Geometry 8.2

*8th grade standard

Use the pythagorean theorem*

Use the converse of the pythagorean theorem

Prove the pythagorean theorem

leg

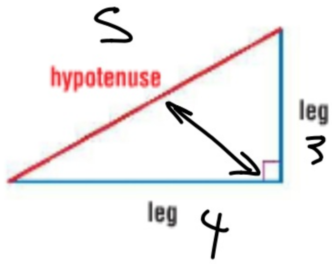
hypotenuse

converse

~~integer~~ whole numbers

pythagorean triple

$$leg^2 + leg^2 = hyp^2$$



$$(3)^2 + (4)^2 = (5)^2$$

$$9 + 16 =$$

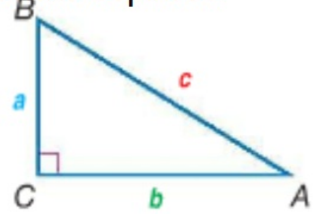
$$25 =$$

Theorem 8.4 Pythagorean Theorem

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

Symbols If $\triangle ABC$ is a right triangle with right angle C, then $\underbrace{a^2 + b^2} = c^2$.

Sum of the squares



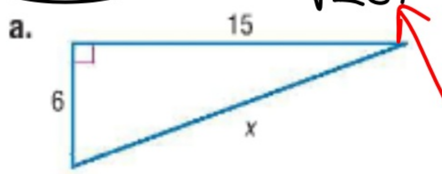
https://www.youtube.com/watch?v=m5Xy3_TOnbs

Exact value or round off?

Example 1 Find Missing Measu

Find x.

a.



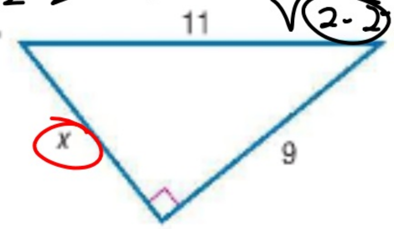
$\sqrt{261}$

$$261$$
$$3 \quad 87$$
$$3 \quad 29$$

$$\sqrt{3 \cdot 3 \cdot 29}$$
$$3\sqrt{29}$$

$$6^2 + 15^2 = x^2$$
$$36 + 225 = x^2$$
$$\sqrt{261} = \sqrt{x^2}$$

b.



$$40$$
$$4 \quad 10$$
$$2 \; 2 \quad 2 \; 5$$

$$x = \sqrt{40}$$
$$x = 2\sqrt{10}$$
$$\sqrt{2 \cdot 2 \cdot 2 \cdot 5}$$

$$x^2 + 9^2 = 11^2$$
$$x^2 + 81 = 121$$
$$\sqrt{x^2} = \sqrt{40}$$

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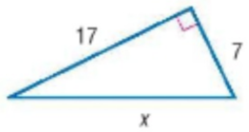
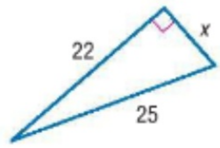
1A.



1B.



$8^2+15^2=17^2$

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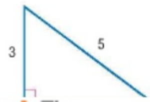
$3^2+4^2=5^2$

$5^2+12^2=13^2$

primitive (parent)
scale factor...
must be whole numbers



StudyTip

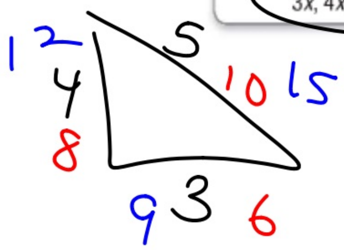
Pythagorean Triples
If the measures of the sides of any right triangle are *not* whole numbers, the measures do not form a Pythagorean triple.

KeyConcept Common Pythagorean Triples

	3, 4, 5		**5, 12, 13**	**8, 15, 17**	**7, 24, 25**
×2	6, 8, 10	×2	10, 24, 26	16, 30, 34	14, 48, 50
×3	9, 12, 15	×3	15, 36, 39	24, 45, 51	21, 72, 75
	$3x, 4x, 5x$		$5x, 12x, 13x$	$8x, 15x, 17x$	$7x, 24x, 25x$

The largest number in each triple is the length of the hypotenuse.

