

Lesson Plan
ETAP 524
Spring 2014

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Module: 5

Lesson Plan Title

The Pythagorean Theorem

Discipline and Topic

This lesson continues the use of triangles, but this time the students will discover the Pythagorean Theorem and use it to solve problems.

Target Population

The lesson is for 20 eight grade students in a general eighth grade mathematics classroom. This classroom period is 80 minutes long.

- General Characteristics: The class consists of 20 students, with 11 boys and 9 girls. The class has three minority student: one Latino student and two Asian students.
- Entry Competencies: The students have learned how to add integer, square numbers, and take the square-root of a number prior to this lesson. These are prerequisites for the lesson and the students will be allowed to use a calculator.
- Learning Styles: 13 students are visual learners, 6 student is kinesthetic, and 1 is a logical/mathematical learner. There are two students that have a 504 plan and get a separate location for testing and extended time.

Curriculum Alignment and Standards

This lesson focuses on the Pythagorean Theorem and is part of the 8th grade curriculum. This is a major topic in mathematics and is part of the NYS Common Core Learning Standards. The students who continue to take regents level classes beyond Algebra I will need this lesson as a basis for many other mathematics topics. This lesson will utilize the NYS module lesson 13 from the 8th grade module 3 available from www.engageny.org but will be modified for a more hands-on approach. Similar triangles proofs will be used in an upcoming lesson. This lesson uses the following NYS CCLS: 8.G.7

Understand and apply the Pythagorean Theorem.

8.G.7

7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

Mathematical Practices

4. Model with mathematics.
5. Use appropriate tools strategically.
7. Look for and make use of structure

ISTE NETS Standards

Teacher:

Facilitate and inspire student learning and creativity

- Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

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.

Students:

Creativity and innovation

- Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

Critical thinking, problem solving, and decision making

- Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

Goals

The students will use the Pythagorean Theorem and trigonometric ratios to solve for a missing leg or the hypotenuse of a right triangle.

Objectives (State)

- Given a bag of 50 one square inch tiles, the students will discover that the square of the legs of a right triangle is equal to the square of the hypotenuse, with 100% accuracy.
- Given an exit ticket using Khanacademy.org, the students will access it through the school laptops and complete the short quiz, with 80% accuracy.
- Given a worksheet from the NYS modules, the student will find the missing side or hypotenuse of a right triangle with 90% accuracy.
- Given a laptop and access to the class blog, the student will write a minimum of three sentences discussing what they learned or suggestions for future lessons, with 100% completion.

Underlying Educational Theory

This lesson utilizes Constructivist learning and Cooperative learning. The students will be doing a hands-on approach and using inquiry-based learning to discover that the squares of the legs of a right triangle is equal to the square of the hypotenuse. The students will be working in pairs on this discovery. The teacher will be a facilitator while the students try to discover the Pythagorean Theorem. After the activity, the teacher will state the theorem in terms of $a^2+b^2=c^2$, where a and b are legs and c is the hypotenuse, or the longest side of a right triangle. The next lesson students will examine the converse of the Pythagorean Theorem.

Materials Description and Timing

Materials: A Do Now will be used to refresh the prerequisite skill of taking a square root of a number. A worksheet with a 3-, 4-, and 5-inch right triangle and 500 one-square inch tiles will be needed for the hands-on approach. A computer and projector to display the digital story from http://digitalstorytelling.coe.uh.edu/view_story.cfm?vid=241&categoryid=6&d_title=Mathematics will be needed, as well. This was chosen because it includes a history of Pythagoras and practical uses of the Pythagorean Theorem. The digital story will be shown after the hands-on activity and include the introduction to the Pythagorean Theorem. A brief audio file will be played for the class that gives a little history behind Pythagoras, as well. This can be accessed from http://www.teacheraudrey.com/voicefile/pyth_eng.mp3. The NYS student module 3 for 8th grade will be needed for classwork and homework. The laptop cart will be used for an exit ticket through Khanacademy.org. There will be a link on the class website to go directly to Khan academy. The students have used it before and all have logins. The address to the quiz is https://www.khanacademy.org/math/geometry/right_triangles_topic/pyth_theor/e/pythagorean_theorem_1. This will allow the students to use technology and a quick and efficient way for the teacher to keep track of student progress. Module 3 can be located from NYS website www.engageny.org.

