**Lesson Plan**

**Mathematics Course: \_X\_ 8th Math \_\_\_ Math 1 (9th) \_\_\_ Math 2 (10th)**

**Title of Lesson** \_Pythagorean Theorem Learning Task\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Unit** \_\_Unit 2 – Powers That Be\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Purpose within unit (include information to help place this lesson within the unit)**:

 \_X\_\_ Exploration \_X\_\_ Direct Instruction \_\_\_\_ Culminating Task

**Georgia Performance Standard:** M8G2.b Recognize and interpret the Pythagorean Theorem

as a statement about areas of squares on the side of a right triangle.

**Objective for This Class Period**: Students will be able to show understanding of Pythagorean Theorem by applying it as a statement of areas as well as side lengths of right triangles.

**Essential Question(s)** What is the Pythagorean Theorem and when does it hold?

**Resources** :

* Learning Task worksheet: to be completed as students learn and accumulate knowledge
* 1 cm grid ruler made from 1cm grid paper (cut prior to lesson)
* 1 cm grid worksheet

**Timing outline :**

* Mixed Review /Bell Ringer – (5 minutes)
* Lesson Warmup/Activator – (10 minutes)

* Lesson/Practice (Learning Task) – (30 minutes)
* Ticket Out the Door – (5 minutes)

**5-Question Mixed Review (Bell Ringer) – project or copy on back of Ticket out the Door**

1. Square root of 64 is \_\_**8 or -8**\_\_\_

2. Side of square is $\sqrt{8}$, then area is \_**8**\_\_\_\_

3. 3.09 x 103 – 1.19 x 102 = \_\_**2.971 x 103**\_\_\_\_\_\_\_\_\_\_

4. a3b x a-3b-1 = \_**1**\_

5. Simplify $\frac{2a^{3}b^{-1}}{8a^{-1}b^{-3}}$ = $\frac{a^{4}b^{2}}{4}$

**Lesson Guide**

* Mixed Review/Bell Ringer – As students enter, they will complete the mixed review
* Review Mixed Review
* Learning Task Worksheet - Hand out Worksheet Packet

**1. WARM UP:** *The warm-up reminds students how to find the area of squares that will be related to the right triangle in the learning task.*

Find area of a square with . . .

a. side = $\sqrt{3}$ Area = \_\_3\_\_\_\_\_\_\_\_\_ d. side = .5 Area = \_\_.25\_\_\_\_\_\_\_\_\_

b. side = 8 Area = \_\_64\_\_\_\_\_\_\_\_ e. side = $\frac{1}{2}$ Area = \_\_$\frac{1}{4}$\_\_\_\_\_\_\_\_\_\_\_

c. side = 11 Area = \_\_121\_\_\_\_\_\_\_ f. side = 3$\sqrt{5 }$ Area = \_\_45\_\_\_\_\_\_

**2. Activators:**

**a. Review the coordinated grid: label parts using vocabulary - origin, x-axis and y- axis, quadrants, and what points are found in each quadrant.**

****

Origin (0,0)

 **I II**

 **( -, +) (+, +)**

 **III IV**

 **( -, - ) ( +, - )**

**b. Pass out the 1 cm coordinate grid. Get students to see the grid as just the first quadrant by labeling the x and y axis. Have students plot the points: (5,6), (9,6), (5,9).** (*Work along with students using coordinate plane screen or ELMO with worksheet while students complete the task.)*

**Connect your lines with a STRAIGHT EDGE** *(ruler, side of book, dry spaghetti noodle, etc)***. What shape do you see?***(triangle)***…What kind of triangle?** *(right…90 degrees)***…How do you know?***(right triangles contain a right angle)* **What symbol could we use in a triangle to denote a “right” angle?***(little square in the right angle)***.**

**3. Let’s label parts of a right triangle….** *(leg), (leg), (hypotenuse)***. Talk about the relation that each part has to make the triangle.** *(Hypotenuse is the longest side across from the right angle, legs make the right angle)* **Fill in answers on worksheet.**

**4. Label each side with the variables: legs**(a and b) **and hypotenuse** (c)**.Use grid ruler to measure the lengths of the legs and hypotenuse of your triangle. Write these lengths on your triangle.** *(students should recognize that the grid ruler is made from the I cm grid that they are using.)*

**5. What do we know about sides and angles of squares?....** *(all side lengths are equal and all angles are equal or measure 90*$°$*)*

**6. With your grid ruler draw squares on the sides of the legs of your triangle.** *(Provide regular rulers if grid ruler proves too flimsy. Walk around, asking, Is it a square, if so,* ***how do you know it is a square?****- students should respond that all sides are the same length all angles are right angles)*

**7. How could you draw a square on the hypotenuse?***(let them attempt this)….***what strategies/tools can you use to draw a square the length of the hypotenuse***?(You can use the grid ruler or mark the length of the hypotenuse on a piece of paper and use that, etc)….(students should notice that the angles or corners of the squares are at grid intersections)*

**8. How do you find the area of a square?** *(multiply side x side)*

**9. What are the areas of the 2 squares on the legs? (** Students should label the areas of the squares drawn using unit2).