$7^2+24^2=25^2$

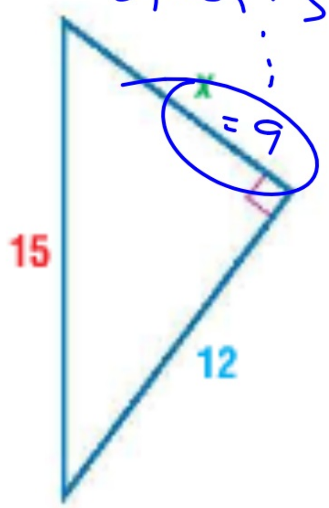


Example 2 Use a Pythagorean Triple

Use a Pythagorean triple to find x. Explain your reasoning.

3, 4, 5

5, 12, 13



?

$x, \frac{12}{3}, \frac{15}{3}$

3, 4, 5

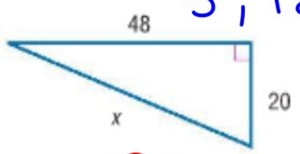
Maybe it is a PT. Try factoring out a GCF

Try dividing out GCF to find the primitive (parent)...

$\frac{20}{4}, \frac{48}{4}, x$

$5, 12, 13$

2A.



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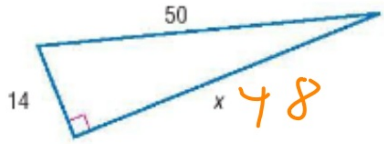
2B.



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$\frac{14}{2}, x, \frac{50}{2}$

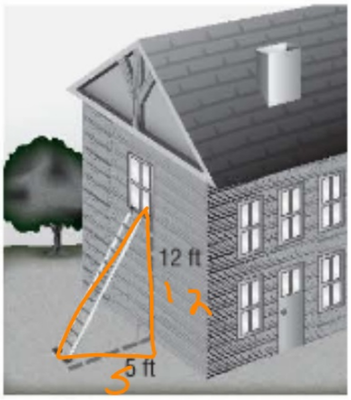
$7, 24, 25$

Standardized Test Example 3 Use the Pythagorean Theorem

Damon is locked out of his house. The only open window is on the second floor, which is 12 feet above the ground. He needs to borrow a ladder from his neighbor. If he must place the ladder 5 feet from the house to avoid some bushes, what length of ladder does Damon need?

A 7 feet **C** 13 feet

B 11 feet **D** 17 feet



Note: Not drawn to scale

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$\frac{5}{5}, \; x, \; \frac{20}{5}$

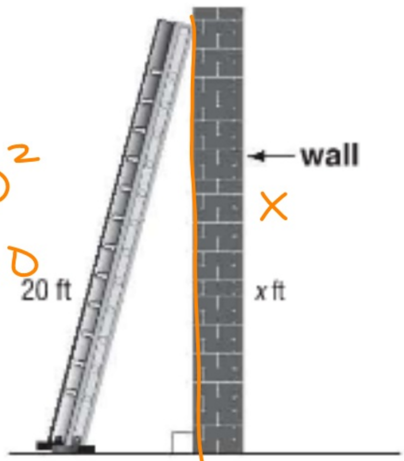
$1, \quad , 4$

3. According to your company's safety regulations, the distance from the base of a ladder to a wall that it leans against should be at least one fourth of the ladder's total length. You are given a 20-foot ladder to place against a wall at a job site. If you follow the company's safety regulations, what is the maximum distance x up the wall the ladder will reach, to the nearest tenth?

$5^2 + x^2 = 20^2$

$25 + x^2 = 400$

$x^2 = 375$



Note: Not drawn to scale.

