WAMC Lab Template

Math Concept(s): Using a point and vertex to create a quadratic
Source / Text: Big Ideas Algebra 2
Developed by: Trevor Roberts E-Mail: troberts@cpps.org
Date: 6/21/2022

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: creating an equation of a quadratic using a vertex and point

Prerequisite skills: Understanding of the characteristics of a quadratic function such as vertex and the equation of a quadratic

Lab objective: Students will be able to create an equation of a quadratic with the use of its vertex and a point on the graph

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

Mathematics K–12 Learning Standards:

- CCSS.MATH.CONTENT.HSF.IF.B.4
- CCSS.MATH.CONTENT.HSF.LE.A.1.B

Standards for Mathematical Practice:

- For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

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

- CCSS.ELA-LITERACY.RST.11-12.9
  Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

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
- ☒ Work Creatively with Others
- ☐ Implement Innovations

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

Communication and Collaboration
- ☐ Communicate Clearly
- ☐ 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)
- ☐ 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
- ☐ 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

- Tape Measure
- Calculator
- Pencil Paper
- Grid of Drinking Fountains found in school and table to insert data for each drinking fountain
    - Data to include is:
        - vertex of water flow,
        - landing point of water in basin or ground

Set-Up Required: Hand out Grid of drinking fountains

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- N/A

Cooperative Learning:

- Students will work in groups of two with one student pushing the button to activate the drinking fountain and the second student measuring the vertex and landing point of the water flow

Expectations:

- Students are to work quietly and independently in their groups while traveling within the school to the drinking fountains

Timeline:

- This lab is expected to take an hour. About ten minutes per drinking fountain found in the school for the collection of the data and the creation of the quadratic

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- What is causing each drinking fountain to have different equations even though each drinking fountain is the same make and model

Career Applications

- Data collection and quality control services/upkeep services

Optional or Extension Activities

- The students can reflect on the equation of the drinking fountains and see if there is any correlation between preferred drinking fountains of the school and the equation of the drinking fountains

Lab Data Sheet:

Drinking Fountain Lab Data Sheet			
Use spout as the (0,0) point of your graph. Use inches for units. (Basin may be in the negatives/below the waterspout)			
Drinking Fountain # and Location	Vertex of Quadratic	Point on Quadratic	Equation of Quadratic
Fountain #1 Cafeteria			
Fountain #2 Main Office			
Fountain #3 Hawks gym			
Fountain #4 Sager Gym			
Fountain #5 Upstairs			
Fountain #6 Breezeway			
Fountain #7 Academic Loop			

Lab Instructions:

1. Get into groups of two
2. Make sure to bring a pencil, graphing calculator, measuring tape/stick
3. Within the 50 minutes of allocated time, travel to each of the seven drinking fountains located within our school
4. At each drinking fountain, use the waterspout of the drinking fountain to be the (0,0) point of your quadrant plane. Choose the units that best works for your fountain. Make sure to state which unit you use for each fountain
5. Start the drinking fountain and measure how far the vertex of the water arc is from the waterspout
6. Measure out how the water lands away from the spout and record the point it lands (the y-value may be a negative if it lands below the spout)
7. For each drinking fountain, use the vertex and point found to create the quadratic equation for the water flow
8. Repeat for all seven drinking fountains in the school:

Drinking Fountain Lab Data Sheet			
Use spout as the (0,0) point of your graph. State your units for each fountain. (Basin may be in the negatives/below the waterspout)			
Drinking Fountain # and Location	Vertex of Quadratic (h ,k)	Point on Quadratic (x ,y)	Equation of Quadratic $y = a(x-h)^2 + k$
Fountain #1 Cafeteria			
Fountain #2 Main Office			
Fountain #3 Hawks gym			
Fountain #4 Sager Gym			
Fountain #5 Upstairs			
Fountain #6 Breezeway			
Fountain #7 Academic Loop			

RUBRIC				
Criteria:	1	2	3	4
Accurate Data:	Data is not collected	Data is recorded but inaccurate/outside range of error	Data is recorded but is sometimes inaccurate/outside range of believable error	Data is recorded but is inside range of error
Correct Equation for quadratics	No equation is created	Equations are created but based on data points is inaccurate	Equations are created and mostly accurate based off data points but not all accurate	Equations are created and accurate
Amount of Water fountains completed	0-1 completed	2-3 completed	4-6 completed	7 completed

Lab Instructions:

