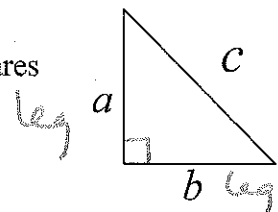Name:_____   Date:_____

Main Ideas/Questions | Title of Notes: **Pythagorean Theorem and It's Converse (8-1)**

The Pythagorean Theorem:

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

leg a C

b leg

$a^2 + b^2 = c^2$ *Use when finding the* <u>Length of a right $\triangle$</u>

$b = \sqrt{c^2 - a^2}$ *Use when finding a* <u>leg</u>

$a = \sqrt{c^2 - b^2}$ *Use when finding a* <u>leg</u>

Handwritten (left column):
$a^2 + b^2 = c^2$
$-a^2 \qquad -a^2$
$\sqrt{b^2} = \sqrt{c^2 - a^2}$
$b = \sqrt{c^2 - a^2}$

Theorem 8-2: Converse of the Pythagorean Theorem

If the square of the length of one 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. $a^2 + b^2 = c^2$
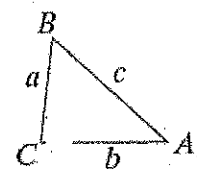
Pythagorean Inequality Theorem (acute △):

If the square of the length of the longest side of a triangle is less than the sum of the squares of the length of the two shorter sides, then the triangle is <u>acute</u> $c^2 < a^2 + b^2 \Rightarrow$ Acute △

Handwritten (left column):
<u>acute</u>
all $\angle$s
are $< 90°$

B
a c
C b A

Ex. Classify the triangle using the lengths of its sides.

a) 6, 8, 10   Right
$10^2 \boxed{?} 6^2 + 8^2$
$100 = 36 + 64$

b) 4, 5, 6   acute
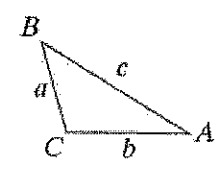$6^2 \boxed{?} 4^2 + 5^2$
$36 < 16 + 25$

Pythagorean Inequality Theorem (obtuse △):

If the square of the length of the longest side of a triangle is greather than the sum of the squares of the length of the two shorter sides, then the triangle is <u>obtuse</u> $c^2 > a^2 + b^2 \Rightarrow$ Obtuse △

Ex. Classify the triangle using the lengths of its sides

c) 3, 4, 6
$6^2 \boxed{?} 3^2 + 4^2$
$36 > 9 + 16$
obtuse

B
a c
C b A

A **Pythagorean triple** is a set of nonzero whole numbers a, b, and c that satisfy the equation $a^2 + b^2 = c^2$
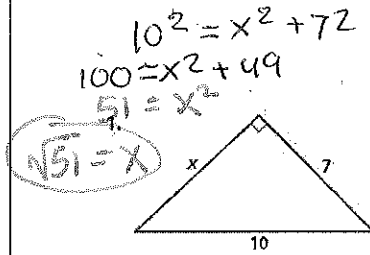
The most common Pythagorean triples are:

3, 4, 5   5, 12, 13   8, 15, 17   7, 24, 25   _6_, _8_, _10_
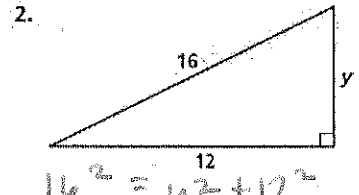
$3^2 + 4^2 = 5^2$ ✓ $8^2 + 15^2 = 17^2$ ✓

Practice

Find the value of x and leave in simplest radical form.

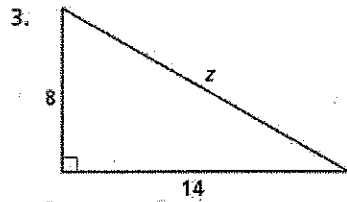$10^2 = x^2 + 7^2$
$100 = x^2 + 49$
$51 = x^2$

$\begin{array}{r} 100 \\ \underline{49} \\ 51 \end{array}$

1.
$\sqrt{51} = x$

(triangle with sides x, 7, base 10, right angle at top)

2.
(triangle with 16, y, 12)

$16^2 = y^2 + 12^2$
$256 = y^2 + 144$
$-144 \qquad -144$
$\sqrt{112} = \sqrt{y^2}$

112
/\
8   14
4 2 7 2
2 2 $4\sqrt{7}$

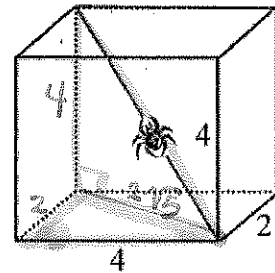3.
(triangle with 8, z, 14)

$8^2 + 14^2 = z^2$
$260 = z^2$
$\sqrt{260} = z$
$2\sqrt{65} = z$

260
/\
2 130
2 65
/\
5 13

4. The sides of a triangle measure 2.4, 3.2, and 4. Is this triangle a right triangle?

$2.4^2 + 3.2^2 \; \boxed{?} \; 4^2$
$16 = 16$ ✓
YES

5. A spider has taken up residence in a small cardboard box which measures 2 inches by 4 inches by 4 inches. What is the length, in inches, of a straight spider web that will carry the spider from the lower right front corner of the box to the upper left back corner of the box?

(cube with dimensions 4, 4, 2)

$(\sqrt{5})^2 = \sqrt{25}$
$= 5$

Summary:

$2^2 + 4^2 = c^2$
$20 = c^2$
$2\sqrt{5} = c$ $c = \sqrt{20}$

20
/\
4 5
2 2

$4^2 + (2\sqrt{5})^2 = x^2$
$16 + (4 \cdot 5) = x^2$
$16 + 20 = x^2$
$36 = x^2$
$6 = x$

51
/\
17 3

260
/\
2 130
2 65
/\
3 13