5

F 12 feet

G 19.4 feet

H 20.6 feet

J 30.6 feet

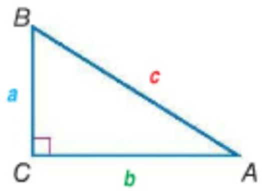
2 Converse of the Pythagorean Theorem

Converse of the Pythagorean Theorem The converse of the Pythagorean Theorem also holds. You can use this theorem to help you determine whether a triangle is a right triangle given the measures of all three sides.

Theorem 8.5 Converse of the Pythagorean Theorem

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

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



You will prove Theorem 8.5 in Exercise 35.

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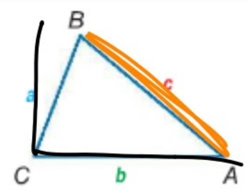
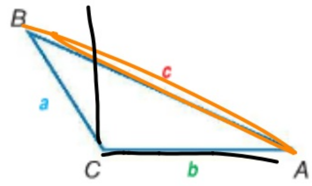
You can also use side lengths to classify a triangle as acute or obtuse.

Study Tip

Determining the Longest Side If the measures of any of the sides of a triangle are expressed as radicals, you may wish to use a calculator to determine which length is the longest.

Theorems Pythagorean Inequality Theorems

8.6 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 an acute triangle. **Symbols** If $c^2 < a^2 + b^2$, then $\triangle ABC$ is acute.	
8.7 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 an obtuse triangle. **Symbols** If $c^2 > a^2 + b^2$, then $\triangle ABC$ is obtuse.	

You will prove Theorems 8.6 and 8.7 in Exercises 36 and 37, respectively.

$a^2+b^2 = (\quad)$

perfect

a^2+b^2 = perfect amount: right triangle

If longest side is less than perfect: acute

If longest side is more than perfect: obtuse

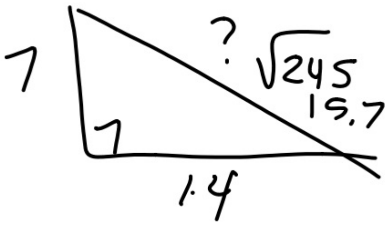
Is it a triangle at all?
What kind of triangle?

Example 4 Classify Triangles

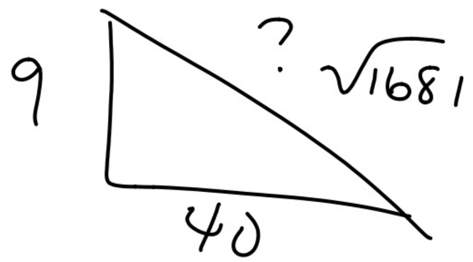
Determine whether each set of numbers can be the measures of the sides of a triangle. If so, classify the triangle as *acute*, *right*, or *obtuse*. Justify your answer.

a. 7, 14, 16

21 =



b. 9, 40, 41



Right

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3.46 5.66 6.71

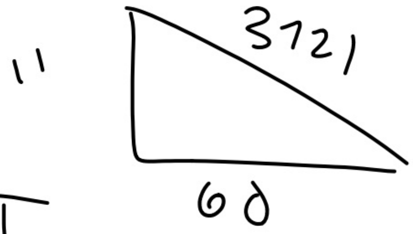
4A. 11, 60, 61

4B. $2\sqrt{3}, 4\sqrt{2}, 3\sqrt{5}$

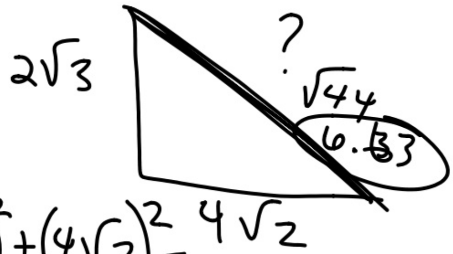
obtuse

4C. 6.2, 13.8, 20

no $\triangle$



RT



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

$2\sqrt{3}\cdot 2\sqrt{3} + 4\sqrt{2}\cdot 4\sqrt{2}$

$4\cdot\sqrt{9} + 16\sqrt{4}$

$12 + 32$

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