9. Get into groups of two
10. Make sure to bring a pencil, graphing calculator, measuring tape/stick and data collection handout
11. Within the 50 minutes of allocated time, travel to each of the seven drinking fountains located within our school
12. At each drinking fountain, use the waterspout of the drinking fountain to be the (0,0) point of your quadrant plane USE INCHES FOR YOUR UNIT OF MEASUREMENT
13. Start the drinking fountain and measure how far the vertex of the water arc is from the waterspout
14. Measure out how the water lands away from the spout and record the point it lands (the y-value may be a negative if it lands below the spout)
15. For each drinking fountain, use the vertex and point found to create the quadratic equation for the water flow
16. Repeat for all seven drinking fountains in the school:

Lesson Plan

Name(s): Trevor Roberts
Email Address: troberts@cpps.org
Lesson Title: Modeling with Quadratics with Vertex Form and Intercept Form
Date: 6/21/2022
Text: Big Ideas Algebra 2 STEM Correlation:
Lesson Length: 30 Minutes

Big Idea (Cluster): Quadratic Functions (Modeling with quadratics and vertex form/intercept forms)	
Mathematics K–12 Learning Standards: • CCSS.MATH.CONTENT.HSF.IF.B.4 • CCSS.MATH.CONTENT.HSF.LE.A.1.B	
Mathematical Practice(s): CCSS.MATH.PRACTICE.MP4 Model with mathematics.	
Content Objectives: Students will be able to create an equation of a parabola using the vertex and a point on the on a parabola	Language Objectives (ELL): Students will be able to analyze data points collected and make a conclusion based on the data found
Vocabulary: Vertex Vertex Form Intercept Form Axis of Symmetry Zeros of a quadratic	Connections to Prior Learning Students will connect the lesson to prior learning using quadratic equations and knowledge of how to find a vertex of a quadratic and findings points on a graph
Questions to Develop Mathematical Thinking: • What are the real life factors that are manipulating the equation of the quadratic equations found at each drinking fountain? How does each one effect the equation? (Vertical/Horizontal Stretch/shrink)	Common Misconceptions: • Misusing quadratic equations. Using intercept form instead of the vertex form for the quadratic equation

Assessment (Formative and Summative):

- Summative: Turn in homework of Quadratic Modeling that is made via Big Ideas Algebra 2 Textbook
    - The Summative will contain 12 questions from the Algebra 2 Big Ideas Textbook from section 2.4: Modeling with Quadratics
- Formative: Entry Task discussion, Exit Ticket Reflection

Use the scale to rate your understanding of the learning target and the success criteria.

1 I do not understand. 2 I can do it with help. 3 I can do it on my own. 4 I can teach someone else.

	Rating	Date
2.4 Modeling with Quadratic Functions		
Learning Target: Write equations of quadratic functions using given characteristics.	1 2 3 4	
I can write equations of quadratic functions using vertices, points, and x-intercepts.	1 2 3 4	
I can write quadratic equations to model data sets.	1 2 3 4	
I can use technology to find a quadratic model for a set of data.	1 2 3 4	

Materials:

- Pencil, Paper, graphing calculator, graphing paper, Lesson Worksheet, and Exit Ticket

Instruction Plan:

Introduction:
When students enter the classroom, have them discuss with their table partners how to find the vertex of a quadratic and how to find the axis of symmetry, and the zeros of the quadratic (if possible)
Give the students five minutes to discuss with their table partner and then as a class discuss with the class their findings

Explore:
The class will go over different modeling scenarios where different information is given regarding the quadratic model. Students and the class will go over the situations and scenarios when one would use vertex form to create the quadratic equation and when one would use intercept form.

When I observe students: When I observe students, the students should be able to analyze the model given and apply the correct formula to create the quadratic equation associated with the model.

Questions to Develop Mathematical Thinking as you observe:

- What formula might apply to this problem? Vertex form or intercept form?
- What equation matches the graph or diagram provided?
- When in your life might this modeling apply to you?

Answers:

- Vertex form/Intercept Form
- Answers may very
- Answers may very
    - Examples may be:
        - Launch trajectory of a baseball/basketball
        - Projectile Motion
        - Correlation of height in the air versus distance traveled

Summarize: In Summary, students should be able to model functions of quadratics using both the vertex form and intercept form based on the data provided to them

Career Application(s):

- Modeling data trends
- Creating models to track data points

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