

Lesson Plan Template
ETAP 524
Spring 2014

Name: Lauren Steers

Module: 4

Lesson Plan Title

Real World Pythagorean Theorem

Discipline and Topic

Math: This lesson will show students how to use the Pythagorean Theorem. Students will then apply their knowledge to real world Pythagorean Theorem problems through the creation of a multimedia poster.

Target Population

This lesson will be presented to a NYS High School Geometry class in which all students have already passed the Algebra 1 regents.

(Analyze Learners)

- General Characteristics: Students are in 9th or 10th grade.
- Entry Competencies: Students need to have knowledge of right triangles, how to set up and solve equations involving one or more variables, and knowledge of how to break down word problems to find the important pieces of information.
- Learning Styles: The learning styles of the students include visual, aural, verbal, and kinesthetic. However, most the majority of the students are visual and verbal.

Curriculum Alignment and Standards

The Pythagorean Theorem is part of the NYS common core curriculum in which students are asked to prove theorems about triangles.

(New York State standards)

High School Geometry: Similarity, Right Triangles, & Trigonometry

4. Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.

8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems

ISTE NETS Standards

Student:

1. Creativity and innovation: Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

- a. Apply existing knowledge to generate new ideas, products, or processes
- b. Create original works as a means of personal or group expression

Teacher:

2. Design and develop digital age learning experiences and assessments: Teachers design, develop, and evaluate authentic learning experiences and assessments incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the Standards-S.

- a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity
- b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress
- d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards, and use resulting data to inform learning and teaching

Goals

Students will be able to use the Pythagorean Theorem to solve right triangles in applied problems.

Objectives (State)

-Given two side lengths in a right triangle, geometry students will use the Pythagorean Theorem to find the missing side length in 4 different examples.

-Given a real world problem, geometry students will construct a diagram and use the Pythagorean Theorem to solve for the unknown value.

-Given an applied Pythagorean theorem problem, geometry students will create a multimedia poster that diagrams the problem, shows the steps to solve the problem, and shows the problem and answer.

Underlying Educational Theory

This lesson draws upon the constructivist theory of leaning in that students actively participate in the lesson to build on prior knowledge and acquire new knowledge. Also, the students work collaboratively in groups to share and test each other's ideas.

Materials Description and Timing

SmartBoard, desktop/laptop computer for teacher use, 7-8 laptops for student use, guided notes packet ([guided notes](#)), SmartBoard slides ([SmartBoard slides](#)), activity instructions/rubric ([Instructions/rubric](#)), homework worksheet ([HW worksheet](#)), student self-evaluation ([Project self-evaluation](#)), video (<http://www.youtube.com/watch?v=uaj0XcLtN5c>)

Supplemental Materials/Links

Student work sample ([student work sample](#))

Lesson

- (5 minutes): Introduction: I will show students images of one way to prove the Pythagorean Theorem. We will discuss the proof, and I will have students explain the proof in their own words.
- (10 minutes): Student will fill in their guided notes packet while I use the SmartBoard to go over the notes. We will then complete 2 examples together and the students will complete 2 more examples independently.
- (5 minutes): I will explain the activity that the students are going to be completing.
 - I will tell the students the groups and they will rearrange themselves so that all group members are sitting together.
 - Instructions: You will be given a real world problem that will be solved using the Pythagorean Theorem. As a group, construct a diagram, set up the problem, complete each step, and come up with a cohesive answer that all group members agree on. Then, you will use the laptops to create a multimedia poster. Each poster needs to have the original problem displayed, a diagram of the situation, the correct steps to solve the problem, and the answer displayed with appropriate units. You will be graded on this based on the rubric I will hand out.
- (25 minutes): Students will have 25 minutes to complete this activity within their assigned groups. I will walk around to monitor students work and assist groups when help is needed. At the completion of the project, students will print out their posters and hang them for others to see.

Assessment of Students

	Excellent (3 points)	Competent (2 points)	Needs Work (1 point)
Question	The question is clearly stated.	The question is mentioned but not fully explained.	The question is not stated on the poster.
Graphics	The diagram is correct and complete with appropriate labels.	The diagram is correct but does not include the appropriate labels.	The diagram does not correctly depict the question.
Steps to Solve	Each step used to solve the problem is complete and correct.	Some of the steps shown are correct, but there are 1 or more mistakes.	None of the steps shown are correct.
Answer	The answer is correct with the appropriate units and clearly shown.	The answer is correct, but the correct units are not shown.	The answer is not correct.
Creativity/Organization	The poster is colorful, organized and is visually appealing.	The poster could use more creativity or organization.	The poster is not colorful and hard to follow.

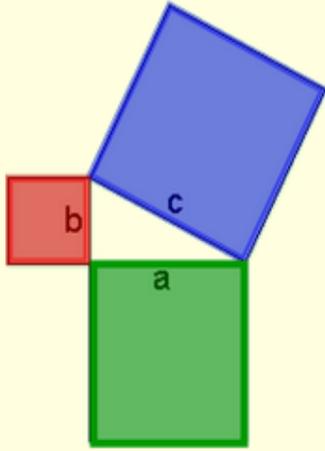
Evaluation of Students and Lesson

In order to see if this lesson was a success, I will give students a self-evaluation. The self-evaluation will allow me to see if students enjoyed this lesson, and whether or not they obtained a deeper understanding of how to use the Pythagorean theorem to solve applied problems. Students will also evaluate their participation in the group activity.

Low Tech Modification

If laptops are not available, I will have students complete the poster using chart paper and markers. If the Smart Board is not working properly, I will use a document camera to go over the guided notes. If that is also unavailable, I will use a white board to go over the notes.