**10. What is the area of the square of the hypotenuse? Label the square with the measurement.***(students should recognize that because they know what the length of the hypotenuse is, then they know the other side lengths of the square.* **How do you know?** *(area of a square equals side x side)*

**11. What relationship do you see between the smaller squares and the larger square?***(the sum of the areas of the smaller squares equal the area of the larger square)*

**12. There is a Theorem** *(What is a theorem?)* **or formula called the** Pythagorean Theorem, **it says that there is a relationship between the areas of the squares on the legs of a right triangle and the area of the square on the hypotenuse….**

**13. Can you guess the formula?** *(a2 + b2= c2 ;* ***What does it mean?*** *one leg squared plus the other leg squared equals the hypotenuse squared )*

**14. Pythagorean Theorem works only with right triangles. It helps find** (a missing side of a right triangle).

**Assessment**: Ticket out the Door

1. The parts of the right triangle are \_2\_legs\_\_\_\_ and \_a\_hypotenuse\_\_\_\_.

2. The longest side is the \_\_\_hypotenuse\_\_\_\_\_\_\_.

3. The \_legs\_\_ make up the right angle.

4. The Pythagorean Formula: \_leg\_ squared + \_leg\_\_ squared = \_\_\_hypotenuse\_\_ squared

OR \_\_a2\_ + \_\_b2\_ = \_c2\_\_

5. Pythagorean Formula helps to find \_\_\_a missing side of a right triangle\_\_\_

**5-Question Mixed Review (Bell Ringer)**

1. Square root of 64 is \_\_\_\_\_

2. Side of square is $\sqrt{8}$, then area is \_\_\_\_\_

3. 3.09 x 103 – 1.19 x 102 = \_\_\_\_\_\_\_\_\_\_\_

4. a3b x a-3b-1 = \_\_\_\_\_\_\_\_

5. Simplify $\frac{2a^{3}b^{-1}}{8a^{-1}b^{-3}}$ = \_\_\_\_\_\_\_\_\_\_\_\_

**5-Question Mixed Review (Bell Ringer)**

1. Square root of 64 is \_\_\_\_\_

2. Side of square is $\sqrt{8}$, then area is \_\_\_\_\_

3. 3.09 x 103 – 1.19 x 102 = \_\_\_\_\_\_\_\_\_\_\_

4. a3b x a-3b-1 = \_\_\_\_\_\_\_\_

5. Simplify $\frac{2a^{3}b^{-1}}{8a^{-1}b^{-3}}$ = \_\_\_\_\_\_\_\_\_\_\_\_

**Ticket Out The Door**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**1. The parts of the right triangle are \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**2. The longest side is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**3. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ make up the right angle.**

**4. The Pythagorean Formula: \_\_\_\_\_\_\_\_ squared + \_\_\_\_\_\_\_ squared = \_\_\_\_\_\_\_\_\_\_\_\_\_ squared**

**OR \_\_\_\_\_\_ + \_\_\_\_\_\_ = \_\_\_\_\_\_\_**

**5. Pythagorean Formula helps to find \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**Ticket Out The Door**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**1. The parts of the right triangle are \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**2. The longest side is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**3. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ make up the right angle.**

**4. The Pythagorean Formula: \_\_\_\_\_\_\_\_ squared + \_\_\_\_\_\_\_ squared = \_\_\_\_\_\_\_\_\_\_\_\_\_ squared**

**OR \_\_\_\_\_\_ + \_\_\_\_\_\_ = \_\_\_\_\_\_\_**

**5. Pythagorean Formula helps to find \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

Pythagorean Theorem Learning Task

(Unit 2)

1. Warm-up: Find area of a square with . . .

a. Side = $\sqrt{3}$ Area = \_\_\_\_\_\_\_\_\_\_\_\_\_ d. Side = .5 Area = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. Side = 8 Area = \_\_\_\_\_\_\_\_\_\_\_\_\_ e. Side = $\frac{1}{2}$ Area = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c. Side = 11 Area = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ f. Side = 3$\sqrt{5}$ Area = \_\_\_\_\_\_\_\_\_\_\_\_

2. a. Review the Coordinate Grid: Label a coordinate grid with the vocabulary – origin, y-axis, x-axis, quadrants, and what points are found in each quadrant.



b. Plot the points (5,6), (9,6), and (5,9) and connect.

What shape is made? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What kind of triangle? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How do you know? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What symbol is used to indicate a right angle? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Parts of a right triangle include 2 shorter sides and a longest side. Shorter sides are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The longest side is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

The longest side is also \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

The shorter sides are perpendicular and form the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in the triangle.

4. Label each side: Legs a and b and hypotenuse c.

Measure the length of each side of the triangle using the ruler. Label the triangle with the lengths.

5. What do we know about the side of squares? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Using the grid ruler draw a square on each leg of the triangle. How do you know each is a square? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Attempt to draw a square on the hypotenuse. What strategy can you use to make sure it’s a square? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Hint: Use grid ruler or a piece of paper to mark the length of the hypotenuse.

8. How do you find the area of a square? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. Find the area of each square attached to the legs of your triangle. Label each square with the area (Example: 16 unit squares)

10. What is the area of the square attached to the hypotenuse? \_\_\_\_\_\_\_\_\_\_\_ How do you know?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. What relationship do you see between the smaller squares and the larger square? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12. There is a theorem (or formula) called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

It is used to find the missing side of a right triangle. It says that there is a relationship between the legs squared and the hypotenuse squared.

13. Write the Pythagorean Formula \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. What does it

mean? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

14. Pythagorean Theorem works only with right triangles. It helps find

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.