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
6-8

Duration
2-3 class periods

National Geography Standards

ELEMENT TWO PLACES AND REGIONS
6. How culture and experience influence people's perceptions of places and regions.

Arizona Geography Strand 4

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.
GRADE 8
PO 1 Identify common characteristics of contemporary and historical regions on the basis of climate, landforms, ecosystems and culture.

Arizona Math Standard

STRAND 1 Number and Operations
CONCEPT 2 Numerical Operations
GRADE 8
PO 5 Simplify numerical expressions using the order of operations that include grouping symbols, square roots, cube roots, absolute values, and positive exponents.

STRAND 3 Patterns, Algebra, and Functions
CONCEPT 3 Algebraic Representations
GRADE 6
PO 1 Use an algebraic expression to represent a quantity in a given context.
PO 3 Translate both ways between a verbal description and an algebraic expression or equation.
GRADE 7
PO 1 Write a single variable algebraic expression or one-step equation given a contextual situation.
PO 2 Evaluate an expression containing one or two variables by substituting numbers for the variables.
GRADE 8
PO 1 Write or identify algebraic expressions, equations, or inequalities that represent a situation.
PO 2 Evaluate an expression containing variables by substituting rational numbers for the variables.
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 #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.
What Can You See From Up There?

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.