Pythagorean Theorem and Its Converse Lesson 6-1 Section 8-2

OBJ: Use the Pythagorean Theorem. G.SRT.8
Use the converse of the Pythagorean Theorem. G.MG.3

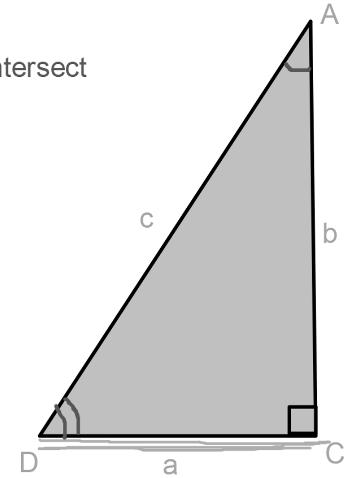
Right triangle vocabulary

2 leg - Two sides of the right triangle that intersect to form the right angle.

1 hypotenuse - Side opposite [across from] the right angle.
longest

opposite side - Segment across from a particular angle.

opposite angle - Angle across from a particular side.



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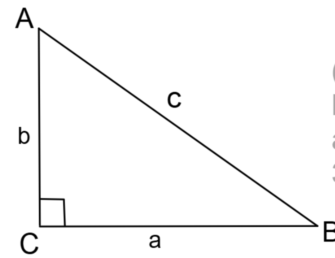
Pythagorean Theorem

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



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

(We use this when we know the lengths of 2 sides of a right triangle and we need to find the length of the 3rd side.)

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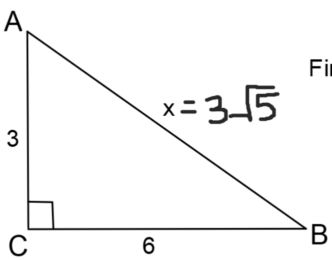


$x = 3\sqrt{5}$

Find x

$3^2 + 6^2 = x^2$

$9 + 36 = x^2$

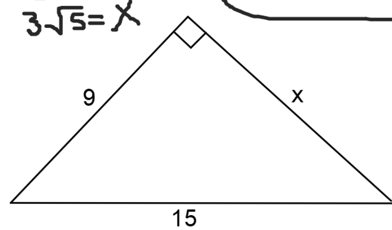
$\sqrt{45} = \sqrt{x^2}$

$\sqrt{45} = x$

$3\sqrt{5} = x$

$3\sqrt{5} = x$

$x \approx 6.7$



$9^2 + x^2 = 15^2$

$81 + x^2 = 225$

$-81 \qquad -81$

$\sqrt{x^2} = \sqrt{144}$

$x = 12$

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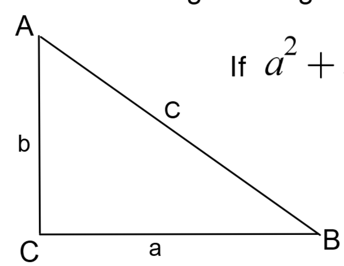
Converse of the Pythagorean Theorem

If the sum of the squares of the measures of two sides of a triangle equals the square of the measure of the longest side, then the triangle is a right triangle.



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

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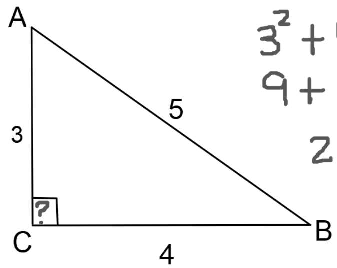
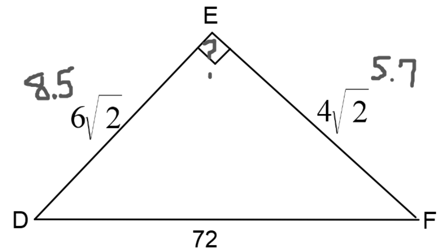
Are the triangles right triangles? Justify with your work.



