# 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.
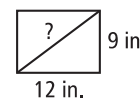
Solve

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

Check

$9^2 + 12^2 = c^2$	Check your solution with the Pythagorean Theorem.
$9^2 + 12^2 = 15^2$	Substitute 15 for c.
$225 = 225$ ✓	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. $a = 5$, $b = 12$ **13**

2. $a = 15$, $c = 25$ **20**

3. $b = 63$, $c = 65$ **16**

4. $a = 1$, $b = \frac{4}{3}$ **$\frac{5}{3}$**
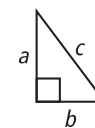
5. A glass worker is making a stained glass lampshade. He cuts a 4.5 in-by-6 in. rectangular piece of blue glass in half along the diagonal. How long is the cut? **7.5 in**

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? **9 km**

10-1 **Reteaching** (continued)

The Pythagorean Theorem

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?

Solve	$a^2 + b^2 = c^2$	Write the Pythagorean Theorem.
	$12^2 + 18^2 \overset{?}{=} 20^2$	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.
	$144 + 324 \overset{?}{=} 400$	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

   yes

8. 0.3 m, 0.4 m, 0.5 m

   yes

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

   no

10. 13 ft, 84 ft, 85 ft

   yes

11. 5 cm, 10 cm, 13 cm

   no

12. 8 mi, 10 mi, 12 mi

   no

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?

   no

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?

   yes