Math in Ancient Civilizations

Submitted by: Judy Kraus, Math/Social Studies
Hyde Park Middle School Academy of Science and Mathematics
Las Vegas, Nevada

Target Grade: 6th to 8th Grade

Time Required: 70 minutes

Standards:

- Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. [7GA1]

Lesson Objectives:

Students will:

- Identify an Ancient Greek structure and its real world dimensions.
- Identify an appropriate scale factor to build an Ancient Greek structure.
- Calculate all dimensions for the model based on the scale factor.

Central Focus:

Students will create their own blue print after researching dimensions of Ancient Greek structures. They will be drawing geometric figures and creating a scale for those figures.

Background Information:

Students should have some knowledge on Ancient Greek history; they will be using structures from Ancient Greek to complete tasks and a project.

Materials

- Unit directions (see below Ancient Civilizations Solid Figure Project)
- Computer with internet access
- Research Information
- Computers or iPads for each student to research on
- Projector
- Exit Ticket (Use in closure, see below)

- Assessment Rubric (see below)

Instruction

Introduction (10 - 15 minutes)
Ask students to share what they know about Ancient Greece. (If using this as an interdisciplinary unit, ideally the English and Language Arts teacher has introduced the culture, history, and mythology that are core.) Focus the discussion on the architecture found in Ancient Greece, as well as the tools and artwork. Project the overview of the architecture found at: https://www.history.com/topics/ancient-history/ancient-greece
Ask students to note structural features and measurements of these structures.
What structures were illustrated in the video? What dimensions were noted? Are all of the structures standing today?

Teacher Led Instruction (15 minutes)
Explain to students that they will be working in groups of 2-4 to incorporate their knowledge of scale factor, surface area, and volume. They will create a blueprint and then build an Ancient Greek structure. (See attached directions, Ancient Civilizations Solid Figure Project below.)

Today you will begin by selecting a structure and deciding on a scale factor for your construction. Return to the video if needed to find the dimensions of the Parthenon (228 ft x 101 ft). Obviously, this is not possible to recreate on your desktop! What would be a reasonable scale? Record responses on the board and compute new measurements by modeling how to compute the new scale.

Example: If 1 ft = 1 inch, then 228 ft = 228 inches. Will that fit on top of your desk?

Encourage the use of metric units and discuss the benefits of constructing with base 10 units.

Example: If 1 ft = .25 cm, then 228 ft = 57 cm. Will that fit on top of your desk? How do you write the scale factor?

In the video, the Parthenon's dimensions were 228 ft X 101 ft. What is missing? How will you find the height? What will you do if you are not able to locate the number? Return to the video at the 2:20 mark and measure the height of the Parthenon (P) on the screen. Model the use of ratios to solve for the missing height. Discuss the interpolation of data and some of the error that may occur with this method. Students should be encouraged to research measurements and use this method as a last resort.

Example: 57 = X 228 P

Student Research (20 - 30 minutes)
Students will break into groups and research a structure. Once a structure is selected, they need to find all of the dimensions and decide on an appropriate scale factor. Compute the dimensions at which your group will build the structure.

Closure (5-10 minutes)
Discuss the progress and problems groups may be having. What Ancient Greek structure did you choose? What scale factor have you chosen? How did you calculate the dimensions for all parts of the structure? Did your group work well? Tomorrow, your group will begin the blueprint for your structure. Complete your exit ticket and have it ready to hand in as you leave the room.

Differentiation

- Student groups may be pre-selected by the teacher, or students may self-select depending on the class population. If there are special needs in the classroom, the teacher should structure groups based on this information.
- Time may be extended for computation of new dimensions. The skill level of the class as well as the individual should be considered. Groups may work on lessons at their own pace with the teacher-providing mini-lesson review throughout the unit as needed. For example, interpolating measurements using ratios may need to be reviewed with an individual or group.
- Each student is responsible for identifying three different solids in the structure, drawing that part in the blueprint, and constructing those parts. Collaboration is integral and the group should help all members. Ancient Greek tools and amphora's may be suggested to students having difficulty with large scale structures. These figures will meet the standards, but make the project more attainable.
- Google translate and speech to text is available online and may be utilized for ELL or special needs students.
- In the next lesson students may choose to hand-draw a blueprint using isometric dot paper or use computer based programs like Tinkercad or Sketchup.

Assessment

- *Ancient Civilizations Solid Figure Project* (Summative): Initially students must identify an Ancient Greek structure and its dimensions. They must decide on an appropriate scale factor and calculate new dimensions in order to create a blueprint
- *Exit Ticket* (Formative): The exit ticket if for the teacher to understand how much work was completed on their Solid Figure Projects in the groups.

Ancient Civilizations Solid Figure Project

In this project you will solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. [7GA1] You will solve real-world and mathematical problems involving area, surface area, and volume. [6G, 7G,8G]

Design a blueprint for an architectural accomplishment in Ancient Greece.

- You must incorporate three different solids.
- Sketch it using Sketchup, Tinkercad (or other program) or hand drawn using isometric dot paper.
- Include the scale factor and dimensions on the drawing.

Create a solid figure representing this architectural accomplishment in Ancient Greece.

- You must build three different solids into your design.

Create a placard for your architectural design. (Use provided template.)

- Include: name, location, dimensions of actual structure

Create a brochure. This is for ELA grade. (Use provided template.)

Write a mathematical report that includes:

- The surface area of each solid used to construct your building and the surface area of the final structure. Include an explanation of ALL calculations.
- The volume of each solid used to construct your building and the volume of the final structure. Include an explanation of ALL calculations.

Solid Figure Assessment Rubric

_____/20 Blueprint with scale factor and dimensions labeled

_____/20 Solid figure constructed with 3 different solids

_____/10 Placard with name, location, and dimensions

_____/50 Report with ALL solid figure volume and surface area calculations

_____/100 Total

Exit Ticket

NAME _____ GROUP GREEK STRUCTURE_____

1. WHAT DID YOUR GROUP ACCOMPLISH TODAY?

   _____

   _____

   _____

2. ON A SCALE OF ONE TO FIVE, WITH FIVE BEING THE BEST, HOW WELL DID YOU WORK WITH MEMBERS OF YOUR GROUP? EXPLAIN.

   _____

   _____

3. WHAT ARE YOU ARE WONDERING?

   _____

Exit Ticket

NAME _____ GROUP GREEK STRUCTURE_____

1. WHAT DID YOUR GROUP ACCOMPLISH TODAY?

   _____

   _____

   _____

2. ON A SCALE OF ONE TO FIVE, WITH FIVE BEING THE BEST, HOW WELL DID YOU WORK WITH MEMBERS OF YOUR GROUP? EXPLAIN.

   _____

   _____

3. WHAT ARE YOU ARE WONDERING?

   _____

Blue Print Rubric:

Did the students select an Ancient Greek structure? Did they find the dimensions for the original structure, or were they able to interpolate missing dimensions?

Identified Ancient Greek Structure	___/4
Identified original dimensions	___/6
Identified scale factor	___/4
Identified new dimensions	___/6
Total Points	___/20