WAMC Lab Template

Math Concept(s): Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Model with mathematics. Look for and make use of structure.

Source / Text: Cord Algebra 1

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Attach the following documents:

- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

Short Description (Be sure to include where in your instruction this lab takes place):

This lab will take place before the Quadratics exploration. The students will design a drinking fountain, focusing on the size of the catch basin, using the arch of the water to determine the size.

Lab Plan

Lab Title: The Drinking Fountain

Prerequisite skills: having drank out of a water fountain, measuring ability, use of a calculator

Lab objective: Through the lab the students will develop real world skills using the quadratic equation.

Standards: *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*

Mathematics K–12 Learning Standards:

- A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Standards for Mathematical Practice:

- Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Model with mathematics. Look for and make use of structure.

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- Determine a central idea of a text and analyze its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.

K-12 Science Standards

- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.

Technology

- Gain competency in using calculators for real world situations

Engineering

- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☐ Global Awareness x☐ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy
☐ Health/Safety Literacy ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION
Creativity and Innovation
x☐ Think Creatively
x☐ Work Creatively with Others
☐ Implement Innovations
Critical Thinking and Problem Solving
x☐ Reason Effectively
x☐ Use Systems Thinking
☐ Make Judgments and Decisions
x☐ Solve Problems
Communication and Collaboration
x☐ Communicate Clearly
x☐ Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS
Information Literacy
x☐ Access and Evaluate Information
☐ Use and manage Information
Media Literacy
☐ Analyze Media
☐ Create Media Products
Information, Communications and Technology (ICT Literacy)
x☐ Apply Technology Effectively

LIFE & CAREER SKILLS
Flexibility and Adaptability
x☐ Adapt to Change
x☐ Be Flexible
Initiative and Self-Direction
x☐ Manage Goals and Time
☐ Work Independently
☐ Be Self-Directed Learners
Social and Cross-Cultural
x☐ Interact Effectively with Others
x☐ Work Effectively in Diverse Teams

Productivity and Accountability
x☐ Manage Projects
☐ Produce Results
Leadership and Responsibility
x☐ Guide and Lead Others
☐ Be Responsible to Others

Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Graph paper, masking tape, and calculators

Set-Up Required:

- Discuss different types of drinking fountains. Make sketches, marking where the vertex might be, where the water might land in uninterrupted.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

Students will be assigned positions of responsibility on rotation every 3 weeks. These positions are:

- Group Facilitator- in charge of keeping the group on task, coordinating group responsibilities.
- Resource manager- in charge of collecting and returning materials
- Project manager- in charge of making sure all projects are completed and turned in on time
- Scribe- in charge of writing down solutions, explanations, and questions from the group

Cooperative Learning:

- Students will have to work together to measure, plot, graph, and develop equations. They will have to listen to each other's' ideas and plans.

Expectations:

- Students are expected to work together respectfully, ensure all group members understand each step, and clean up after they are finished.

Timeline:

- 10 minutes to review lab expectations, and explain what the students are doing
- 30 minutes to do the work for the pretend fountain
- 10 minutes to do the real fountain
- 10 minutes for discussion.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- How could this lab be used in the real world?

Career Applications

- What kinds of jobs might use a similar process?

Optional or Extension Activities

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Lab instructions:

Each group is responsible to design a drinking foundation. We will use masking tape to mark where your fountain starts, where the vertex of the arch of water is, and where you predict the water to reach the basin if unbroken by a person drinking water.

Then you sketch a diagram of your drinking fountain on graph paper. Use your graph to write an equation for the arch of water. Use this information to determine how big your basin needs to be.

Student Handout:

Have one member of your group stand next to a counter and act like they are taking a drink of water from a drinking fountain. Have another group member use masking tape to mark the faucet location and where the water will fall if uninterrupted. Measure the vertex of the arch of water too.

Now graph your fountain and water. (Hint: make the countertop your x-axis.)

Use the data points to write an equation for the parabola of your water arch. (Hint: use (0, 0) as the start of your arch.)

Use a graphing calculator to check your equation.

Determine the minimum width of the basin of your “pretend” fountain.

At an actual drinking fountain turn on the fountain and measure the actual height of the vertex. Measure the width of the basin.

How does the actual fountain compare to your fountain? (Explain the height and width differences)

Rubric and/or Assessment Tool

Assessment will include the completion of the lab, with explanations for their conclusions.