Lesson: Real World Pythagorean Theorem



Geometrical Proof: The Pythagorean Theorem has drawn a good deal of attention from mathematicians. There are hundreds of geometrical proofs (or demonstrations) of the theorem, with even a larger number of algebraic proofs.

Geometrically, the Pythagorean Theorem can be interpreted as discussing the areas of squares whose sides are the sides of the triangle (as seen in the picture at the left). The theorem can be rephrased as, "The (area of the) square described upon the hypotenuse of a right triangle is equal to the sum of the (areas of) the squares described upon the other two sides."

Review: The Pythagorean Theorem states

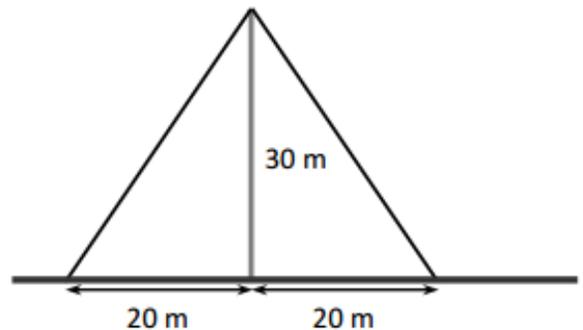
$$a^2 + b^2 = c^2$$

Real World Examples involving the Pythagorean Theorem

Try these

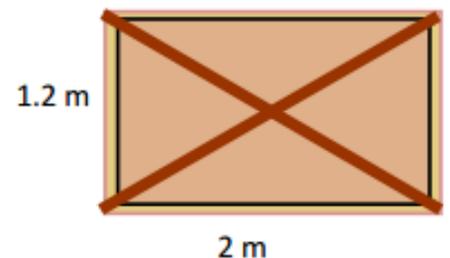
1 A mast is supported by two cables attached to the top, and to points on the ground 20 metres from its base. The height of the mast is 30 metres.

Calculate the length of each cable.



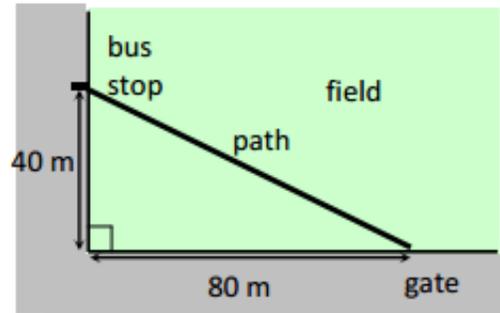
2 A gate is strengthened by fixing a strut along each of its diagonals. The gate is 2 metres long and 1.2 metres high.

Find the length of each strut.



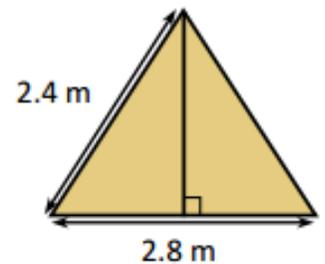
3 Ken takes a shortcut along the path from the gate to the bus stop to the bus stop.

Calculate how much further it would have been if he had walked around the edges of the field instead.



4 A tent is 2.8 metres wide. Its sloping sides are 2.4 metres long.

Calculate the height of the tent correct to 2 decimal places.



<http://www.nuffieldfoundation.org/sites/default/files/files/FSMA%20Pythagoras%20theorem%20student.pdf>, <http://www.regentsprep.org/Regents/math/geometry/GP13/Pythag.htm>

Pythagorean Theorem Group Project

You will be given a real world problem that will be solved using the Pythagorean Theorem. As a group, construct a diagram, set up the problem, complete each step, and come up with a cohesive answer that all group members agree on. Then, you will use the laptops to create a multimedia poster. You will use PowerPoint to create your poster. Each poster needs to have the original problem displayed, a diagram of the situation, the correct steps to solve the problem, and the answer displayed with appropriate units. You will be graded on this based on the rubric below.

	Excellent (3 points)	Competent (2 points)	Needs Work (1 point)
Question	The question is clearly stated.	The question is mentioned but not fully explained.	The question is not stated on the poster.
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Name: _____

Date: _____

Real World Pythagorean Theorem Homework

1)



A baseball diamond is a square with sides of 90 feet. What is the shortest distance, to the *nearest tenth* of a foot, between first base and third base?

2)



A suitcase measures 24 inches long and 18 inches high. What is the diagonal length of the suitcase to the *nearest tenth* of a foot?

3)



In a computer catalog, a computer monitor is listed as being 19 inches. This distance is the diagonal distance across the screen. If the screen measures 10 inches in height, what is the actual width of the screen to the *nearest inch*?

4)



The older floppy diskettes measured $5 \frac{1}{4}$ inches on each side. What was the diagonal length of the diskette to the *nearest tenth* of an inch?

5)



Ms. Green tells you that a right triangle has a hypotenuse of 13 and a leg of 5. She asks you to find the other leg of the triangle without using paper and pencil. What is your answer?

6)



Two joggers run 8 miles north and then 5 miles west. What is the shortest distance, to the *nearest tenth* of a mile, they must travel to return to their starting point?

Name: _____

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Pythagorean Theorem Self-Evaluation

Throughout this lesson, I learned how to...

Would you recommend I use this project in future lesson? Why or why not?

Two skills I learned throughout this lesson are (mathematical)

- 1)
- 2)

Two technology skills I learned throughout this lesson are

- 1)
- 2)

Rate your performance: 1(needs improvement), 2(satisfactory), 3(excellent)

Participation in all group activities	1	2	3
Time management	1	2	3
Leadership	1	2	3
Technology Skills	1	2	3

Describe the role that you played in completing this project:
