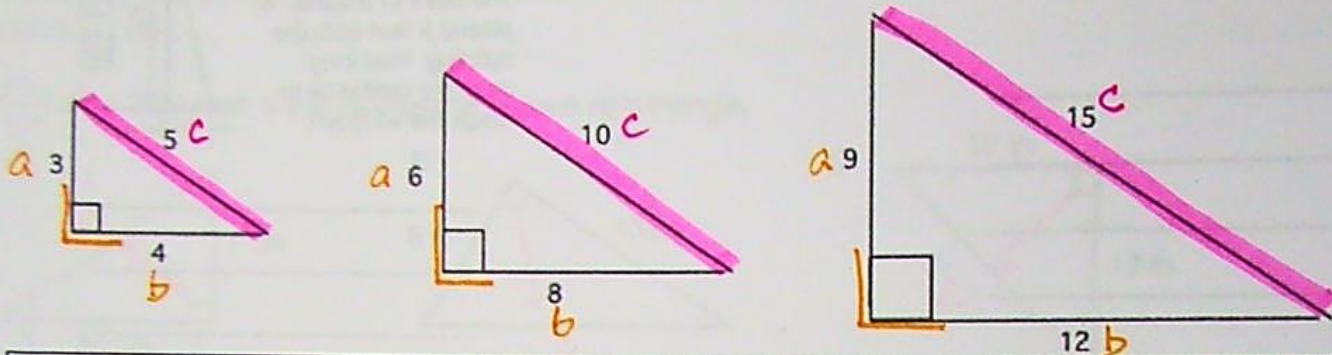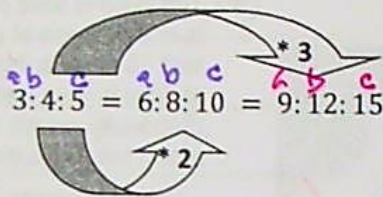~~ Unit 6, Page 34 ~~

## Pythagorean Triplets or Triples

A Pythagorean Triple is a set of three counting numbers that are the lengths of the sides of a right triangle.



Notice that the three triangles above are similar. Similar polygons have congruent angles and the side lengths are in equal ratio. You can multiply the three lengths by a common factor and the other lengths.

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

3:4:5 = 6:8:10 = 9:12:15   *3   *2

$$10^2 = 6^2 + 8^2$$
$$100 = 36 + 64$$
$$100 = 100 ✓$$

The triangles above are all members of the {3, 4, 5} family, which you see the most often.

$$15^2 = 9^2 + 12^2$$
$$225 = 81 + 144$$
$$225 = 225 ✓$$

When we see a new Pythagorean Triplet, we will write them with their family below:

| a | b | c | | a | b | c | | a | b | c | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3, | 4, | 5 | ✓ | 5, | 12, | 13 | ✓ | 8, | 15, | 17 | ✓ |
| (*2) 6, | 8, | 10 | | (*2) 10, | 24, | 26 | | (*2) 16, | 30, | 34 | |
| (*3) 9, | 12, | 15 | | (*3) 15, | 36, | 39 | | (*3) 24, | 45, | 51 | |
| (*4) 12, | 16, | 20 | | (*4) 20, | 48, | 52 | | (*4) 32, | 60, | 68 | |
| (*5) 15, | 20, | 25 | | | | | | | | | |

| a | b | c | |
|---|---|---|---|
| 7, | 24, | 25 | ✓ |
| (*2) 14, | 48, | 50 | |
| (*3) 21, | 72, | 75 | |

~~ Unit 6, Page 35 ~~ | Objectives: I can apply the Pythagorean Theorem to find the missing length of a right triangle.

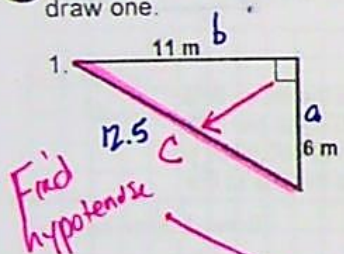## Using the Pythagorean Theorem to Find the Missing Length

Trace over the legs of the right triangle and circle the measurement of the hypotenuse.

8in. 17in. $c$
15in.

$c$ 13m
5m 12m

4in.
3in. 5in. $c$

7mm $c$ 25mm
24mm

leg   leg
hypotenuse $c$

$c$ 10ft   8ft
6ft
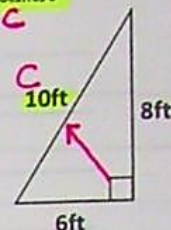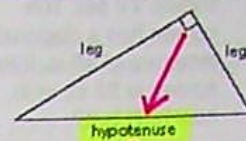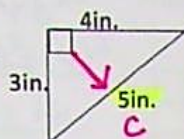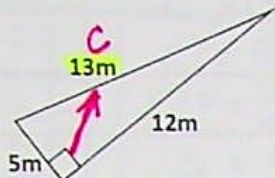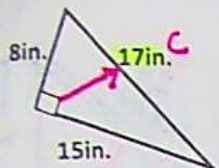
**Notes:** The ___hypotenuse___ is ALWAYS the longest side of the right triangle. What do you think you will need to do if you are missing the leg length instead of the hypotenuse? In the following problems, you will have to decide if you are finding the length of the hypotenuse or a leg length.

If you are calculating the length of the hypotenuse, you need to ___add, then take $\sqrt{\ }$___ .

If you are calculating the length of a leg, you need to ___subtract, then take $\sqrt{\ }$___ .

