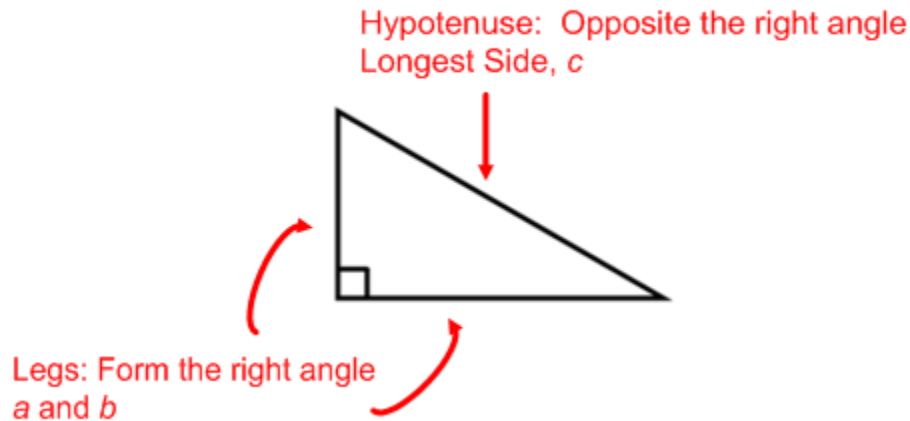## 11.4: Apply the Pythagorean Theorem and its Converse

Goals: *Use the Pythagorean Theorem to find a missing side of the right triangle
*Use the Pythagorean Theorem to decide if three sides could form a right triangle

Anatomy of a Right Triangle

Hypotenuse: Opposite the right angle
Longest Side, c

Legs: Form the right angle
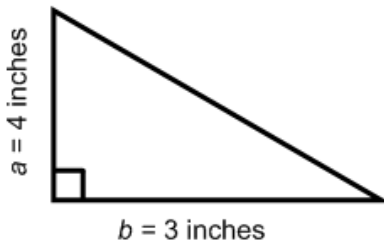a and b

Pythagorean Theorem: if, and only if, a triangle is a right triangle, then the sum of the squares of the lengths of the legs is equal to the length of the hyptonenuse squared.
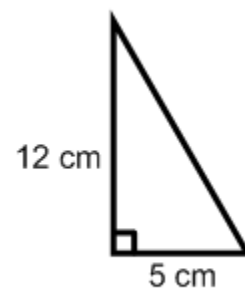
$$a^2 + b^2 = c^2$$
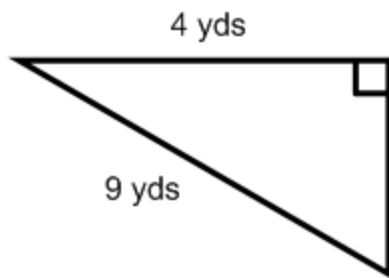
Use the Pythagorean Theorem to find the missing length:

Ex:

$a = 4$ inches

$b = 3$ inches

Ex:

12 cm

5 cm

$a^2 + b^2 = c^2$
$4^2 + 3^2 = c^2$
$16 + 9 = c^2$
$25 = c^2$
$5 = c$

$a^2 + b^2 = c^2$
$12^2 + 5^2 = c^2$
$144 + 25 = c^2$
$169 = c^2$
$13 = c$

Ex:

4 yds

9 yds

$a^2 + b^2 = c^2$
$4^2 + b^2 = 9^2$
$16 + b^2 = 81$
$-16 \qquad -16$
$b^2 = 65$
$b = 8.06$ yards

Ex:

c = 7 m

b = 6 m
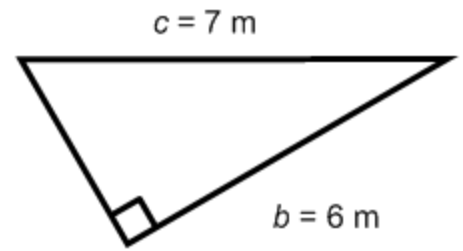
$a^2 + b^2 = c^2$
$a^2 + 6^2 = 7^2$
$a^2 + 36 = 49$
$-36 \quad -36$
$a^2 = 13$
$a = 3.61$ m

Ex: Four people standing in a rectangle are playing Frisbee. Approximately how far is the throw from person A to person C?

$a^2 + b^2 = c^2$
$20^2 + 18^2 = c^2$
$400 + 324 = c^2$
$724 = c^2$
$26.09 = c$

Approximately 27 feet

A _____ D

18 ft
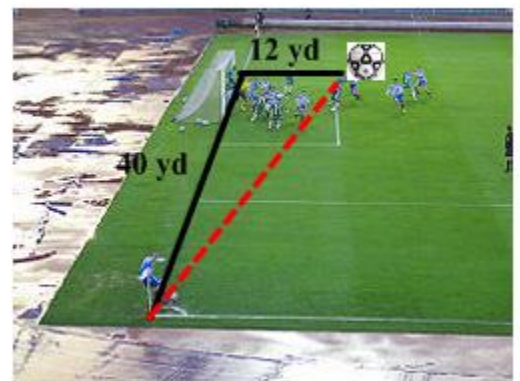
20 ft

B   C
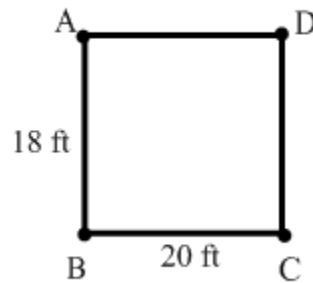
Ex: A soccer player makes a corner kick to another player as shown below. How far is the kick, to the nearest yard?

$a^2 + b^2 = c^2$
$40^2 + 12^2 = c^2$
$1600 + 144 = c^2$
$1744 = c^2$
$41.76 = c$

Approximately 42 yards

12 yd

40 yd

<u>CONVERSE OF THE PYTHAGOREAN THEOREM</u>: If a triangle has side lengths a, b and c such that $a^2 + b^2 = c^2$, then the triangle is a right triangle.

*If the Pythagorean Theorem works, then it's a right triangle. If not, then its not.

Tell whether the following side lengths could form a right triangle. Show or explain your work.

Ex: 8, 15, 17

$a^2 + b^2 = c^2$
$8^2 + 15^2 = 17^2$
$64 + 225 = 289$
$289 = 289$

Yes

Ex: 5, 9, 8

$a^2 + b^2 = c^2$
$5^2 + 8^2 = 9^2$
$25 + 64 = 81$
$89 = 81$

No

Ex: 13, 12, 5

$a^2 + b^2 = c^2$
$5^2 + 12^2 = 13^2$
$25 + 144 = 169$
$169 = 169$

Yes