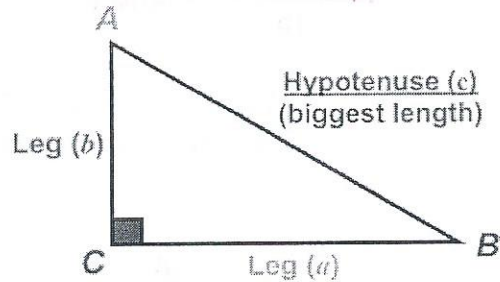In a right triangle, the sides that form the right angle are called *LEGS* (a and b).
The side opposite of the right angle is called the *HYPOTENUSE* (c).

The Pythagorean Theorem

$(\text{leg})^2 + (\text{leg})^2 = (\text{hypotenuse})^2$
$a^2 + b^2 = c^2$

Hypotenuse (c)
(biggest length)
Leg (b)
C   Leg (a)   B

Finding the Length of the Hypotenuse

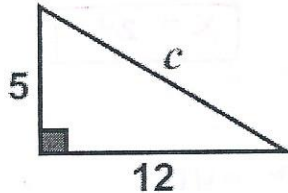$(\text{leg})^2 + (\text{leg})^2 = (\text{hypotenuse})^2$
$5^2 + 12^2 = c^2$
$25 + 144 = c^2$
$169 = c^2$
$\sqrt{169} = \sqrt{c^2}$
$13 = c$

5
c
12

Finding the Length of a Leg

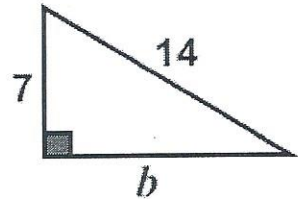$(\text{leg})^2 + (\text{leg})^2 = (\text{hypotenuse})^2$
$7^2 + b^2 = 14^2$
$49 + b^2 = 196$
$\underline{-49 \qquad\qquad -49}$
$b^2 = 147$
$\sqrt{b^2} = \sqrt{147}$
$b = 12.1$

7
14
b

Find the length of the unknown side. Round to the nearest tenths if necessary.
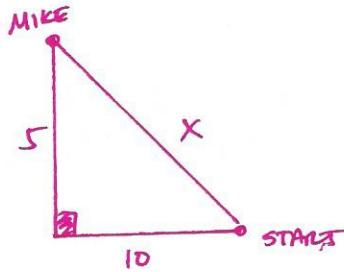
1.

14
20
c

$14^2 + 20^2 = c^2$
$196 + 400 = c^2$
$596 = c^2$
$\sqrt{596} = \sqrt{c^2}$
$\boxed{24.4 = c}$

2.

6
10
a

$a^2 + b^2 = 10^2$
$a^2 + 36 = 100$
$a^2 = 64$
$\sqrt{a^2} = \sqrt{64}$
$\boxed{a = 8}$

3.

8
7
c

$7^2 + 8^2 = c^2$
$49 + 64 = c^2$
$113 = c^2$
$\sqrt{113} = \sqrt{c^2}$
$\boxed{10.6 = c}$

4.

15
17
b

$15^2 + b^2 = 17^2$
$225 + b^2 = 289$
$b^2 = 64$
$\sqrt{b^2} = \sqrt{64}$
$\boxed{b = 8}$

5. Mike starts out ridding his bikes 10 miles due West and then finishes his ride by turning and heading 5 miles due North. About how many miles is Mike from his starting point?
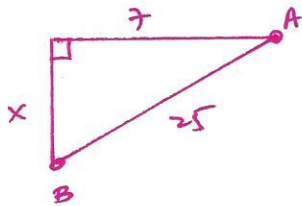
MIKE

5   X

10   STARA

$$5^2 + 10^2 = X^2$$
$$25 + 100 = X^2$$
$$125 = X^2$$
$$\sqrt{125} = \sqrt{X^2}$$
$$\boxed{11.2 = X}$$