$3^2 + 4^2 \stackrel{?}{=} 5^2$ yes

$9 + 16 \quad 25$

$25 = 25$



$8.5 + 5.7 \approx 14.2$

$14.2 \not> 72$

so not a $\triangle$

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Verify that ΔPAR is a right triangle.

P(1, -1)

A(-9,-3)

R(-3,-7)

Distance Formula

$$\text{distance} = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

$PA = \sqrt{(-9-1)^2 + (-3+1)^2} = \sqrt{104}$

$AR = \sqrt{(-3+9)^2 + (-7+3)^2} = \sqrt{52}$

$PR = \sqrt{(-3-1)^2 + (-7+1)^2} = \sqrt{52}$

14.4 10.2

$\sqrt{52} + \sqrt{52} > \sqrt{104}$

$(\sqrt{52})^2 + (\sqrt{52})^2 \stackrel{?}{=} (\sqrt{104})^2$

$52 + 52 = 104$

yes

rt $\triangle$.

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Pythagorean Triples - three whole numbers that satisfy the pythagorean theorem

Can save you work, if you can identify these.
Infinitely many sets of pythagorean triples.
often appear on SAT, ACT and in class tests.

4 sets to learn - multiples of these sets are also triples

3, 4, 5	6, 8, 10	9, 12, 15
5, 12, 13	15, 36, 39	25, 60, 65
7, 24, 25	28, 96, 100	70, 240, 250
8, 15, 17	16, 30, 34	24, 45, 51

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Division of triples, make right triangles, but may not be triples

Do the sides $\overset{1.5}{\frac{3}{2}}, 2, \overset{2.5}{\frac{5}{2}}$ form a right triangle? yes

If so, are they a pythagorean triple? no, due to fractions.

$\left(\frac{3}{2}\right)^2 + 2^2 \stackrel{?}{=} \left(\frac{5}{2}\right)^2$

$\frac{9}{4} + \frac{4 \cdot 4}{1 \cdot 4} \stackrel{?}{=} \frac{25}{4}$

$\frac{9}{4} + \frac{16}{4}$

$\frac{25}{4} = \frac{25}{4}$

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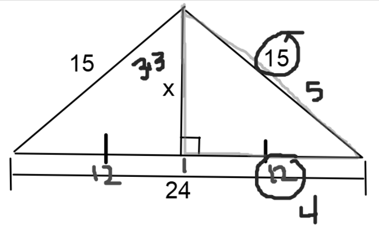
Find x



$x^2 + 12^2 = 15^2$

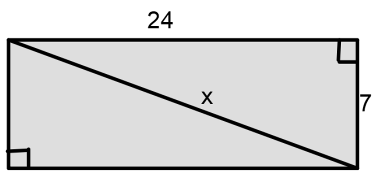
$x^2 + 144 = 225$

$-144 \quad -144$

$x^2 = 81$

$x = \sqrt{81} = 9$

$\boxed{x=9}$



X=25

$7^2 + 24^2 = x^2$

49 + 576

$625 = x^2$

$25 = \sqrt{625} = x$

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compare

Theorem 8.6- If $c^2 < a^2 + b^2$, then Δ ABC is an acute Δ .

Theorem 8.7- If $c^2 > a^2 + b^2$, then Δ ABC is an obtuse Δ .

* If the Sum of the smaller sides squared wins, the trianlge is ACUTE
  If the longest side squared wins, the triangle is OBTUSE.

Reminder - The sum of the lengths of any 2 sides of a triangle must be greater than the length of the third side or it doesn't make a triangle.

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.

11, 60,61

11+60

71 > 61 yes, Δ

$61^2 \quad 11^2 + 60^2$

3721 = 121 + 3600

3721

Right Δ

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6.2, 13.6, 20

6.2 + 13.6

19.8 ≯ 20

Not Δ

$\approx 3.5 \quad \approx 5.7 \quad \approx 6.7$

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

3.5 + 5.7

9.2 > 6.7

yes Δ

$(3\sqrt{5})^2 \quad (2\sqrt{3})^2 + (4\sqrt{2})^2$

45 > 12 + 32

44

Obtuse