7.2 Use the Converse of the Pythagorean Theorem

Before Use the Pythagorean Theorem to find missing side lengths.

Now You will use its converse to determine if a triangle is a right triangle.

Why? To verify right triangles and perpendicularity.

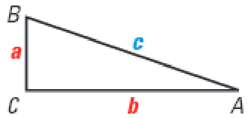
KNOW:

7.1 If ΔABC is a ***right triangle,*** then $c^2 = a^2 + b^2$

THEOREM *For Your Notebook*

THEOREM 7.2 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.

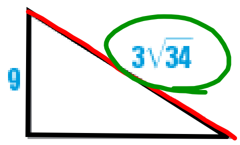


If $c^2 = a^2 + b^2$, then ΔABC is a ***right triangle.***

EXAMPLE 1 Verify right triangles

Tell whether the given triangle is a right triangle.

a.



longest

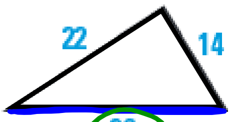
$(3\sqrt{34})^2 \overset{?}{=} 9^2 + 15^2$

$3^2 \sqrt{34}^2 \overset{?}{=} 81 + 225$

$9 \cdot 34 \overset{?}{=} 306$

$306 = 306 \quad \therefore$ rt Δ

b.



$26^2 \overset{?}{=} 14^2 + 22^2$

$676 \overset{?}{=} 484 + 196$

$676 \overset{?}{\neq} 680$

$\therefore$ not rt Δ

TRY THIS:

Tell whether a triangle with the given side lengths is a right triangle.

1. 4, $4\sqrt{3}$ and 8

$8^2 = 4^2 + (4\sqrt{3})^2$

$64 = 16 + 4^2\sqrt{3}^2$

$64 = 16 + 16 \cdot 3$

$64 = 16 + 48$

$64 = 64$

$\therefore$ rt Δ

2. 10, 11 and 14

$14^2 = 10^2 + 11^2$

$196 = 100 + 121$

$196 \neq 221$

$\therefore \sim$ rt Δ

3. 5, 6 and $\sqrt{61}$

$\sqrt{61}^2 = 5^2 + 6^2$

$61 = 25 + 36$

$61 = 61$

$\therefore$ rt Δ

CLASSIFYING TRIANGLES:

The *Converse of the Pythagorean Theorem* is used to verify that a given triangle is a ***right triangle***. The theorems below are used to verify that a given triangle is ***acute*** or ***obtuse.***

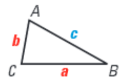
THEOREMS *For Your Notebook*

THEOREM 7.3

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 an acute triangle.

longest

If $c^2 < a^2 + b^2$, then the triangle is acute.

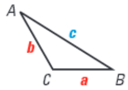


THEOREM 7.4

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 an obtuse triangle.

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

longest



EXAMPLE 2 CLASSIFY TRIANGLES.

1. Can segments with lengths of 4.3 ft, 5.2 ft, and 6.1 ft form a triangle?
2. If so, would the triangle be *acute*, *right*, or *obtuse*?

① 4.3, 5.2, 6.1 Largest

$9.5 \overset{?}{>} 6.1$

yes, ∴ △

② Kind △

Longest

$6.1^2 \; ? \; 4.3^2 + 5.2^2$

$37.21 \; ? \; 18.49 + 27.04$

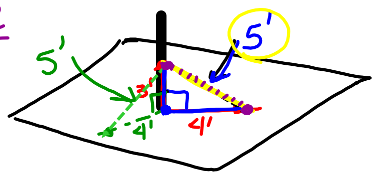
$37.21 < 45.53$

∴ acute △

EXAMPLE 2 CONVERSE OF THE PYTHAGOREAN THEOREM

CATAMARAN: You are part of a crew that is installing the mast on a catamaran. When the mast is fastened properly, it is perpendicular to the trampoline deck. How can you check that the mast is perpendicular using a tape measure?

3, 4, 5



TRY THIS

1. Show that segments with lengths 3, 4 and 6 can form a triangle.

   $7 > 6$ ∴ △

2. Classify the triangle as acute, right, or obtuse.

   $6^2 \; ? \; 3^2 + 4^2$

   $36 \; ? \; 9 + 16$

   $36 > 25$ ∴ obtuse

3. Could you use triangles with side lengths 2, 3, and 4 to verify that you ~~have~~ perpendicular lines? *Explain.*

   3, 4, 5

   2, 3, 4

   $4^2 \; ? \; 2^2 + 3^2$

   $16 \; ? \; 4 + 9$

   $16 \neq 13$ ∴ ~rt △

   NOT ⊥

Questionnaire