6. The distance between points A and B is 25 miles. To get from point A, you would need to travel 7 miles West and some unknown number of miles South. Find this unknown number.
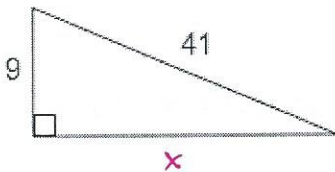
7   A

X   25

B

$$X^2 + 7^2 = 25^2$$
$$X^2 + 49 = 625$$
$$X^2 = 576$$
$$\sqrt{X^2} = \sqrt{576}$$
$$\boxed{X = 24}$$

7. What is the perimeter of the following right triangle?

9   41

x

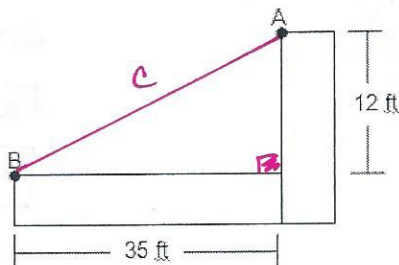$$X^2 + 9^2 = 41^2$$
$$X^2 + 81 = 1681$$
$$X^2 = 1600$$
$$\sqrt{X^2} = \sqrt{1600}$$
$$X = 40$$

PERIMETER
9 + 40 + 41
$$\boxed{90}$$

8. Mr. Simpson needs to travel from point B to point A. He can either travel on the indicated path or walk directly from B to A. How many feet shorter is it if he decides to take the direct route from B to A instead of staying on the path?

A

C   12 ft

B

35 ft

$$35^2 + 12^2 = c^2$$
$$1225 + 144 = c^2$$
$$1369 = c^2$$
$$\sqrt{1369} = \sqrt{c^2}$$
$$37 = c$$

$$35 + 12 = 47$$
$$47 - 37$$
$$\boxed{10}$$

9. Isaac is fencing in a triangular garden. If fencing costs 89 cents per foot, what will it cost to buy the fence for his garden?

10 ft   c

24 ft

$$10^2 + 24^2 = c^2$$
$$100 + 576 = c^2$$
$$676 = c^2$$
$$\sqrt{676} = \sqrt{c^2}$$
$$26 = c$$

PERIMETER OF FENCE
10 + 24 + 26
60 FT
COST TO BUY FENCE
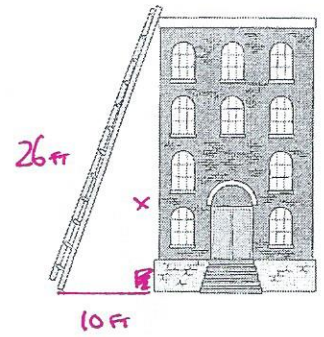$$60(.89) = \boxed{\$53.40}$$

10. A 26 foot ladder is leaning against a building with the top of the ladder touching the exact top of the building. The bottom of the ladder is 10 feet from the building. How tall is the building?

$$10^2 + x^2 = 26^2$$
$$100 + x^2 = 676$$
$$x^2 = 576$$
$$\boxed{x = 24 \text{ ft}}$$

26 ft
x
10 ft

11. A giant redwood tree fell during a storm. The place where it cracked is 28 feet from the ground and the top of the tree is 96 feet from the base. How tall was the redwood before it fell?

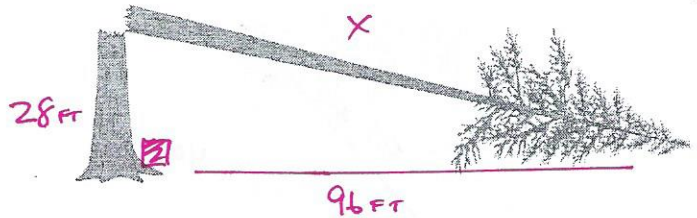$$28^2 + 96^2 = x^2$$
$$784 + 9216 = x^2$$
$$10000 = x^2$$
$$\sqrt{10000} = \sqrt{x^2}$$
$$100 = x$$

