Geometry

Ms. Linzmeier

Unit 7: Right Triangles and Trigonometry

Priority Standard: CC.9-12.G.SRT.8 Define trigonometric ratios and solve problems involving right triangles. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

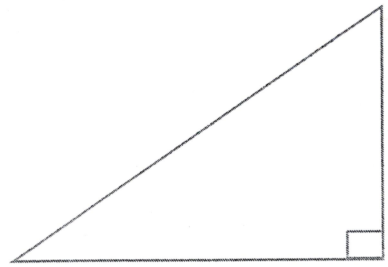
Unit 7 "I can" Statements:

1. I can apply the Pythagorean Theorem to find side lengths of right triangles.
2. I can use the Converse of the Pythagorean Theorem to identify whether triangles are acute, obtuse or right.
3. I can use the altitude of a right triangle to set up proportions to find unknown side lengths.
4. I can use special right triangles to find unknown side lengths and angle measures.
5. I can define and apply the tangent ratio to find unknown side lengths.
6. I can define and apply the sine and cosine ratios to find unknown side lengths.
7. I can find unknown side and angle measurements using trigonometric ratios (sine, cosine and tangent) and their inverses.

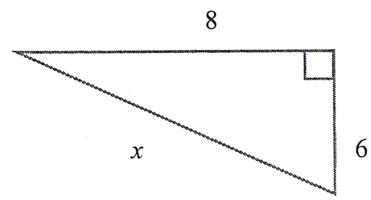
Pythagorean Theorem (Theorem 7.1)**:**

In a right triangle, the square of the hypotenuse equals the sum of the squares of the legs.

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



Example #1: Find the length of the hypotenuse of the right triangle



$8^2 + 6^2 = x^2$

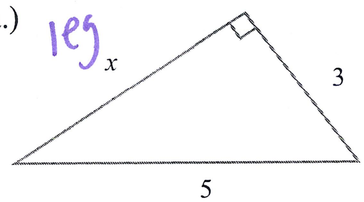
$64 + 36 = x^2$

$\sqrt{100} = \sqrt{x^2}$

$\boxed{x = 10}$

Example #2: Identify the unknown side as a leg or hypotenuse. Then, find the unknown side length of the right triangle. Write your answer in simplest radical form.

a.) leg



$3^2 + x^2 = 5^2$

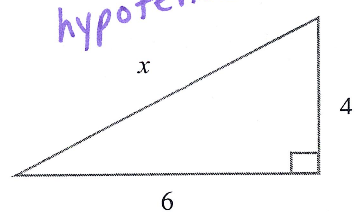
$9 + x^2 = 25$

$-9 \qquad -9$

$\sqrt{x^2} = \sqrt{16}$

$x = 4$

b.) hypotenuse



$4^2 + 6^2 = x^2$

$16 + 36 = x^2$

$\sqrt{52} = \sqrt{x^2}$

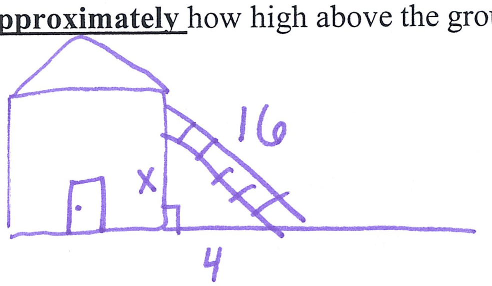
4 13

2 2

$\boxed{2\sqrt{13} = x}$

exact

Example #3: A 16ft ladder rests against the side of the house, and the base of the ladder is 4ft away. **Approximately** how high above the ground is the top of the ladder?



$x^2 + 4^2 = 16^2$

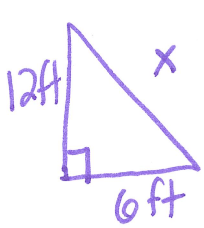
$x^2 + 16 = 256$

$-16 \qquad -16$

$\sqrt{x^2} = \sqrt{240}$

$\boxed{x = 15.5 \text{ ft}}$

Example #4: The top of a ladder rests against a wall, 12ft above the ground. The base of the ladder is 6ft away from the wall. Find the **exact** length of the ladder?



$12^2 + 6^2 = x^2$

$144 + 36 = x^2$

$\sqrt{180} = \sqrt{x^2}$

18 10

$\sqrt{180}$

18 10

2 9 2 5

3 3

$2 \cdot 3\sqrt{5}$

$\boxed{6\sqrt{5} \text{ ft}}$

Pythagorean Triples:

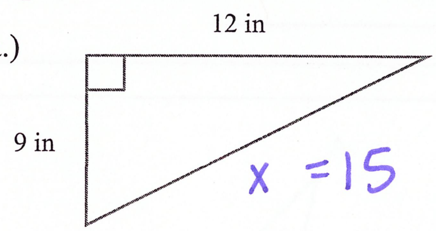
A set of 3 positive integers *a, b* and *c* that satisfy the equation $a^2 + b^2 = c^2$

Common Pythagorean Triples

	3, 4, 5	5, 12, 13	8, 15, 17	7, 24, 25
	6, 8, 10	10, 24, 26	16, 30, 34	14, 48, 50
	9, 12, 15	15, 36, 39	24, 45, 51	21, 72, 75
	12, 16, 20	20, 48, 52	32, 60, 68	28, 96, 100
	15, 20, 25	25, 60, 65	40, 75, 85	35, 120, 125

Example #5: Find the unknown side length using a Pythagorean Triple.

a.)

