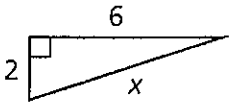
Honors Geometry
Notes - Section 5.7 Pythagorean Theorem

Name KEY
Date _____ Period _____

I. What is the **Pythagorean Theorem**? $a^2+b^2=c^2$ (Right Triangles ONLY)

Example #1: Find the value of x. Give your answer in simplest radical form.

a.



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

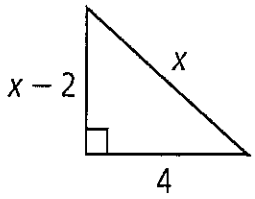
$4+36=x^2$

$40=x^2$

$x=\sqrt{40}=\sqrt{4}\cdot\sqrt{10}$

$x=2\sqrt{10}$

b.



$(x-2)^2+4^2=x^2$

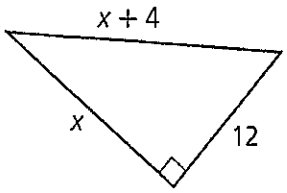
$x^2-4x+4+16=x^2$

$-4x+20=0$

$-4x=-20$

$x=5$

c.



$x^2+12^2=(x+4)^2$

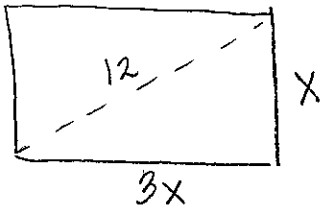
$x^2+144=x^2+8x+16$

$144=8x+16$

$128=8x$

$x=16$

Example #2: Randy is building a rectangular picture frame. He wants the ratio of the length to the width to be 3:1 and the diagonal to be 12 centimeters. How wide should the frame be? Round to the nearest tenth of a centimeter.



$(3x)^2+(x)^2=(12)^2$

$9x^2+x^2=144$

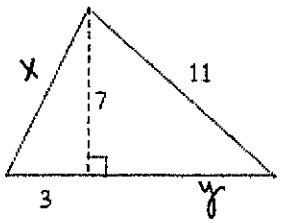
$10x^2=144$

$x^2=14.4$

$x=3.8$ cm

II. **Multi-Step** Pythagorean Theorem Problems (Round to the tenths place!)

Example #3: Find the area and perimeter.



$3^2+7^2=x^2$

$9+49=x^2$

$58=x^2$

$x=7.6$

$P=7.6+11+8.5+3$

$P=30.1$ un

$A=\frac{1}{2}(3+8.5)(7)$

$A=40.25$ un^2

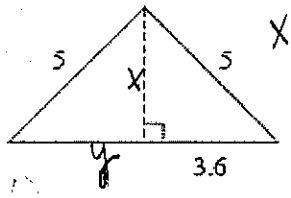
$7^2+y^2=11^2$

$49+y^2=121$

$y^2=72$

$y=8.5$

Example #4: Find the area and perimeter.



$x^2+(3.6)^2=5^2$

$x^2+12.96=25$

$x^2=12.04$

$x=3.5$

$P=5+5+3.6+3.6$

$P=17.2$ un

$A=\frac{1}{2}(3.6+3.6)(3.5)$

$A=12.6$ un^2

$(3.5)^2+y^2=5^2$

$12.25+y^2=25$

$y^2=12.75$

$y=3.6$

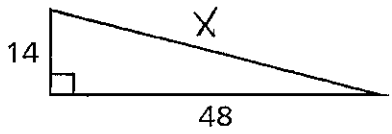
III. What are **Pythagorean Triples?**

A set of three nonzero whole numbers a, b, and c such that $a^2 + b^2 = c^2$ is called a **Pythagorean Triple**.

Counting #s

Common Pythagorean Triples
3, 4, 5 5, 12, 13, 8, 15, 17 7, 24, 25

Example #5: Find the missing side length, then tell if the side lengths form a Pythagorean Triple. Explain.



$14^2 + 48^2 = x^2$

$196 + 2304 = x^2$

$2500 = x^2$

$x = 50$

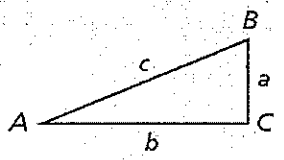
14, 48, 50

3 nonzero whole #s

∴ YES

IV. The **Converse of the Pythagorean Theorem** and **Pythagorean Inequalities Theorem**

Theorems 5-7-1 Converse of the Pythagorean Theorem

THEOREM	HYPOTHESIS	CONCLUSION
If the sum of the squares of the lengths of two sides of a triangle is equal to the square of the length of the third side, then the triangle is a right triangle.	 $a^2 + b^2 = c^2$	$\triangle ABC$ is a right triangle.

Example #6: Tell if the measures can be the side lengths of a RIGHT triangle.

a. 5, 7, 10 (a, b, c)

$5^2 + 7^2 = 10^2$

$25 + 49 = 100$

$74 \neq 100$

NOT a right triangle!

b. 21, 28, 35

$21^2 + 28^2 = 35^2$

$441 + 784 = 1225$

$1225 = 1225$

YES!

c. 22, 23, 25

$22^2 + 23^2 = 25^2$

$484 + 529 = 625$

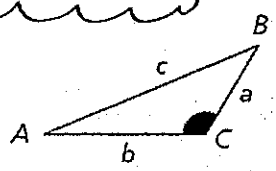
$1013 \neq 625$

NOT a right triangle!

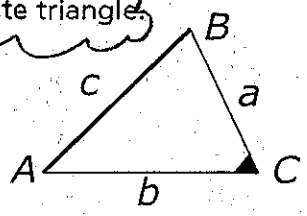
Theorems 5-7-2 **Pythagorean Inequalities Theorem**

In $\triangle ABC$, c is the length of the longest side.

If $c^2 > a^2 + b^2$, then $\triangle ABC$ is an obtuse triangle.



If $c^2 < a^2 + b^2$, then $\triangle ABC$ is an acute triangle.



Example #7: Classify the triangles in Example #4 as acute, obtuse, or right.

a. $\overset{a}{5}, \overset{b}{7}, \overset{c}{10}$

$5^2+7^2 \square 10^2$

$25+49 \square 100$

$74 \boxed{<} 100$

Obtuse

b. 21, 28, 35

$21^2+28^2 \square 35^2$

$441+784 \square 1225$

$1225 \boxed{=} 1225$

Right

c. 22, 23, 25

$22^2+23^2 \square 25^2$

$484+529 \square 625$

$1013 \boxed{>} 625$

Acute