

Math, Science, Columns!

Title: Math, Science, Columns!

Descriptive Subtitle: The Math and Science Behind the Architecture of the Columns of Monticello.

Grade Level: High School (9-12)

Author Information:

Name: Lee Pruett & Beverly Heigre

Email: lpruett@ndsj.org & bheigre@ndsj.org

School: Notre Dame High School

School Address: 596 S. 2nd Street

City: San Jose

State: CA

Duration: 0-30 minutes

TRIGONOMETRY

Overview:

For this exercise, we will focus on several mathematical and scientific properties of the doric order columns that adorn the porticos at Monticello. This is a two part activity for two subjects. One part will be given to the AP Environmental Science class and one part will be given to the math class during the Right Triangle Trigonometry Unit. These lessons can be done in just the math class, just the AP Environmental Science class, or given to both classes.

Prior Knowledge

Math

Evaluate the trigonometric functions using SOHCAHTOA
Evaluate an equation by plugging in given values for variables
Perform unit conversions (using dimensional analysis or alternative method)

Objectives

Math

Students will understand how to apply the trigonometric functions to solve a multi-step problem related to architecture.

Students will be able to use SOHCAHTOA to find a height of an object (a column), use dimensional analysis to convert units and manipulate a formula calculate the mass of an object (the column).

Students will know how to solve multi-step problems.

AP ENVIRONMENTAL SCIENCE

Science

Basic geologic principles, such as:
–The distinction between a rock and mineral, –Weathering processes (chemical and mechanical).

Science

Students will understand that the use of natural resources is deliberate and often based on the chemical properties of the materials.

Students will be able to describe the Goldich stability series and Moh's scale of hardness, and identify the position of quartz on both.

Students will know how to read and interpret common stability and hardness scales and give examples of materials on each.

Steps:

1. Ask a question to assess prior knowledge: “What is your house made out of?”; “Have you ever seen a column?”; “What is density?”; “If you are building a house, does the density of a material factor into your decisions? Why or why not?”
2. Divide class into groups of 3-4.
3. Hand out both or either of the copies of the Math and Science handouts. Allow students to work on the worksheet for approximately 20 min.
4. Review student responses and provide correct answers to problems.

Materials: Copies of worksheets, scientific calculator

Assessments: Formative

Assessment Criteria:

This content can be incorporated into a larger unit test or project for trigonometry, geology, or environmental science. It falls within the AP environmental science unit on earth systems and resources, and within a unit on rocks and minerals in a geology course. It falls within the Right Triangle Trigonometry unit of a math class (Trigonometry, Geometry, Alg2/Trig, etc).

Accommodations:

For students that have not had experience with dimensional analysis, the units given in the math section can be converted right from the start to centimeters.

For students that have not yet had density lessons, you can omit question 3 of the math section.

For classes with an ELL population, mix groups to have a balance of native English speakers in each group.