Name

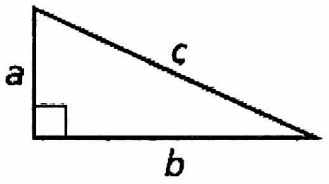
The Pythagorean Theorem

Lesson Objective IWBAT apply the Pythagorean theorem and its converse; determine if a △ is acute, right, or obtuse.

One of the most famous theorems in mathematics is the Pythagorean Theorem, named for the ancient Greek mathematician Pythagoras. This theorem describes the relationship between the side lengths of a right triangle.

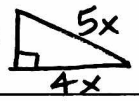
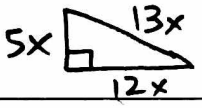
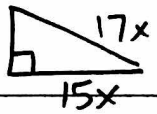
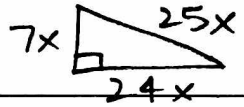
The Pythagorean Theorem

In a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the legs.



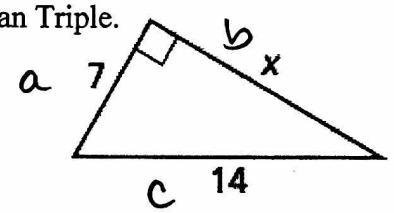
rt. △ → $a^2+b^2=c^2$

Pythagorean Triple: A Pythagorean Triple is a set of three positive integers (no decimals) (a, b, and c) that satisfy the equation $a^2 + b^2 = c^2$.

Common Pythagorean Triples			
3, 4, 5	5, 12, 13	8, 15, 17	7, 24, 25
$3^2+4^2=5^2$ 	$5^2+12^2=13^2$ 	$8^2+15^2=17^2$ 	$7^2+24^2=25^2$ 

Example:

1. Find the exact value of x. Then tell whether the side lengths form a Pythagorean Triple.



$7^2+x^2=14^2$

~~$7^2+14^2=x^2$~~

$49+x^2=196$

$\sqrt{x^2}=\sqrt{147}=\sqrt{3\cdot 49}=7\sqrt{3}$ (exact)

$x\approx 12.124355\,65$ (approx.)

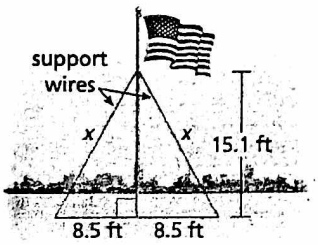
2. The flagpole shown is supported by wires attached to the ground. Use the Pythagorean Theorem to approximate the length of each wire to the nearest tenth.

$15.1^2+8.5^2=x^2$

$\sqrt{300.26}=\sqrt{x^2}$

$x\approx 17.3$

≈17.3 ft



Using the CONVERSE of the Pythagoream Theorem

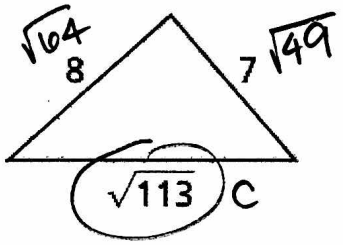
Conditional: If right triangle → $a^2 + b^2 = c^2$ * longest side is "c"

Converse: If $a^2+b^2=c^2$ → rt. △

Example:

3. Tell whether each triangle is a right triangle.

a.



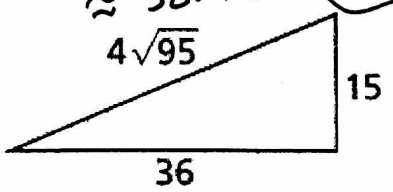
$8^2+7^2 \stackrel{?}{=} (\sqrt{113})^2$

$64+49 = 113$

$113 = 113$

yes, rt. Δ

b.



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

$= 4^2(\sqrt{95})^2$

$= 16 \cdot 95$

$1521 \neq 1520$

Not a right Δ

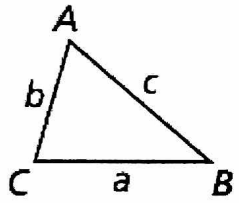
$(a \cdot b)^2 = a^2 \cdot b^2$

Classifying Triangles

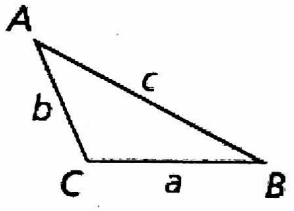
Pythagorean Inequalities Theorem

For any ΔABC, where c is the length of the longest side, the following statements are true:

If $a^2+b^2 > c^2$, then ΔABC is acute.



If $a^2+b^2 < c^2$, then ΔABC is obtuse.



Example:

4. What type of triangle (if at all) do the following side lengths make? 4.3 feet, 5.2 feet, 6.1 feet

Δ? $4.3+5.2 > 6.1$

$9.5 > 6.1$

yes

$4.3^2+5.2^2 \stackrel{?}{>} 6.1^2$

$45.53 > 37.21$

acute Δ

5. What type of triangle (if at all) do the following side lengths make? 3m, 4m, 6m

Δ? $3+4 > 6$

$7 > 6$

yes

$3^2+4^2 \stackrel{?}{<} 6^2$

$25 < 36$

obtuse Δ