State all lengths as square roots, then approximate to the nearest tenth. If a diagram is not provided, you must draw one.
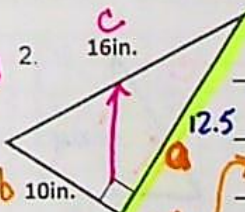
1.
11 m $b$
12.5 $c$
$a$
6 m
Find hypotenuse

$c^2 = a^2 + b^2$
$c^2 = 6^2 + 11^2$
$c^2 = 36 + 121$ ← add
$\sqrt{c^2} = \sqrt{157}$
$c \approx 12.54$

2.
$c$
16in.
12.5
$b$ 10in.
Find a leg

$a^2 + b^2 = c^2$
$a^2 + (10)^2 = (16)^2$
$a^2 + 100 = 256$
subtract $-100$  $-100$
$\sqrt{a^2} = \sqrt{156}$
$a \approx 12.54$

**Assignment:**

① (1)

Ⓐ (Leg)
Find ⓐ
$c$
8 cm   5.3
$a$
$b$ 6 cm
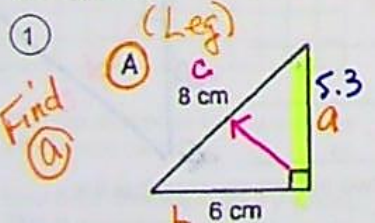
$a^2 + b^2 = c^2$
$a^2 + (6)^2 = (8)^2$
$a^2 + 36 = 64$
$-36$  $-36$
$\sqrt{a^2} = \sqrt{28}$
$a \approx 5.3$

Ⓑ (Hypotenuse)
Find ⓒ
$a$   $b$
11 m   14 m
$c$ 17.8
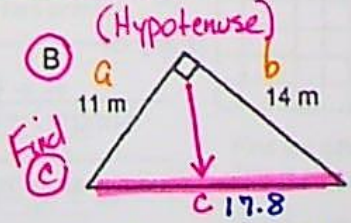
$c^2 = a^2 + b^2$
$c^2 = (11)^2 + (14)^2$
$c^2 = 121 + 196$
$\sqrt{c^2} = \sqrt{317}$
$c = 17.8$

Ⓒ (Leg)
$a$ 9.7
$b$ 7 in.   12 in.
$c$
Find ⓐ
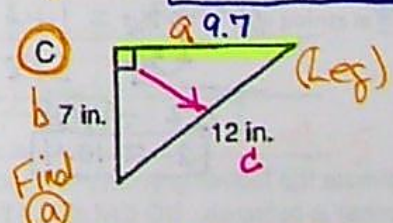
$a^2 + b^2 = c^2$
$a^2 + (7)^2 = (12)^2$
$a^2 + 49 = 144$
$-49$  $-49$
$\sqrt{a^2} = \sqrt{95}$
$a \approx 9.7$

Homewor HELP! ~~ Unit 6, Page 36 ~~

② Yuki just bought a big-screen TV set. The screen has a diagonal measure of 40 in. If the screen is 32 in. wide, how high is it?
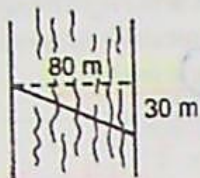
[diagram: rectangle, diagonal 40", width 32"]
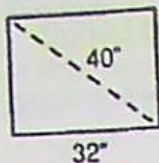
③ A 25-foot ladder is leaned against a wall. If the base of the ladder is 7 ft from the wall, how high up the wall will the ladder reach?
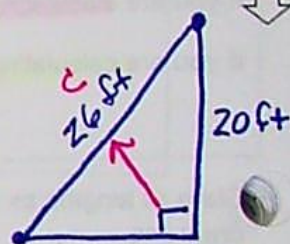
[Draw diagram here.]

[diagram: ladder 25, wall, base 7]
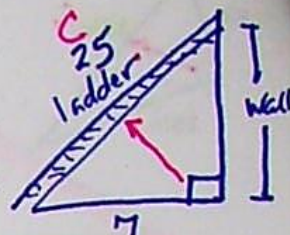
④ As Greg swam across an 80-meter river, the current carried him 30 m downstream. How far did he swim?
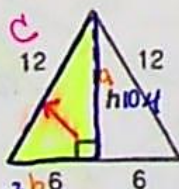
[diagram: 80 m, 30 m]

⑤ The mast of a sailing ship is 20 ft tall. A rope is stretched 26 ft from the top of the mast to a cleat on the deck of the ship. How far is the cleat from the base of the mast?

[Draw diagram here.]

[diagram: 26 ft, 20 ft]

⑥ Each side of an equilateral triangle measures 12 cm. Find the height, $h$, of the triangle.

[diagram: triangle sides 12, 12, base 6 and 6, height h]

$a^2 + b^2 = c^2$
$a^2 + (6)^2 = (12)^2$
$a^2 + 36 = 144$
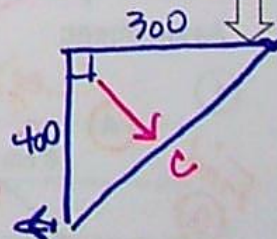$-36 \quad -36$
$\sqrt{a^2} = \sqrt{108}$
$a \approx 10.4$

⑦ Two jets left an airport at the same time. One traveled east at 300 miles per hour. The other traveled south at 400 miles per hour. How far apart were the jets at the end of an hour?

[Draw diagram here.]

[compass N/S/E/W diagram; triangle 300, 400, c]

Estimate the following square roots to the nearest tenth. You must show the two perfect squares that the number is between. **NO CALCULATOR!!!**

8) $\sqrt{68}$  $\sqrt{81}$ $8\frac{4}{17}$
8 ≈ 8.2  9
$\frac{4}{17} \approx \frac{4}{16} = \frac{1}{4}$
$\frac{1}{4} = 0.25$

9) $\sqrt{78}$

10) $\sqrt{51}$

11) $\sqrt{123}$

12) $\sqrt{287}$

13) $\sqrt{30}$

14) $\sqrt{5}$

15) $\sqrt{47}$