

# 10-1 Reteaching

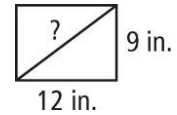
## The Pythagorean Theorem

You can use the *Pythagorean Theorem* to find the length of the third side of a right triangle if you are given the lengths of any two of the sides.

### Problem

What is the length of the diagonal in a 9 in.-by-12 in. rectangle?

The diagonal divides the rectangle into two right triangles of the same size and shape. Use the Pythagorean Theorem and substitute the lengths of the legs for the variables  $a$  and  $b$ . Then solve for  $c$ , the length of the hypotenuse.



<b>Solve</b>	$a^2 + b^2 = c^2$	Use the Pythagorean Theorem to find the length of the missing leg.
	$9^2 + 12^2 = c^2$	Legs $a$ and $b$ are given as the length and width of the rectangle. Substitute 9 for $a$ and 12 for $b$ .
	$81 + 144 = c^2$	Follow the order of operations. Simplify the exponents first.
	$225 = c^2$	Then add to find the value of $c^2$ .
	$15 = c$	Take the positive square root of each side.
<b>Check</b>	$9^2 + 12^2 = c^2$	Check your solution with the Pythagorean Theorem.
	$9^2 + 12^2 = 15^2$	Substitute 15 for $c$ .
	$225 = 225 \checkmark$	Simplify.

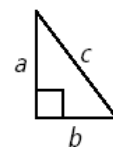
Solution: The length of the diagonal is 15 in.

### Exercises

Use the triangle at the right. Find the length of the missing side.

1.  $a = 5$ ,  $b = 12$

2.  $a = 15$ ,  $c = 25$



3.  $b = 63$ ,  $c = 65$

4.  $a = 1$ ,  $b = \frac{4}{3}$

5. A glass worker is making a stained glass lampshade. He cuts a 4.5 in.-by-6 in. rectangular piece of blue glass in half along the diagonal. How long is the cut?

6. A sailboat traveled 40 kilometers west and then some kilometers north. If the sailboat ended 41 kilometers from the starting point, how far north did the boat sail?

You know that the Pythagorean Theorem states that  $a^2 + b^2 = c^2$ , where  $a$  and  $b$  are the legs of a right triangle and  $c$  is the hypotenuse. The *Converse of the Pythagorean Theorem* states that if a triangle has side lengths  $a$ ,  $b$ , and  $c$  and  $a^2 + b^2 = c^2$ , then the triangle is a right triangle. Substitute the side lengths into the equation and simplify. If the statement is true, then it is a right triangle. If the statement is not true, then it is not a right triangle.

### Problem

Could the lengths 12 m, 18 m, and 20 m be the side lengths of a right triangle?

<b>Solve</b>	$a^2 + b^2 = c^2$	Write the Pythagorean Theorem.
	$12^2 + 18^2 \stackrel{?}{=} 20^2$	Substitute 12, 18, and 20 for $a$ , $b$ , and $c$ . Make sure to substitute the longest length for $c$ , the hypotenuse. Substitute the shorter lengths for legs $a$ and $b$ .
	$144 + 324 \stackrel{?}{=} 400$	Use the Order of Operations; simplify the exponents first.
	$468 \neq 400$	Simplify to determine if the statement is true.

Solution: The statement is not true. A triangle with side lengths 12 m, 18 m, and 20 m is not a right triangle.

### Exercises

State whether the given lengths could be the side lengths of a right triangle.

7. 18 cm, 24 cm, 30 cm

8. 0.3 m, 0.4 m, 0.5 m

9. 12 in., 16 in., 24 in.

10. 13 ft, 84 ft, 85 ft

11. 5 cm, 10 cm, 13 cm

12. 8 mi, 10 mi, 12 mi

13. An artist is building triangular braces for the back of a large painting. The braces must be right triangles. If the sides of the braces measure 14 cm, 18 cm, and 22 cm, will the braces be right triangles?

14. A tourist drew a triangle in the sand, with sides that measure 28 in., 45 in. and 53 in. Was the triangle a right triangle?