



MISSISSIPPI

EXEMPLAR

Units & Lessons

MATHEMATICS

Algebra I

Grant funded by:



Lesson 4: The Graph Tells It All

Focus Standard(s): A-APR.3, F-IF.4, F-IF.7a

Additional Standard(s): F-IF.5, F-IF.9

Standards for Mathematical Practice: SMP.1, SMP.2, SMP.3, SMP.4, SMP. 6

Estimated Time: 60 minutes – 180 minutes

Resources and Materials:

- “Entrance Tickets” (given out during the previous day’s lesson)
- Cardstock
- Colored pencils or highlighters
- Scissors
- Questions 4 Quadratics (Q4Q) and Answers 4 Quadratics (A4Q) Wall
- Handout 4.1: The Graph Tells It All
- Handout 4.2: Choose A Side

Lesson Target:

- Students will write the equation for a quadratic function given only the graph.

Guiding Question(s):

- What is the most important information we need to write the function rule for a quadratic function?
- Are there any graphical features that are not used when attempting to write the function rule that models it?






Vocabulary

Academic Vocabulary:

- Factors of Zero Property/Zero Product Property
- Linear Factor
- Maximum/Minimum
- Parabola
- Quadratic Function
- Roots/Solution/X-intercept/Zero
- Standard Form
- Vertex
- y-intercept

Instructional Strategies for Academic Vocabulary:

- Introduce academic vocabulary with student-friendly definitions and pictures
- Model how to use academic vocabulary in discussion
- Discuss the meaning of an academic vocabulary word in a mathematical context
- Justify responses and critique the reasoning of others algebraically, geometrically, and/or technologically using academic vocabulary
- Create pictures/symbols to represent academic vocabulary
- Write or use literacy strategies involving academic vocabulary

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)
	Writing Activity
	Make up a Story
	Mississippi Assessment Program (MAP) Preparation
	ACT Preparation

Instructional Plan

Note: This lesson allows students to explore factorizations that are available as stated in the standard. Teachers should consider following this unit with subsequent lessons on the standards A-REI.4 and F-IF.8.

Understanding Lesson Purpose and Student Outcomes: Students will combine all skills they learned over the past few days to learn how to write the function rule (or symbolic form) for a quadratic function that has been graphed in the Coordinate Plane.

Note: Collect each student's "Entrance Ticket" they were given at the end of each class for homework. Take a few minutes to read each of their responses on the back and provide feedback to the entire class without providing each student's name. Upon completion, place tape on each Ticket and placed it on one of the whiteboards in random order.

Anticipatory Set/Introduction to the Lesson: Story Time



Instruct the students that they are going to make up a quick math story, poem, or rap using the concepts that are printed on the front of each ticket. The story, poem, or rap can be fictional or real. The goal is to use as many tickets as possible to create one cohesive short story, poem, or rap. Encourage students to use their academic vocabulary throughout (SMP.6).

- ✓ To begin, allow one student to take one word off the whiteboard and provide the introduction. S/he writes their introduction on the other whiteboard, taping the Entrance Ticket where it belongs in the story. Another student should come to the whiteboard to retrieve a ticket and add to the story/poem/rap, and write their part immediately behind the previous student's work. They will also tape their entrance ticket where it belongs in the story/poem/rap. This process should continue until each student has had an opportunity to add to the story/poem/rap. The result will be an interactive word wall. Read the final product as a class and allow students to copy the it on notebook paper and discuss as a class.

For students who are EL, have disabilities, or perform well below grade level:

- Allow students to select their own original "Entrance Ticket" back and use it in this activity.

Activity 1: The Graph Tells It All

Display and distribute **Handout 4.1: The Graph Tells It All** to each student and explain that you will go over this handout as a class to ensure precision. Upon completion, ask a student to translate the classes' observations into a "Question" for the Q4Q Wall and instruct another student to translate their observations into an "Answer" for the A4Q Wall.

Note: Be sure student responses include the academic vocabulary (SMP.6).

For students who are EL, have disabilities, or perform well below grade level:

- Allow students to reference any notes they have from the previous day's class as needed.

**Reflection and Closing: All Hands On Deck**

Tell each student to take out a sheet of cardstock and trace their hand. Instruct them to complete the following prompts on each finger as it relates to today's lesson. [Figure 1]

Figure 1.



- ✓ **One** thing I am confident about is _____
- ✓ When writing the function rule for a quadratic I have **to** remember _____
- ✓ Tonight, as I do my homework, I will "**tri**" _____
- ✓ **Before** solving any problem, I _____
- ✓ As I "**thumb** through" my notes, I noticed _____

Upon completion, allow students to stand in a circle as a whole class and read them aloud.

Note: You may consider posting these up in the classroom, hanging them from ceiling, or taping them around the perimeter of the windows/doors.

Homework



Algebra I



Distribute **Handout 4.2: Choose A Side** for homework and encourage students to complete this activity without a calculator (SMP.1-4 and SMP.6).

