

Chapter 9

Right Triangles and Trigonometry

Section 3

The Converse of the Pythagorean Theorem

GOAL 1: Using the Converse

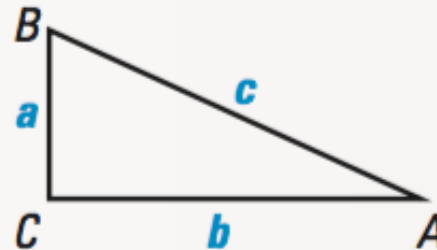
In Lesson 9.2, you learned that if a triangle is a right triangle, then the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the legs. The Converse of the Pythagorean Theorem is also true, as stated below. Exercise 43 asks you to prove the Converse of the Pythagorean Theorem.

THEOREM

THEOREM 9.5 *Converse of the Pythagorean Theorem*

If the square of the length of the longest side of a triangle is equal to the sum of the squares of the lengths of the other two sides, then the triangle is a right triangle.

If $c^2 = a^2 + b^2$, then $\triangle ABC$ is a right triangle.



You can use the Converse of the Pythagorean Theorem to verify that a given triangle is a right triangle, as shown in Example 1.

Example 1: Verifying Right Triangles

The triangles below appear to be right. Tell whether they are right triangles.

a.



$$c^2 ? a^2 + b^2$$

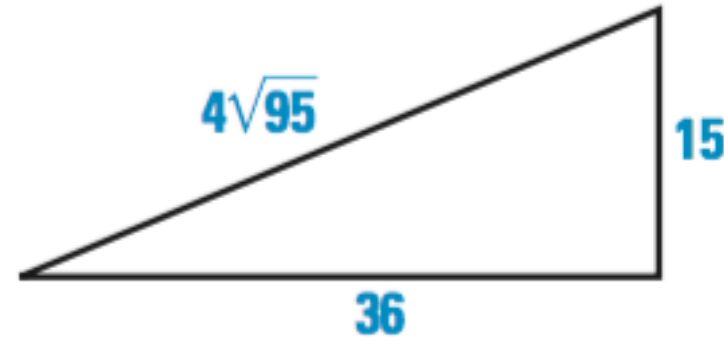
$$(\sqrt{113})^2 ? 8^2 + 7^2$$

$$113 ? 64 + 49$$

$$113 = 113$$

right

b.



$$c^2 ? a^2 + b^2$$

$$(4\sqrt{95})^2 ? 36^2 + 15^2$$

16×95

$$1520 ? 1296 + 225$$

$$1520 \neq 1521$$

not right

GOAL 2: Classifying Triangles

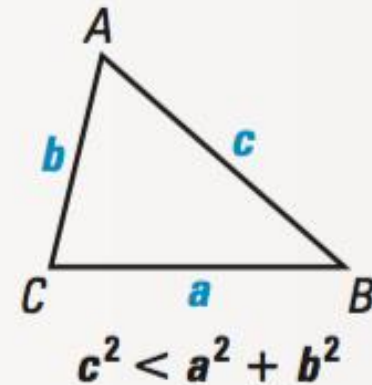
Sometimes it is hard to tell from looking whether a triangle is obtuse or acute. The theorems below can help you tell.

THEOREMS

THEOREM 9.6

If the square of the length of the longest side of a triangle is less than the sum of the squares of the lengths of the other two sides, then the triangle is acute.

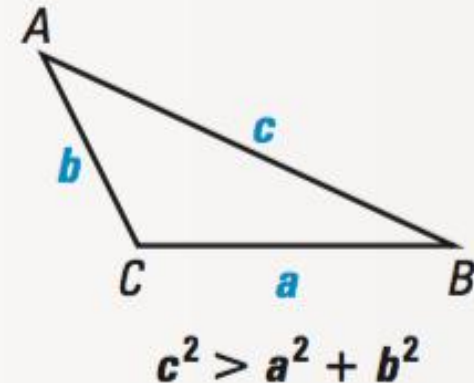
If $c^2 < a^2 + b^2$, then $\triangle ABC$ is **acute**.



THEOREM 9.7

If the square of the length of the longest side of a triangle is greater than the sum of the squares of the lengths of the other two sides, then the triangle is obtuse.

If $c^2 > a^2 + b^2$, then $\triangle ABC$ is **obtuse**.



Example 2: Classifying Triangles

Decide whether the set of numbers can represent the side lengths of a triangle. If they can, classify the triangle as right, acute, or obtuse.

a) 38, 77, 86

$$c^2 ? a^2 + b^2$$

$$86^2 ? 38^2 + 77^2$$

$$7396 ? 1444 + 5929$$

$$7396 > 7373$$

obtuse

b) 10.5, 36.5, 37.5

$$c^2 ? a^2 + b^2$$

$$37.5^2 ? 10.5^2 + 36.5^2$$

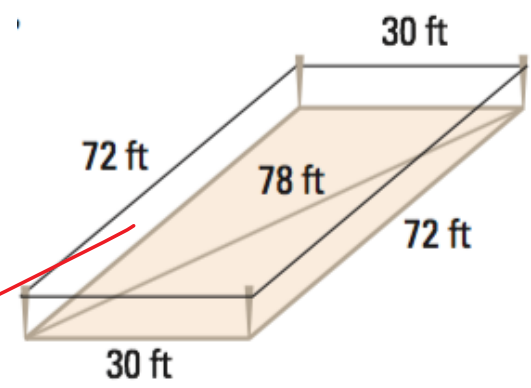
$$1406.25 ? 110.25 + 1332.25$$

$$1406.25 < 1442.5$$

acute

Example 3: Building a Foundation

Construction: You use four stakes and string to mark the foundation of a house. You want to make sure the foundation is rectangular.



- a) A friend measure the four sides to be 30 feet, 30 feet, 72 feet, and 72 feet. He says these measurements prove the foundation is rectangular. Is he correct?
- b) You measure one of the diagonals to be 78 feet. Explain how you can use this measurement to tell whether the foundation will be rectangular.

EXIT SLIP