28 + 100
$\boxed{128 \text{ ft}}$
28 ft
x
96 ft

12. You've just picked up a ground ball at first base, and you see the other team's player running towards third base. How far do you have to throw the ball to get it from first base to third base, and throw the runner out?
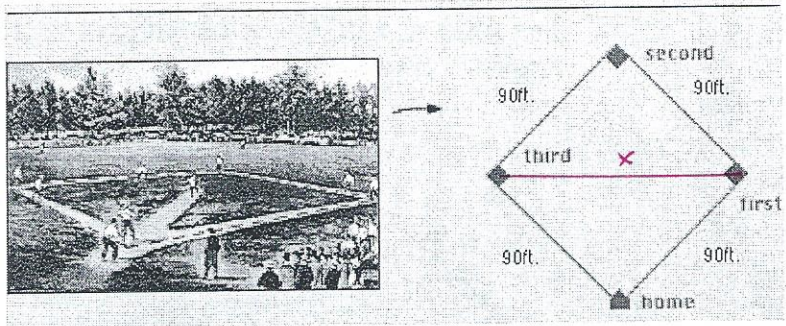
$$90^2 + 90^2 = x^2$$
$$8100 + 8100 = x^2$$
$$16200 = x^2$$
$$\sqrt{16200} = \sqrt{x^2}$$
$$\boxed{127.3 \text{ ft} = x}$$

second
90ft.   90ft.
third   x
                first
90ft.   90ft.
home

13. The Chicago White Sox built a new stadium that opened in 1991. In the picture below, home plate is located 205 ft from the bottom of the stadium. The height of the stadium from top to bottom is 143 ft. How many feet is it from home plate to the top of the stadium?
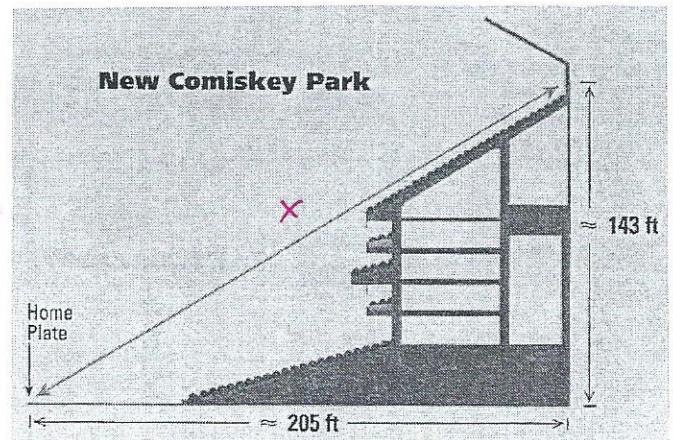
$$205^2 + 143^2 = x^2$$
$$42025 + 20449 = x^2$$
$$62474 = x^2$$
$$\sqrt{62474} = \sqrt{x^2}$$
$$\boxed{249.9 \text{ ft} = x}$$

New Comiskey Park
x
≈ 143 ft
Home Plate
≈ 205 ft

14. You're locked out of your house and the only open window is on the second floor, 40 feet above the ground. You need to borrow a ladder from one of your neighbors. There's a bush along the edge of the house, so you'll have to place the ladder 11 feet from the house. What length of ladder do you need to reach the window?
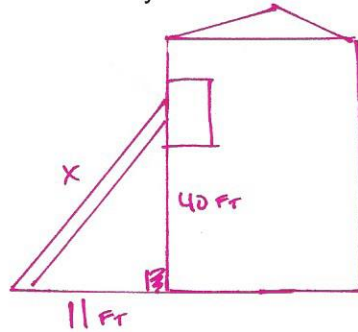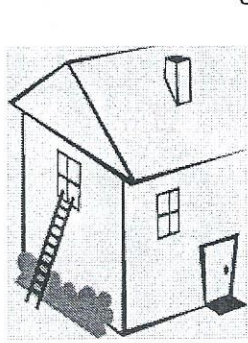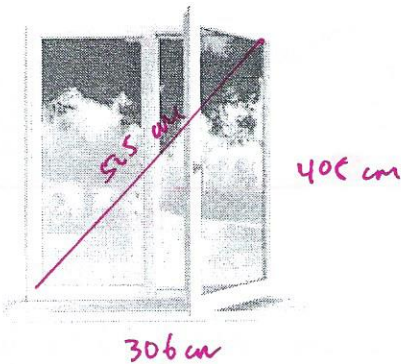
$11^2 + 40^2 = x^2$

