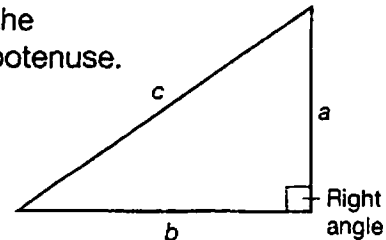




## SKILL 21: The Pythagorean Theorem

The **hypotenuse** of a right triangle is the side opposite the right angle and is the longest side. The other two sides are called **legs**. In the triangle at the right, sides  $a$  and  $b$  are the legs. Side  $c$  is the hypotenuse.

The **Pythagorean Theorem** states that the sum of the squares of the lengths of the legs of a right triangle is equal to the square of the length of the hypotenuse. This can be written algebraically as  $a^2 + b^2 = c^2$ .

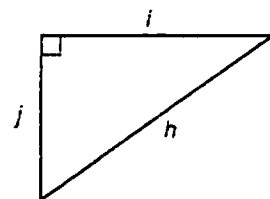


### Example 1

Name the hypotenuse and legs of the right triangle.

Side  $h$  is opposite the right angle, so it is the hypotenuse.

Sides  $i$  and  $j$  are the legs.



### Example 2

Find the length of side  $c$ .

Use the Pythagorean Theorem.

Substitute 9 for  $a$  and 12 for  $b$ .

Square 9 and 12.

Add.

Find  $\sqrt{225}$ .

The length of the hypotenuse is 15 cm.

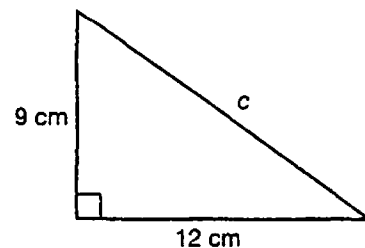
$$a^2 + b^2 = c^2$$

$$9^2 + 12^2 = c^2$$

$$81 + 144 = c^2$$

$$225 = c^2$$

$$15 = c$$



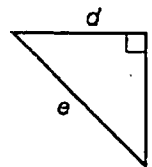
### Guided Practice

1. Name the hypotenuse and legs of the right triangle.

a. The side opposite the right angle is side \_\_\_\_\_.

So, the hypotenuse is side \_\_\_\_\_.

b. The legs of the right triangle are sides \_\_\_\_\_ and \_\_\_\_\_.



2. Find the missing length in the right triangle.

Use the Pythagorean Theorem.

Substitute 4 for  $b$  and 5 for  $c$ .

Replace each squared number with its value.

Undo the addition. Subtract \_\_\_\_\_ from both sides.

To find  $a$ , find the square root of 9.

The missing length is \_\_\_\_\_ in.

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

$$a^2 + \underline{\quad\quad} = \underline{\quad\quad}$$

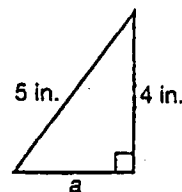
$$a^2 + 16 = 25$$

$$a^2 + 16 - 16 = 25 - 16$$

$$a^2 = \underline{\quad\quad}$$

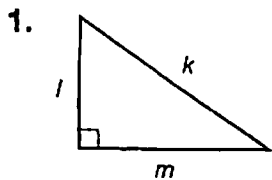
$$\sqrt{9} = \underline{\quad\quad}$$

$$a = \underline{\quad\quad}$$



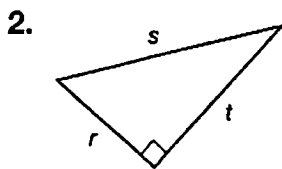
**SKILL 21: Practice**

Name the hypotenuse and legs of each right triangle.



Hypotenuse: \_\_\_\_\_

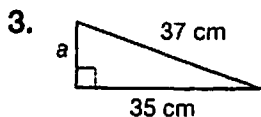
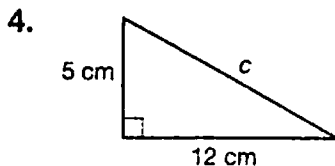
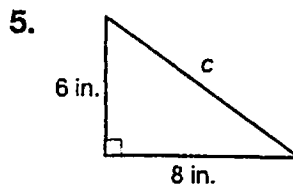
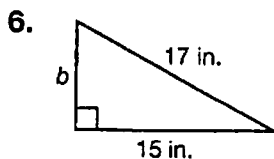
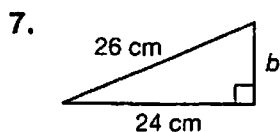
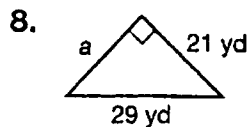
Legs: \_\_\_\_\_ and \_\_\_\_\_



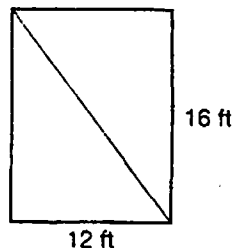
Hypotenuse: \_\_\_\_\_

Legs: \_\_\_\_\_ and \_\_\_\_\_

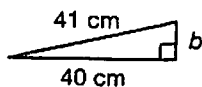
Find the missing length in each right triangle.

 $a =$  \_\_\_\_\_ $c =$  \_\_\_\_\_ $c =$  \_\_\_\_\_ $b =$  \_\_\_\_\_ $b =$  \_\_\_\_\_ $a =$  \_\_\_\_\_

9. A courtyard that is 12 feet by 16 feet has a diagonal walkway. What is the length of the walkway? \_\_\_\_\_

**TEST PREP**

10. What is the length of side  $b$  of the right triangle?



Skill 21

- A 1 cm                      C 9 cm  
B 7 cm                      D 11 cm

11. Evaluate  $4 + x^2$  for  $x = 8$ .

- F 60                      H 68  
G 20                      J 144

Skill 20