Handout 4.1: The Graph Tells It All

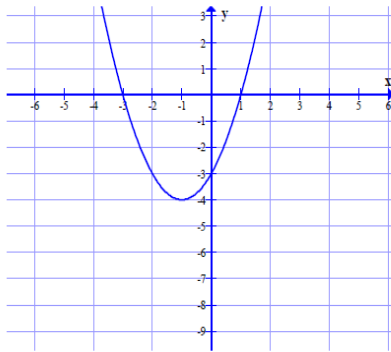
Name _____

Date _____

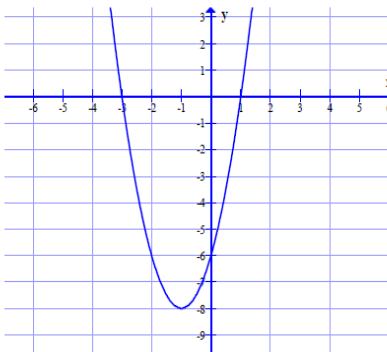
Directions: Complete each item provided without the use of a calculator.

- Let's take a look at the following three graphs of quadratic functions. Identify the functions zeros, linear factors, and vertex in the table below.

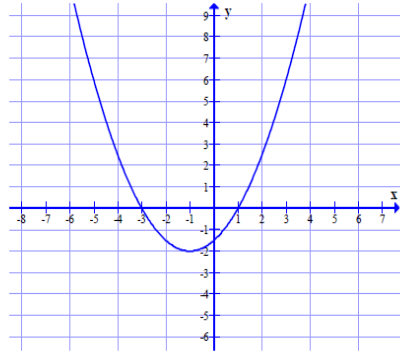
$$y = b(x)$$



$$y = k(x)$$



$$y = r(x)$$



Function	Zeros	Linear Factors	Vertex
$y = b(x)$			
$y = k(x)$			
$y = r(x)$			

- What is similar amongst all three graphs?

- What is different amongst all three graphs?

Handout 4.1: The Graph Tells It All

4. The factored form of a quadratic function is $y = a(x - p)(x - q)$. Using the vertex and the two linear factors that you discovered, find the value of a for $b(x)$, $k(x)$, and $r(x)$.

 $b(x)$ $k(x)$ $r(x)$

5. Using the value of a , write the quadratic equation in factored form for the given graph of each quadratic function.

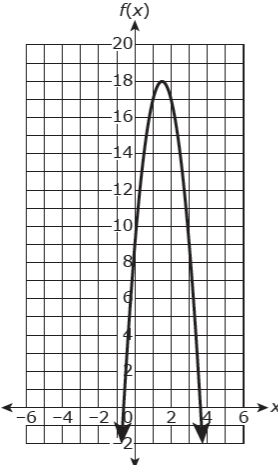
6. Explain the role that the value of “ a ” plays in the factored form of a quadratic function.

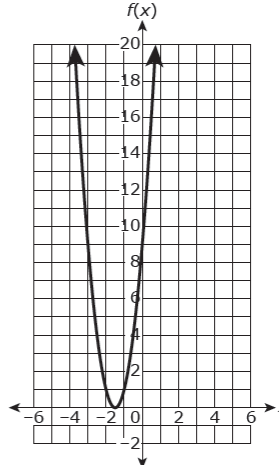
7. What do you think would happen to the graph of $b(x)$ if the value of a is less than zero?

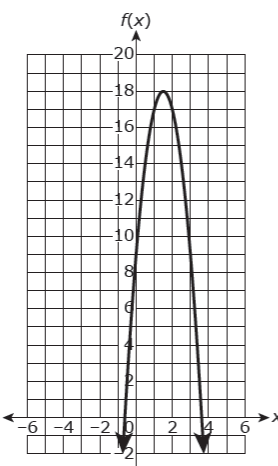
Handout 4.2: Choose a Side

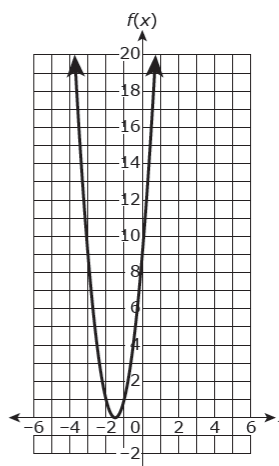
Denise and Edward are having a disagreement. Denise states that she can answer the MAP Assessment problem below without a calculator. Edward states that it is impossible to do without a calculator. Whose side are you on? Justify your response.

Given the polynomial $4x^2 + 12x + 9$, which option correctly identifies a zero and a sketch of the graph of the function defined by the polynomial?

(A) $x = -\frac{3}{2}$, 

(B) $x = -\frac{3}{2}$, 

(C) $x = \frac{3}{2}$, 

(D) $x = \frac{3}{2}$, 

Adapted from the 2016-2017 MAP/Questar Sample Test. Item #57

For training or questions regarding this unit,
please contact:

exemplarunit@mdek12.org