WAMC Lab Template

Math Concept(s): Graphing quadratic functions

Source / Text:

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Date: 6/21/22

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):

Lab Plan

Lab Title: Projectile motion graphs

Prerequisite skills: graphing points

Lab objective: Students will use projectile launchers and their phones to plot graphs of projectile height vs time. Students will launch at different angles (25, 35, 45, and 55) and be able to describe how this change affects the intercepts and maximum of the graph.

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

Mathematics K–12 Learning Standards:

- CCSS.MATH.CONTENT.HSF.IF.C.7.A Graph linear and quadratic functions and show intercepts, maxima, and minima

Standards for Mathematical Practice:

- MP4 Model with mathematics
- MP5 Use appropriate tools strategically
- MP6 Attend to precision

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

- CCSS.ELA-LITERACY.SL.9-10-4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task

K-12 Science Standards

- HS-PS2-1

Technology

-

Engineering

-

Leadership/21st Century Skills:

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

☐ Global Awareness ☐ 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
☐ Think Creatively
X Work Creatively with Others
☐ Implement Innovations

Critical Thinking and Problem Solving
☐ Reason Effectively
☐ Use Systems Thinking
X Make Judgments and Decisions
☐ Solve Problems

Communication and Collaboration
☐ Communicate Clearly
X Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy
☐ 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
☐ Adapt to Change
☐ Be Flexible

Initiative and Self-Direction
☐ Manage Goals and Time
☐ Work Independently
☐ Be Self-Directed Learners

Social and Cross-Cultural
☐ Interact Effectively with Others
☐ Work Effectively in Diverse Teams

Productivity and Accountability
☐ Manage Projects
X Produce Results

Leadership and Responsibility
☐ Guide and Lead Others
☐ Be Responsible to Others

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

Materials

- projectile launchers (1 per pair)
- phone for recording launch (1 per pair)
- graph paper
- yard stick & painter's tape (1 per pair)

Set-Up Required:

- Students will need a backdrop where they can measure the height of the projectile as it moves through the air. If a brick or tiled wall is available this could allow students to easily keep track of projectile height. Alternatively, students could mark off regular height intervals (s.a. every 4'') on the wall with tape and use this to estimate the projectile's height.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

-

Cooperative Learning:

- Students will be working in pairs, with one student in charge of launching the projectile, and the other student responsible for using their recording device to gather and record data.

Expectations:

- Students will collect relevant data, plot it, and use it to draw conclusions.

Timeline:

- This lab is expected to take about 50 minutes to gather data, and another 25 minutes to record data and write observations about maxima and intercepts.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- gathering and organizing data
- making observations and conclusions based on data

Career Applications

- aerospace, military, data analysis

Optional or Extension Activities

- Other activities could involve recording and plotting horizontal distances, and calculating vector quantities for horizontal and vertical velocity.

Student Data Collection Table

	25° Launch	35° Launch	45° Launch	55° Launch
Time (sec)	Distance (inch)	Distance (inch)	Distance (inch)	Distance (inch)
0				
0.25				
0.50				
0.75				
1.00				
1.25				
1.50				
1.75				
2.00				
2.25				
2.50				
2.75				
3.00				

WAMC Lesson Plan

Name(s): Andrew Goodwin
Email Address: andrew.goodwin@oceanbeachschools.org
Lesson Title: Characteristics of Quadratics
Date: 6/21/22
Text: STEM Correlation: Projectile motion Lesson Length: 50m

Big Idea (Cluster): Analyze functions using different representations	
Mathematics K–12 Learning Standards: HSF.IF.C.7.A	
Mathematical Practice(s): MP4, MP5	
Content Objectives: Students will be able to identify different parts of a parabola, including the x-intercept(s), y-intercept, and minimum or maximum	Language Objectives (ELL): Most students will be able to identify at least 6 of 7 vocab words correctly
Vocabulary: x-axis y-axis x-intercept y-intercept parabola minimum maximum	Connections to Prior Learning identifying intercepts identifying type of relationship from graph
Questions to Develop Mathematical Thinking: ● Is there a part of the graphs you could ask about that would confirm or eliminate multiple graphs? ● Is there a mathematical term for the part of the graph that you're trying to ask about? ● Is there anything unique about any of the graphs that you could ask about?	Common Misconceptions: ● mixing up x- & y-axis ● writing a point's coordinates in the wrong order

Assessment (Formative and Summative):

- Formative: observations as students play first part of game, answers student submit on second part of activity
- Summative: test at end of unit

Materials:

- chromebooks
- internet access
- Polygraph Parabolas part 1: https://teacher.desmos.com/activitybuilder/custom/601863234c0a233b7c229276?collections=featured-collections,5da649da5a46437eff2441d0
- Polygraph Parabolas part 2: https://teacher.desmos.com/activitybuilder/custom/574f12421390db611564fa32?collections=featured-collections,5da649da5a46437eff2441d0

Instruction Plan:

Introduction:

When students come into class, they will log into their chromebooks. On the board will be the student code for the first activity, Polygraph Parabolas part 1. This game will pair up students. Student A will see a display of several graphs, and Student B will be given one particular graph. Student A can ask yes/no questions to try to determine which graph Student B has. After completing a game, students will be paired with a new student to play again. Let students play several rounds of this game for about 15 minutes.

Explore:

After students have played the polygraph game, come back as a class and have a group discussion, asking students what questions were more helpful, versus what kinds of questions were less helpful. Look for students mentioning ideas that match the concept of intercepts, and minima/maxima.

Once students have had a chance to discuss their thoughts, have them move on to the Part 2 activity. This part of the activity will introduce the vocabulary for quadratics, including vertex, concavity, and x-intercepts.

Note: part 2 does not use the terms minimum or maximum, so you will want to introduce these to your class at some point. You could also make a copy of the activity and add your own pages to it to include those topics if you are familiar enough with desmos.

When I observe students:

Students should be asking their partners questions that concern the graphs in order to narrow down which graph they were given. They should be trying to use mathematical terminology to do this. Students do not necessarily need to use exact terms to begin with, but the wording they use should be clear enough for their partners to be able to understand what aspect of the graph they are asking about.

Questions to Develop Mathematical Thinking as you observe:

1) Is there a part of the graphs you could ask about that would confirm or eliminate multiple graphs?
2) Is there a mathematical term for the part of the graph that you're trying to ask about?
3) Is there anything unique about any of the graphs that you could ask about?

Answers:

1) Answers could include x- and y-intercepts, min/max, direction of concavity
2) Answers could include x- and y-intercepts, min/max, direction of concavity
3) Answers could include x- and y-intercepts, min/max, direction of concavity

Summarize: Students will complete a matching activity to develop their knowledge of graphs of quadratic functions. This activity will be followed by a discussion about what questions

students found effective. Then students will complete the second part of the activity which will introduce students to specific vocabulary terms about quadratics.

Career Application(s):

- projectile motion in Aerospace, tracking movements of objects

Leadership/21st Century Skills:

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

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