

Name: \_\_\_\_\_

***Mathematics: The Language of STEM Draft 4***  
**Pythagorean Football**

**CONTENT AND TASK DECISIONS**

**Grade Level(s):** 8<sup>th</sup> Grade Mathematics

**Description of the Task:** Students will be presented with a problem using the Pythagorean Theorem (football). Students will discuss in group the properties and ways to measure/calculate the length of the 3 sides. Students will find or manipulate right triangles and measure the 3 sides. Students will get in groups and make a chart comparing the 3 sides in any right triangle and discuss and relationship or patterns they notice. Students will use a geoboard app to create a right triangle and derivate the formula for the Pythagorean Theorem using the squares of the 3 sides. Students will create another chart comparing their data from the geo charts and discuss patterns and hypothesize the formula. We will discuss what does and doesn't work. We will prove why the theorem works using graph paper. Students will now take the formula and prove what they charted and then we will use the theorem to solve the initial and other real world problems that use the Pythagorean Theorem.

**Indiana Mathematics Content Standards:** 8.GM.8: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and other mathematical problems in two dimensions.

**Indiana Mathematics Process Standards:**

- PS.1: Make sense of problems and persevere in solving them
- PS.4: Model with mathematics
- PS.5: Use appropriate tools strategically

**Mathematics Content Goals:** Students will be able to articulate and visually represent why the Pythagorean Theorem works. Students will be able to calculate and explain how to find the third side in any right triangle where two of the sides are known and give a real world example where the theorem could be used.

**Language Objectives:** Students will be able to articulate, in their journal, how the theorem works and why it works and give a real world example where the theorem could be used.

**Materials:** Rulers, measuring tape, measuring wheel, geo board or geo board app, pencil, paper, calculator

**THE LESSON**

**Before:**

- Student Actions
  - Students will discuss, in groups, the properties and ways to measure/calculate the length of the 3 sides.
- Teacher Actions
  - I will present the football problem on the board with 2 known sides and one unknown side in a right triangle.

- Allow students to pull upon prior knowledge of the properties of right triangles.
- Tell students the first step, second step and third step of the lesson progressively.

### **During:**

- Student Actions
  - We will act out the football problem, in an open area, and come up with strategies to find the distance a pass must be thrown.
  - Students will find, or manipulate, 3 sides of a right triangles and make charts to notice relationships.
  - Students use geo boards and charts to notice relationship between the areas of each given side of the triangle.
    - Students will discuss the properties of area. (i.e This is what I know about area, this is what I notice about the charts)
  - Discuss in groups patterns and possible derivations of the Pythagorean formula.
    - See that the square of the two sides is the same as the square of the longest. Students will discuss why this will be true. Is it always true?
  - Students will prove theorem using graph paper.
  - Students will now take the formula and prove what they charted.
- Teacher Actions
  - Walk around room.
  - Talk with students and see what they know and where they are struggling in order to help funnel questions so students can think for themselves.

### **After:**

- Student Actions
  - We will discuss as a group and discuss where they found right triangles
  - Discuss methods used to measure.
  - What patterns were noticed and relationships in the charts
  - Explore how they applied the theorem and proved what they initially measured
- Teacher Actions
  - We will discuss as a group and discuss where they found right triangles,
  - Discuss how they measured, how they noticed patterns and relationships in the charts and how they applied the theorem and proved what they initially measured.
  - Take their findings and start putting vocabulary and terms to the sides of the triangle, the theorem itself, and any other mathematical discoveries they found. (i.e leg, hypotenuse, squared, sum, square roots, Pythagorean Theorem, variables, equation etc...)

## **ASSESSMENT**

### **Observe:**

- Are students able to see the connections between the manipulated triangles, the chart, and the algorithm?
- Are students using the algorithm correctly to find the third side in any right triangle?
- Is vocabulary being used and applied appropriately?

**Ask:**

- How did you find or manipulate right triangles?
- What did you notice as patterns in your charts of right triangles?
- How can we use our observations to derive an algorithm?
- How can this algorithm be applied in real life situations?