MATH NEWS

Grade 8, Module 2, Topic D

8th Grade Math

Module 2: The Concept of Congruence

Math Parent Letter

This document is created to give parents and students a better understanding of the math concepts found in Eureka Math (© 2013 Common Core, Inc.) that is also posted as the Engage New York material which is taught in the classroom. Module 2 of Eureka Math (Engage New York) focuses on translations, reflections, and rotations in the plane and precisely defines the concept of *congruence*.

Focus Area Topic D:

The Pythagorean Theorem

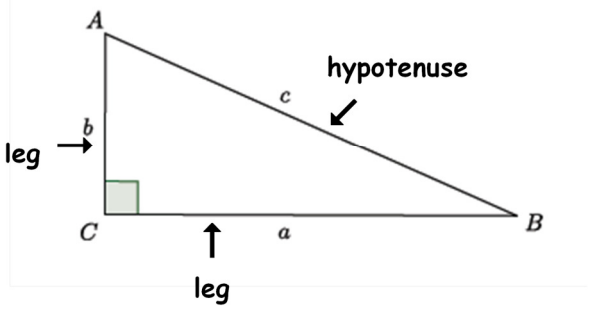
Informal Proof of the Pythagorean Theorem

The Pythagorean Theorem is a famous theorem that will be used throughout much of high school mathematics. Consequently, students will see several proofs of the theorem throughout the course of the year.

◢◣◢◣◢◣ Pythagorean Theorem◢◣◢◣◢◣

◢ If the lengths of the legs of a right triangle are **a** and **b**, and the length of the hypotenuse is **c**, then $a^2 + b^2 = c^2$.

◢ Given a right triangle ABC with C being the vertex of the right angle, then the sides AC and BC are called the legs of △ABC and AB is called the **HYPOTENUSE** of △ABC.



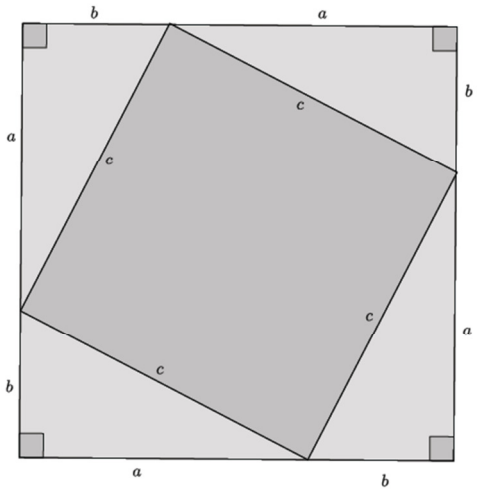
NOTE: side a is opposite of ∠A, side b is opposite of ∠B, and side c is opposite of ∠C.

Focus Area Topic D:

The Pythagorean Theorem

Students will be guided through the square within a square proof of the Pythagorean Theorem: this requires students to know that **congruent figures** also have **congruent areas**.

A SQUARE WITHIN A SQUARE



Our goal is to show that $a^2 + b^2 = c^2$.

To do this, students will compare the total area of the outside square with the parts that compose it—specifically the four triangles and the smaller inside square.

ALGEBRAICALLY

AREA of the OUTSIDE SQUARE: $(a + b)^2 = a^2 + 2ab + b^2$
AREA of the FOUR TRIANGLES: $4(\frac{1}{2}ab) = 2ab$
AREA of the INSIDE SQUARE: c^2

AREA of OUTSIDE ■ = AREA of 4 ▲ + AREA of INSIDE ■
$a^2 + 2ab + b^2 = 2ab + c^2$

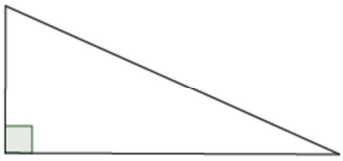
Simplify:

$a^2 + 2ab - 2ab + b^2 = 2ab - 2ab + c^2$
$a^2 + 0 + b^2 = 0 + c^2$
$a^2 + b^2 = c^2$

PROOF of the PYTHAGOREAN theorem using a square within a square.