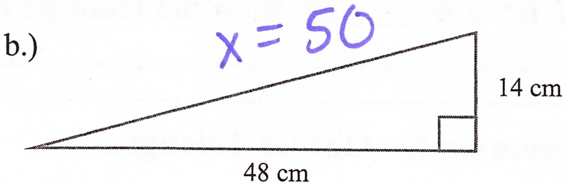


$x = 15$

$3(3,4,5)$

b.)

$x = 50$



$2(7,24,25)$

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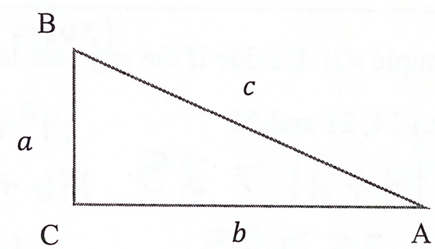
3, 9-19 odd, 24, 25, 31

Chapter 7.2: Use the Converse of the Pythagorean Theorem

Converse of the Pythagorean Theorem (Theorem 7.2):

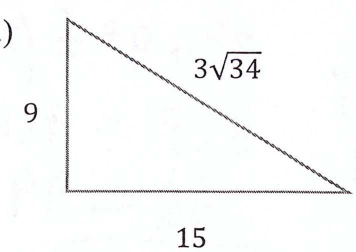
If the square of the length of the longest side of a triangle is equal to the sum of the squares of the lengths of the other two sides, then the triangle is a right triangle.



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

Example #1: Tell whether the given triangle is a right triangle.

a.)



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

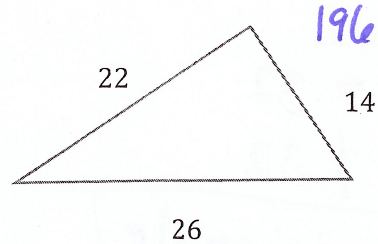
$81 + 225 = 3^2(34)$

$306 = 9 \cdot 34$

$306 = 306$ ✓

$\boxed{\text{Yes}}$

b.)



$14^2 + 22^2 = 26^2$

$196 + 484 = 676$

$680 \neq 676$

No

c.) 10, 11and 14

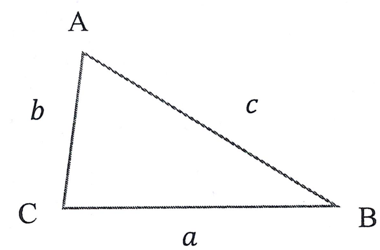
$10^2 + 11^2 = 14^2$

$100 + 121 = 196$

$221 \neq 196$

No

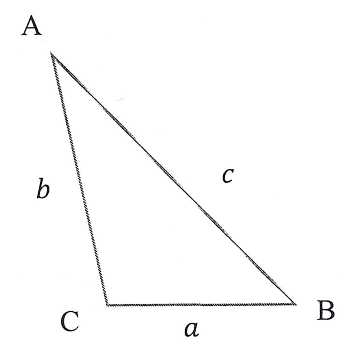
Theorem for Acute Triangle:



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__

If $a^2 + b^2$ __>__ c^2, then the triangle is __acute__

Theorem for Obtuse Triangle:



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 $a^2 + b^2$ __<__ c^2, then the triangle is __obtuse__

(sum of 2 sides > third)

Example #2: Decide if the segment lengths form a triangle. If so, would the triangle be acute, right or obtuse?

a.) 14, 21 and 25

$14 + 21 > 25$

$35 > 25$

yes a $\triangle$

$14^2 + 21^2 \stackrel{?}{=} 25^2$

$196 + 441 \stackrel{?}{=} 625$

$637 > 625$

acute

b.) 32, 60 and 68

$32 + 60 > 68$

$92 > 68$ ✓

$32^2 + 60^2 \stackrel{?}{=} 68^2$

$1024 + 3600 = 4624$

$4624 = 4624$

$\boxed{\text{right}}$

c.) 11, 19 and 32

$11 + 19 > 32$

$30 \not> 32$

$\boxed{\text{Not a triangle}}$

d.) 3, 9 and $3\sqrt{11}$

$3 + 9 > 3\sqrt{11}$

$12 > 9.9$

yes

$3^2 + 9^2 \stackrel{?}{=} (3\sqrt{11})^2$

$9 + 81 = 9(11)$

$90 < 99$

$\boxed{\text{obtuse}}$

Hw: pg 444-445
3-7 odd 15-21 odd 24, 25