What Can You See From Up There? Determining Visibility From The Top of Tall Structures

Students learn how a formula can give you geographic information and a better appreciation of some world famous landmarks.

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Grade Level	6-7
Duration	2-3 class periods

National Geography Standards	Arizona Geography Strand	Other Arizona Standards
ELEMENT TWO PLACES AND REGIONS **6.** How culture and experience influence people's perceptions of places and regions.	**Concept 1: The World in Spatial Terms** **Grades 6 and 7** **PO 1.** Construct maps, charts, and graphs to display geographic information. **CONCEPT 2** **Places and Regions** **Grade 6** PO 1 Identify regions studied using a variety of criteria (e.g., climate, landforms, culture, vegetation). **Grade 7** PO 1 Describe the human and physical characteristics of places and regions.	**Mathematics Common Core Standards** **The Number System** 6.NS.3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. 7.NS.3. Solve real-world and mathematical problems involving the four operations with rational numbers. (Computations with rational numbers extend the rules for manipulating fractions to complex fractions.) **Expressions and Equations (EE)** 6.EE.2. Write, read, and evaluate expressions in which letters stand for numbers. ***c.*** Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). 6.EE.6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

Overview

This lesson provides an opportunity to explore some well-known landmarks using height and an algebraic formula.

Purpose

Students will learn about well-known cultural landmarks, their locations, and their dimensions. Using the height (which will be referred to as altitude for this lesson) students will calculate the distance they would be able to see from that height under pristine atmospheric conditions. Students will practice working with a

mathematical formula, find square roots (or use a square root retrieval), and multiply while also learning the locations of some world landmarks and their locations on a map.

Materials

- Handout #1 World Structure Data Sheet
- Handout #1 World Structure Data Sheet answer key
- Handout #2 Square Root Retrieval
- Atlases
- Almanacs or other resources to provide information on the landmarks (optional)
- Math Assessment
- Math Assessment Answer Key
- World map

Objectives

The student will be able to:

1. Find the square root (or its nearest number) of a given numeral, or retrieve the approximate square root from the chart.

2. Calculate the visibility from the top of the landmark using the formula to determine the distance in miles.

3. Use an almanac or other source to determine the location on a map of a given cultural landmark and then mark that location.

Procedures

Note: The formula provided is for places above sea level and to a certain altitude. It has a range of validity. This lesson is meant to introduce students to cultural landmarks and to practice working with a formula. The square root chart is available for those students who have not yet been introduced to determining square roots.

1. Discuss what a landmark is (a human or physical feature that is known by many people). Have the students generate a list of landmarks. Write these on the board.

2. Have the students compare their class list to the ones on Handout #1. Give the students a world map and have them use their textbook or an almanac to locate the 7 countries/cities where the landmarks mentioned on Handout #1 would be found. Students will then label the cities/countries and create a key to indicate the locations of the landmarks.

3. Use Handout #1 or an almanac or other resource to determine the height of the landmark.

4. Use the formula **$V=1.22 \times \sqrt{A}$** (V = Visibility; A = feet above ground) with the height in feet to figure out the distance in miles one would be able to see under pristine conditions. Model a fictional example for the students. “The roller coaster at the fair is 100 feet above ground. How far could you see from the top of the roller coaster?” Visibility would equal 1.22 times the square root of 100, so visibility equals 1.22 times 10, with an answer of 12.2 miles

5. Give the students time to complete Handout #1 with visibility statistics.

Assessment

Geography: Students should locate by city or country the landmarks listed on Handout #1 on the world map. Mastery is considered 80% or higher.

Math: Students should solve problems on the math assessment with 80% accuracy.

Extensions

Students may use resource books to find information on other well-known cultural

landmarks, mark their location on a map, and determine the visibility from the top of each.

Students could research the height of a tall building in their neighborhood or city, calculate the visibility, then visit the building and check to see if they can actually see that far. The students would identify buildings, parks, etc. that they could see clearly, and then calculate the distance.

The book, *Ben's Dream* by Chris Van Allsburg, presents several world landmarks and could be used as an introduction to this lesson.