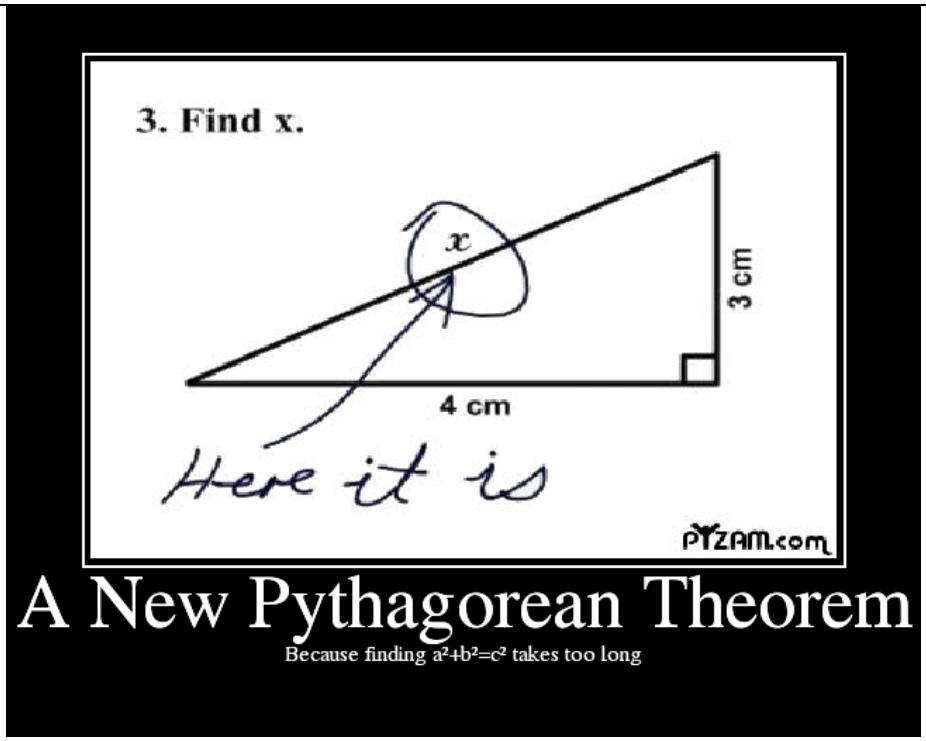
Notes Section R.1 – The Pythagorean Theorem

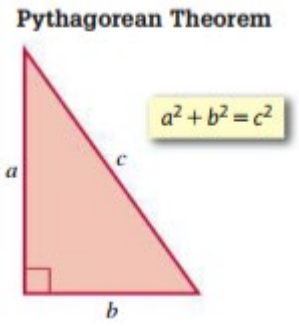


Lesson Objectives

1. Overview of The Pythagorean Theorem
2. Solve problems related to The Pythagorean Theorem

A. Overview of The Pythagorean Theorem

Do you recall how **The Pythagorean Theorem** goes?



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

But what does it mean? What are $a, b,$ and c?
What is needed for The Pythagorean Theorem to work?

This formula, $a^2 + b^2 = c^2$, makes little sense without some context.

The Pythagorean Theorem applies to **right triangles** only, not all triangles.

Sides ***a*** and ***b*** are called **legs**, and they come together to form the right angle.
The legs *a* and *b* are arbitrary – either one could be the shorter side (or the same length).

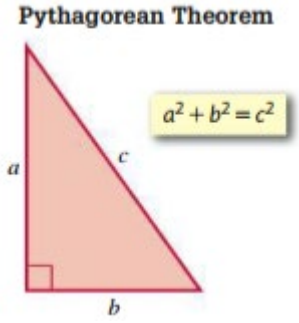
Side ***c*** is called the **hypotenuse**, and it is always the **longest** side, opposite the right angle.

Notes Section R.1 – The Pythagorean Theorem

B. Solve Problems Related to The Pythagorean Theorem

- Hypotenuse is unknown

- **EXAMPLE:** The lengths of the legs of a right triangle are given. Find the hypotenuse.
  $a = 24$, $b = 45$ [R.1.27]

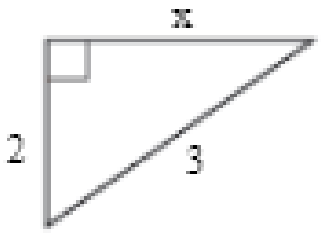


Using The Pythagorean Theorem, $a^2 + b^2 = c^2$ (easier to reverse it)

$c^2 = a^2 + b^2$	Plug in the values for *a* and *b*
$c^2 = (24)^2 + (45)^2$	Simplify
$c^2 = 576 + 2025$	Simplify
$c^2 = 2601$	Square root both sides
$\sqrt{c^2} = \sqrt{2601}$	Use calculator
$c = 51$	

- One of the Legs is unknown

- **EXAMPLE:** Find the value of *x*. [*PHG 8.1.17]
  (Simplify your answer. Type exact answer, using radicals as needed.)



It may be very tempting to just glance at this triangle and say *x* = 1.
Try again…resist that temptation!

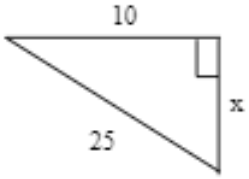
This is a right triangle, so we'll use The Pythagorean Theorem, $a^2 + b^2 = c^2$.

$a^2 + b^2 = c^2$	
$(2)^2 + x^2 = (3)^2$	Common error is: $(2)^2 + (3)^2 = x^2$
$4 + x^2 = 9$	Subtract 4 from both sides
$-4 \quad -4$	Combine like terms and simplify
$x^2 = 5$	Square root both sides
$\sqrt{x^2} = \sqrt{5}$	Simplify the square root, if needed.
$\boldsymbol{x = \sqrt{5}}$	Common error is: $x = 5$

Notes Section R.1 – The Pythagorean Theorem

- **EXAMPLE:** Find the value of *x*. If necessary, write your answer in simplest radical form.

[*Martin-Gay 9.1.9]



This is a right triangle, so we'll use
The Pythagorean Theorem, $a^2 + b^2 = c^2$.

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

$(10)^2 + x^2 = (25)^2$ Common error is $(10)^2 + (25)^2 = x^2$

$100 + x^2 = 625$ Subtract 100 from both sides

$-100 \quad -100$ Combine like terms and simplify

$x^2 = 525$ Square root both sides

$\sqrt{x^2} = \sqrt{525}$ Simplify the square root

$\boldsymbol{x = 5\sqrt{21}}$

Sources Used:

1. MyLab Math for *Geometry*, Martin-Gay, Pearson Education Inc.
2. MyLab Math for *Prentice Hall Geometry*, ©2011, Pearson Education Inc.
3. MyLab Math for *College Algebra with Modeling and Visualization*, 6th Edition, Rockswold, Pearson Education Inc.
4. Wabbitemu calculator emulator version 1.9.5.21 by Revolution Software, BootFree ©2006-2014 Ben Moody, Rom8x ©2005-2014 Andree Chea. Website https://archive.codeplex.com/?p=wabbit