Lesson Title:	Geometry in Football
Length of Lesson	2 Days
Created By	Michael Andre Hamilton
Subject	Geometry, Algebra
Grade Level	10^{th}-12^{th} grade
State Standards	Transition to Algebra 3a, Geometry 4a,4b,
DOK Level	DOK 2
DOK Application	Estimate, Predict, Interpret, Make Observation
National Standards	Geometry for 9 – 12^{th} Math Standards
Graduate Research Element	Understanding how to use math concepts to solve problems

Student Learning Goal:

State Standards for 9 – 12^{th} Geometry

A. Apply the Pythagorean Theorem to solve problems
B. Solve real-world problems involving formulas for perimeter, area, distance, and rate
C. Explain and apply the appropriate formula to determine length, midpoint, and slope of a segment in a coordinate plane

National Standards for 9 – 12^{th} Transition to Algebra

A. Apply the Pythagorean Theorem to solve problems

Materials Needed (supplies, hand-outs, resources):

Writing utensils; Notebook paper; White board; rope, ruler, Inspiring Minds;

Lesson Performance Task/Assessment:

The lesson performance task is to give the student's understanding using rope to calculate dimensions using the Pythagorean Theorem. The students will take the rope to the field tight it to a goal post. Slack will be added to the rope and the student will have to calculate how much slack is in the rope. The student will be given measuring tape to measure the vertical height slack in the rope. The student will take the measure and calculate the slack using the Pythagorean Theorem.

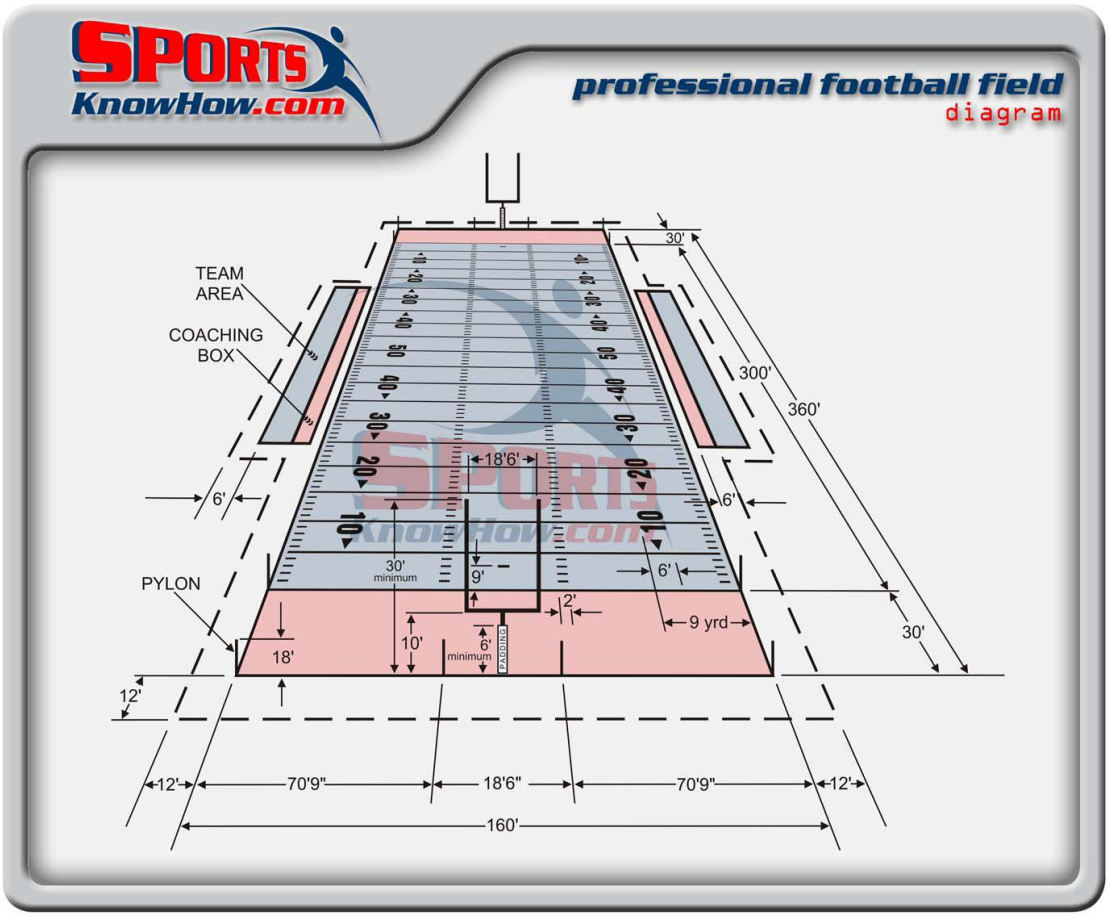
Lesson Relevance to Performance Task and Students:

The lesson performance task is to give the student's understanding of how to apply the Pythagorean Theorem in a real world situation. Also the objective calculate different dimension on the field using Geometry

Anticipatory Set/Capture Interest:

Each student will be given a small piece of rope and two cones. They will be asked different question about triangles and try to tell me different relationship using Pythagorean Theorem of different items in the real world. I will also bring a football to the classroom and a slideshow with big football hits to get there initial attention. I will

show them a bird eye view of a football field and explain how geometry is used to create the dimensions on the field. Example of my diagram is show below:



Guided Practice:

Day One:

The instructor will talk about the Pythagorean Theorem and it concepts. The student will be in the classroom the whole day. They will perform calculations to get the missing side of the triangle using the Pythagorean Theorem. I will give a quiz to check for concept understanding.

Day Two:

If possible, the students will go the football field to perform the experiment. They will take a long rope, tie it to the bottom of the goal post at one end of a football field. Then run it across the length of the field (120 yards) to a goal post at the other end. Stretch it

tight, and then tie it to the bottom of that goal post, so that it lies flat against the ground. We will add 1 foot of slack to the rope and ask the class how high it would lift at the 50 yard line

A. not high enough to fit my finger under it.
B. just high enough to crawl under
C. just high enough to walk under
D. high enough to drive a truck under.

Surprise answer: it's D! It will be 13.43 feet high at the 50-yard line!

Take a show of hands each possible answer. For maximum effect, ask them quickly so that they have to rely on their intuition and do not have time to do the calculation. If anyone answers D, you can playfully jest "you really think it is high enough to drive a truck under?" to see if they are confident of this answer, or are just doing it because the answer seems outrageous.

This is a simple, but surprising application of the Pythagorean Theorem. The answer is the square root of (180.5^2 - 180^2)

Independent Practice:

Day One:
The students will listen and gain understanding about the Pythagorean Theorem. The students will take a quiz showing that they understand the concepts of the Pythagorean Theorem.

Day Two:
The students will go to the field to perform hands on Experiment.

Remediation and/or Enrichment:

Remediation
Individual IEP; partner help throughout lesson; shorten parts of assignment; focus on few process

Enrichment:
Google Earth could be used to enhance the project.

Check(s) for Understanding:

Day 1:
What is the Pythagorean Theorem?
How many sides of the triangle you need to calculated the Pythagorean Theorem?

Day 2:
Do you understand how the slack in the rope was calculated?
Give me examples how using the Pythagorean Theorem in real world application can be useful?

Closure:
Day One
I will have a quiz about their understanding of the topic
Day Two:
Explain how Geometry is used in other situations.
Possible Alternate Subject Integrations:
*None
Teacher Notes:
Su, Francis E., et al. "Football Field." *Math Fun Facts*.
<http://www.math.hmc.edu/funfacts>.