LESSON PLAN
INVESTIGATING PYTHAGOREAN TRIPLES

Lesson Summary: In this lesson the student will use existing knowledge along with inquiry base activities to further study Pythagorean Triples.

Key Words: Pythagorean Theorem, Right Triangle

Existing Knowledge:
Students should be familiar with the following concepts: definition of a right angle, right triangle, and a basic knowledge of the Pythagorean Theorem. They should also have knowledge of Cabri Geometry II, creating a triangle, and some exposure to the Cabri calculator.

NCTM Standards:
"Make and test conjectures about characteristics and properties (sides, angles, symmetry) of 2-dimensional figures and 3-dimensional figures." (1)

"Represent and analyze shapes using coordinate Geometry." (4)

Learning Objectives:
1. Student will be able to create a right triangle on a coordinate plane.
2. Students will be able to use the inverse of the Pythagorean Theorem to verify a right triangle.
3. Students will be able to recognize and create Pythagorean Triples.

Materials:
1. Laboratory worksheet.
2. Access to a computer or calculator equipped with Cabri Geometry II.

Procedure:
1. Students should be grouped in pairs. The method of grouping is left to the individual instructor.
2. Have students complete the lab for Pythagorean Triples.
PYTHAGOREAN TRIPLES WORKSHEET

Team Members: ____________________
____________________

File Name: ____________________

**Problem:** What happens to the hypotenuse of a right triangle as the 2 legs of the triangle are increased? Explore using Cabri II Software or TI-92 Calculator.

**I. Set Up Axes and Grid:**

1. Select Show Axes.
2. Select Define Grid.

**II. Create a triangle starting at the origin:**

1. Select Triangle.
2. Click at the origin.
3. Go along the X-axis 3 units, click at the point. (If you are given a choice between grid or axis on any of these points, click grid).
4. Proceed to a point on the Y-axis 4 units above the origin, click at the point. You should now have a triangle drawn.

**III. Label the vertices of the triangle.**

Label C the vertex at the origin, A the point on the X-axis, and B the point on the Y-axis (Label tool)

**IV. Measure and label the sides of ∠ABC.**

1. Measure and label \( \overline{AB} \), \( \overline{BC} \), and \( \overline{AC} \). (Distance and length tool)

What kind of triangle is \( \triangle ABC \)? How do you know?

\[ BC = 4.00 \text{ cm} \]
\[ AB = 5.00 \text{ cm} \]
\[ AC = 3.00 \text{ cm} \]
V. Measure $\angle C$.

Measure $\angle ACB$. 

(Angle tool)

Is this a right angle?

VI. Use the inverse of the Pythagorean Theorem to also verify that the triangle is a right triangle.

$AB = AC + BC$  

(Calculate tool)

What is the result of your calculation? 

VII. Drag your answer out of the Calculator and place on the drawing.

1. Label this answer Result $AB$.

2. Your calculator answer should have the answer of 5, which is the length of $AB$ according to the Pythagorean Theorem. Does this match the measured length of $AB$ on your drawing?

VIII. Next, you will change the sides of the triangle.

1. Clink Pointer to drag the Origin down to the lower left corner of your screen, so that the first quadrant fills most of the screen.

2. Drag the points $A$ along the $X$-axis to a length of 6, and $B$ along the $Y$-axis to a length of 8. How do the lengths of the 2 new legs compare with the original triangle?

3. How does the new $AB$ compare in length to the original $AB$?

4. Drag the points $A$ along the $X$-axis to a length of 9, and $B$ along the $Y$-axis to a length of 12. How do the lengths of the 2 new legs compare with the original triangle?

5. How does the new $AB$ compare in length to the original $AB$?

What do you suppose would happen if you create a triangle with legs four times greater than the original sides. How would the new hypotenuse compare to the original? 

What if the legs were ten times greater?
**Extension:**

- What if the legs were half as long? Create a triangle and use the Pythagorean Theorem to see if the resulting hypotenuse is half the original.

- Do you suppose this idea would hold true if the sides were n times greater? __________

- Another Pythagorean Triple is 5, 12, 13. Would this idea apply to this triple as well? _____
  Create a triangle and explain.