 + b^2 = c^2$

$15^2 + 8^2 = x^2$

$225 + 64 = x^2$

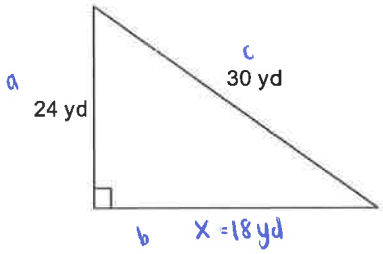
$289 = x^2$

$x = \sqrt{289}$

$x = 17$

The ladder is 17 ft long

b) A developer is planning a new park in the shape of a right triangle, as represented in the diagram below. Find the perimeter and area of the new park.



$a^2+b^2=c^2$

$24^2+x^2=30^2$

$576+x^2=900$

$x^2=324$

$x=\sqrt{324}$

$x=18$

Perimeter $= 30+24+18$

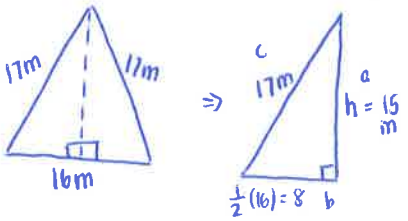
$P = 72$ yds

Area $= \frac{1}{2}bh = \frac{1}{2}(18)(24)$

$A = 216\ yd^2$

Example 3: Find the area of an isosceles triangle.

Find the area of the isosceles triangle with side lengths 16 meters, 17 meters, and 17 meters.



$a^2+b^2=c^2$

$h^2+8^2=17^2$

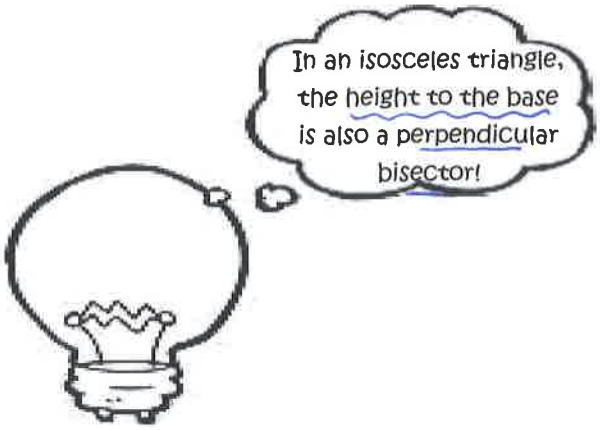
$h^2+64=289$

$h^2=225$

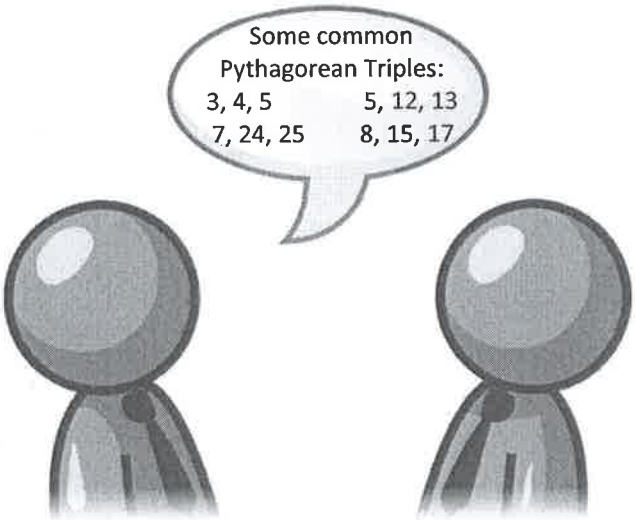
$h=15$ m

$A = \frac{1}{2}bh = \frac{1}{2}(16)(15)$ (16 ← whole base; 15 ← vertical height)

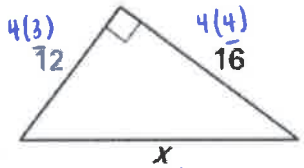
$A = 120\ m^2$



Example 4: Use a Pythagorean Triple



a) Find the value of x using Pythagorean Triples.



3,4,5 triangle

$x=5$

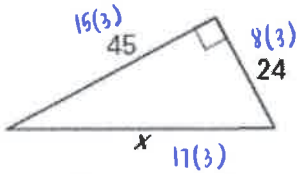
Check: $12^2+16^2=x^2$

$144+256=x^2$

$400=x^2 \Rightarrow x=20$

$4(5)=20$ ✓

b) Find the value of x using Pythagorean Triples.



$x=17$

Since it is an 8,15,17 triangle

c) 24 and 32 are two sides of a right triangle. All three side lengths of the triangle are integers and together form a Pythagorean Triple. Find the length of the third side and tell whether it is a leg or the hypotenuse.

$24 = 3(8)$

$32 = 4(8)$

$x = 5(8)$

The third side is 40 units and is the hypotenuse since it is the longest side