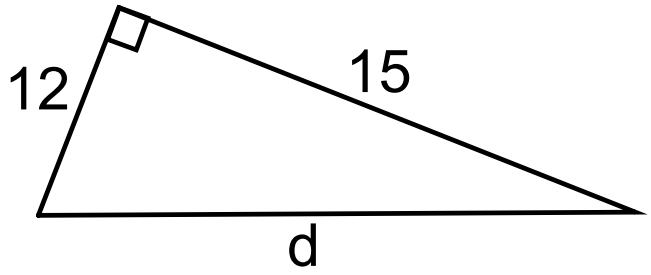
Warm-Up

Find the missing side of the right triangle below. Put your answer in simplest radical form.



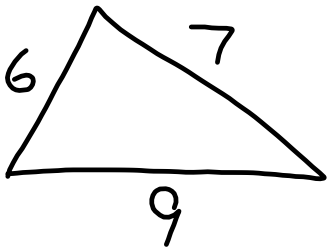
Objectives

The Pythagorean Theorem and its Converse

a. I can use the converse of the Pythagorean Theorem to classify a triangle as right, acute or obtuse.

Yesterday we learned that if a triangle is a right triangle, and you know two of its side lengths, then you can find the third using the Pythagorean Theorem.

However, could we use the Pythagorean Theorem to determine <u>if a triangle is a right triangle or not</u>?



$6^2 + 7^2 \quad 9^2$

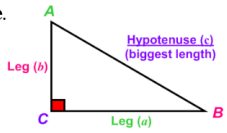
$36 + 49 \quad 81$

$85 > 81$

The Converse of the Pythagorean Theorem

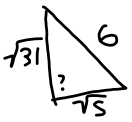
If the square of the length of the longest side of a triangle is equal to the sum of the square of the lengths of the other two sides, then the triangle is a right triangle.

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



Do the given side lengths form a right triangle? Explain why or why not.
(Remember, the hypotenuse will always be the longest length)

1. $\sqrt{5}, 6, \sqrt{31}$



Testing

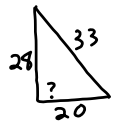
$\sqrt{5}^2 + \sqrt{31}^2 \stackrel{?}{=} 6^2$

$5 + 31 = 36$

$36 = 36$

It is a right triangle since $a^2 + b^2 = c^2$

2. 33, 20, 28



$20^2 + 28^2 \stackrel{?}{=} 33^2$

$1184 \neq 1089$

Not a right triangle

3. 25, 7, 24

~~$25^2 + 7^2 \stackrel{?}{=} 24^2$~~

$24^2 + 7^2 \stackrel{?}{=} 25^2$

$625 = 625$

Yes, it is a right triangle.

4. $13, 3\sqrt{2}, 9$

$3\sqrt{2} \cdot 3\sqrt{2}$

$9 \cdot 2$

$9^2 + (3\sqrt{2})^2 \stackrel{?}{=} 13^2$

$81 + 18 = 169$

$91 \neq 169$

No

Acute or obtuse?

If the sides of a triangle do not form right triangles, then there are two other options.

Either they could be *acute triangles* or they could be *obtuse triangles*.

It turns out that when numbers are substituted into the Pythagorean Theorem, there is a way to tell if the triangle will be acute or obtuse.

https://www.geogebra.org/m/qmu58Kvu

Classifying Triangles

In ΔABC with the longest side c:
If $a^2 + b^2 > c^2$, then ΔABC is an **ACUTE** triangle.

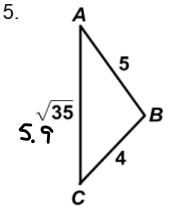
If $a^2 + b^2 = c^2$, then ΔABC is a **RIGHT** triangle.

If $a^2 + b^2 < c^2$, then ΔABC is an **OBTUSE** triangle.

greater > ACUTE
= RIGHT
less than < OBTUSE

Classify each triangle as acute, right, or obtuse.

5.



$4^2 + 5^2 \_ \sqrt{35}^2$

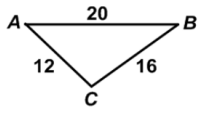
$16 + 25 \_ 35$

$41 > 35$

acute Δ

Classify each triangle as acute, right, or obtuse.

6.



$12^2 + 16^2 \_ 20^2$

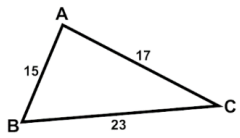
$144 + 256 \quad 400$

$400 = 400$

Right Δ

Classify each triangle as acute, right, or obtuse.

7.



$15^2 + 17^2 \quad 23^2$

$225 + 289 \quad 529$

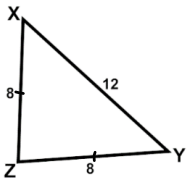
$514 < 529$

Obtuse

Classify each triangle as acute, right, or obtuse.

isosceles

8.

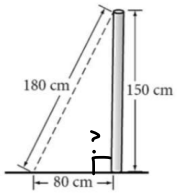


$8^2 + 8^2 \quad 12^2$

$128 < 144$

obtuse

9. A steel pole 150 cm in length has been placed in the ground ready for cement to seal it in place. To check to see if it is perpendicular to the ground, the contractor has measured a distance of 180 cm from the top of the pole to 80 cm from the base of the pole on the ground. Is the pole perpendicular to the ground?



$150^2+80^2 \quad 180^2$

$22500+6400 \quad 32400$

$28900 < 32400$

No.

Review

10. If the two legs of a right triangle are 4 and 6, what is the length of the hypotenuse? Keep your answer in simplest radical form.

$2\sqrt{13}$