Timing of lesson: 80 Minutes of class time

Do Now: 5 minutes

Hands-on activity: 15 minutes

Digital story and introduction to Pythagorean Theorem: 15 minutes

Audio file: 5 minutes

Module Classwork: 25 minutes

Exit ticket & Blog: 15 minutes

Supplemental Materials/Links

- Calculators
- Module 3 Grade 8 workbook

Lesson

The students will be greeted at the door and will grab a Do Now warm-up. The students will put up their answers using the ELMO document camera. After the warm-up on square roots, the students will break into pairs that were chosen the previous day and try to figure out the relationship among the squares of the sides of a right triangle. They will be given a worksheet and 50 one square inch tiles. The students should see that the square of the legs of a right triangle are equal to the hypotenuse, the longest side of a right triangle, when trying to make a square off of the sides (and using all of the pieces). After this hands-on activity, the students will watch the digital story that gives a great introduction of the Pythagorean Theorem, including some history and practical uses. After this, the class will listen to an under four minute audio file about Pythagoras. This gives detail about his life and strange math meeting in caves, as well as allow women into the club. This was unheard of in most places during this era. Following this, the teacher will model one problem and then the students will be guided through one problem in the

module workbook. Next, the students will work in the same pairs to complete the rest of the problems. The teacher will circulate around the room to assess the students and make sure they are on task and using the theorem correctly. The students will again use the ELMO to display their answers and work to the rest of the class. They will be asked to explain and defend their answer, if needed. The last fifteen minutes of class the students will use the school laptops to access khanacademy.org to take a quick exit ticket quiz to assess what they learned from this class. This is only 5 questions and will take only around 5 minutes. The remaining 10 minutes students will be asked to go onto the class website and blog about today's lesson. They can put down what they learned, how they felt about the lesson, suggestions for improvement, or ways they could use the Pythagorean Theorem in their life, such as in building something at home. They will need a minimum of three sentences. Extra credit will be given to those who provide constructive feedback to other student's posts. This gives the students a chance to use technology, a way for the teacher to easily see how all the students are doing (exit ticket), and promoting writing in a mathematics classroom (class blog). The students have used the laptop cart before and it only takes a few minutes to get set up. Homework will be the problem set in the module workbook. A summative assessment test will be given. This will include the Pythagorean Theorem and basic trigonometric ratios.

Assessment of Students

The grade on the test will be a percentage. There are 7 two-point questions and 1 four-point question (2 parts-2points each). The students grade will be the points earned divided by the maximum points (18) and then multiplied by a 100 to get a percentage. The test will be graded with each question based on zero points for no work or incorrect use of the Pythagorean Theorem. One point will be given for small mistakes but using the theorem correctly. Two points will be given for the correct answer. Students will be assessed based on their classwork, the exit ticket, blog, homework, and the test.

Evaluation of Students and Lesson

The lesson went well. The students enjoyed the hands-on approach and discovering the idea behind the Pythagorean Theorem. 80% of the students correctly answered 100% of the questions correctly on the exit ticket. 10% of the students answered 80% of the questions correctly. 5% (one student) only answered 60 % of the questions correctly and was asked to stay activity period for remediation. This student stayed and scored an 80% on the summative test. I was looking for a minimum class average on the test of an 80% with no failures. The students meet this by scoring an average of 86.5% on the summative assessment with the lowest score being an 80%. I may look for another way for students to use technology to teach others about this lesson next time. An example would be having the students creating a PowerPoint presentation or using Inspiration to make a graphic organizer for extra credit. Then I could print and display around the classroom so that other students can have a great visual to remember the Pythagorean Theorem and see work done by other students.

Low Tech Modification

If the internet, computer, or projector is down then I will have to scrap the digital story and I instead draw pictures on the board to show examples of the Pythagorean Theorem, such as drawing a ship to demonstrate real world applications. This will take more time but the teacher will still be able to execute the lesson. If the audio file is not accessible, I will play it from my phone. If that fails, I will explain the key points of the audio file to my students, such as Pythagoras allowing women into his secret math club and meeting in caves to discover mathematics. If the students cannot access [khanacademy.org](https://www.khanacademy.org) for the exit ticket, then the teacher will have the students take the exit ticket from the module instead. Worst case scenario (printer failure), I will write the questions on the whiteboard and students copy them to a blank piece of paper.

Name _____ Date _____
DO NOW

Directions: Answer the following questions. In needed, round to the nearest tenth.

1. What is the square root of 81?
2. What is the square root of 129?
3. What is the square root of 346?
4. What is the square root of 125? What is the square root of 125 in simplest form?
5. What is the square root of c^2 ?
6. How can you tell which side of a right triangle is the hypotenuse?