$121 + 1600 = x^2$

$1721 = x^2$

$\sqrt{1721} = \sqrt{x^2}$

$41.5 \text{ ft} = x$

15. A window frame that seems rectangular has height 408 cm, length 306 cm, and one diagonal with length 525 cm. Is the window frame really rectangular? Explain.

$306^2 + 408^2 = 525^2$

$93636 + 166464 = 275625$

$260100 \neq 275625$

∴ NOT RECTANGULAR WINDOW FRAME

16. You are building a foundation with Mr. Hernandez. You want to ensure the base is a rectangle with 4 right angles. You setup the foundation boundaries using some stakes and rope and take the following measurements. Is the base a rectangle with 4 right angles? Explain why or why not.
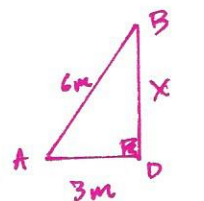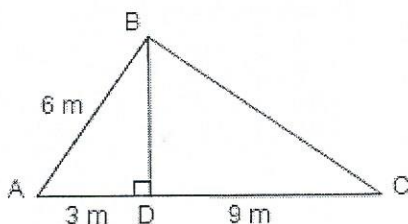
30 ft

72 ft   78 ft

72 ft

30 ft
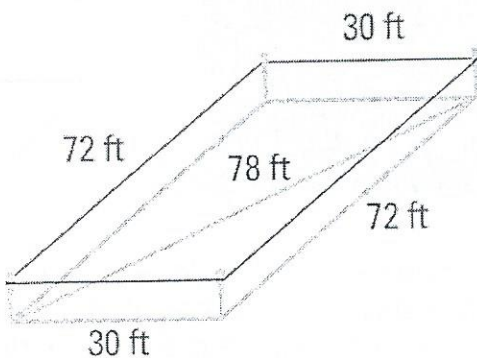
$30^2 + 72^2 = 78^2$

$900 + 5184 = 6084$

$6084 = 6084$

∴ INDEED A RECTANGULAR BASE
WITH 4 RIGHT ANGLES

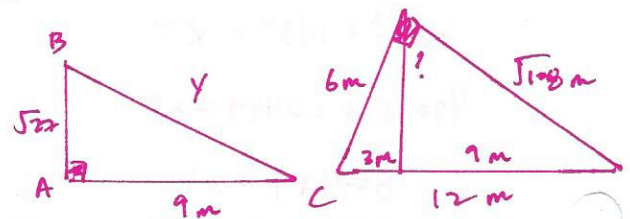17. Is $\triangle ABC$ a right triangle? Explain why or why not.

B

6 m

A   3 m D   9 m   C

6m   x   3m

A   3m   D

$x^2 + 3^2 = 6^2$
$x^2 + 9 = 36$
$x^2 = 27$
$\sqrt{x^2} = \sqrt{27}$
$x = \sqrt{27} \text{ m}$

B   y

$\sqrt{27}$

A   9m   C

$9^2 + (\sqrt{27})^2 = y^2$
$81 + 27 = y^2$
$108 = y^2$
$\sqrt{108} = \sqrt{y^2}$
$\sqrt{108} = y$

6m $\sqrt{108}$ m

3m   9m

12 m

$6^2 + (\sqrt{108})^2 = 12^2$
$36 + 108 = 144$
$144 = 144$
∴ $\triangle ABC$ IS A RIGHT $\triangle$