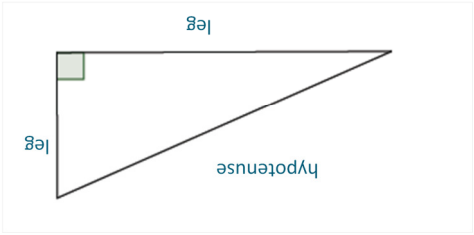
Focus Area Topic D:

The Pythagorean Theorem



Can you label the sides of the right triangle above with leg, leg, and hypotenuse?

SOLUTION:

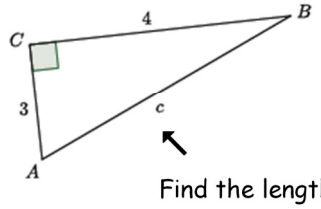


Applications of the Pythagorean Theorem

The following examples come from the **CLASS EXERCISES** and **PROBLEM SETS** for Lessons 15 & 16.

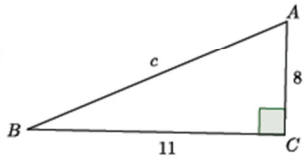
Find the length of the hypotenuse for each of the triangles.

#1



Find the length of the hypotenuse. (Find c.)

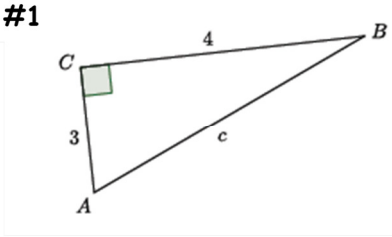
#2



Applications of the Pythagorean Theorem

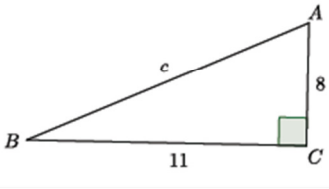
SOLUTIONS:

#1



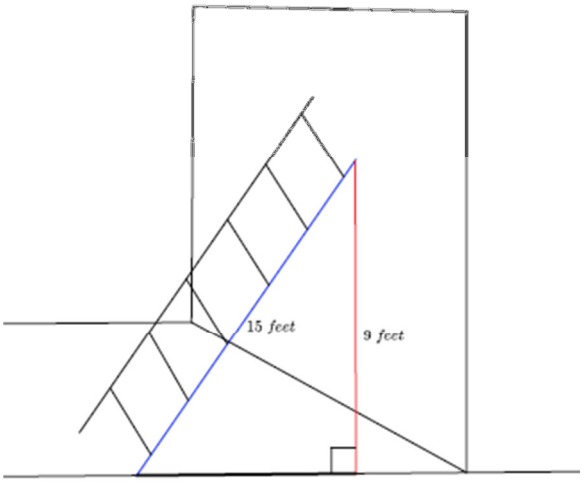
$$a^2 + b^2 = c^2$$
$$4^2 + 3^2 = c^2$$
$$16 + 9 = c^2$$
$$25 = c^2$$
$$5 = c$$

#2



$$a^2 + b^2 = c^2$$
$$11^2 + 8^2 = c^2$$
$$121 + 64 = c^2$$
$$185 = c^2$$
$$\sqrt{185} = c$$

You have a 15-foot ladder that needs to reach exactly 9 feet up the wall. How far away from the wall should you place the ladder to reach the desired height?



SOLUTION:

Let a represent the distance the ladder must be placed from the wall, then

$$a^2 + 9^2 = 15^2$$
$$a^2 + 9^2 - 9^2 = 15^2 - 9^2$$
$$a^2 = 225 - 81$$
$$a^2 = 144$$
$$a = 12$$

The ladder must be placed exactly 12 feet from the wall.