



## Student Instruction Sheet: Unit 3, Lesson 2

### The Parabola Crosses the x-axis and y-axis

Suggested Time: 45 minutes

**What's important in this lesson:**

In this lesson, you will learn how to find out where the parabola crosses the x and y axes. This point is called the y-intercept and zeros of the function.

**Complete the following steps:**

1. Read through the lesson portion of the package on your own.
2. Complete the exercises.
3. Check your answers with the Answer Key that your teacher has.
4. Seek assistance from the teacher as needed.
5. Complete the Assessment and Evaluation and hand it in.

**Hand in the following:**

1. Student Handout
2. Assessment and Evaluation sheet

**Questions for the teacher:**



## Student Handout: Unit 3, Lesson 2

### Vocabulary about the Parabola crossing the y axis and x axis

$$y = ax^2 + q$$

- Vertex is found at  $(0, q)$
- Axis of symmetry is the y-axis (the line  $x = 0$ )

$$y = ax^2 + bx + c$$

- Vertex is **not**  $(0, c)$
- Axis of symmetry is **not** the y-axis

$$y = a(x - p)^2 + q$$

- Vertex is found at  $(p, q)$
- Axis of symmetry is the line  $x = p$

### Zeros of the Relation

The **x-intercepts** of the graph of a function are also called the **zeros of the function**. These are the values of  $x$  when  $y = 0$ .

### Y-Intercept

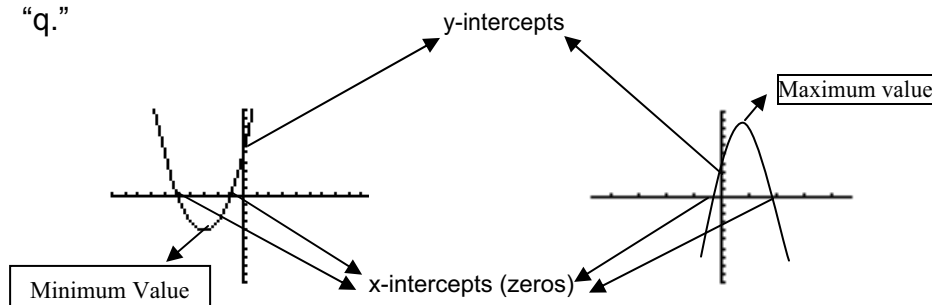
The **y-intercept** is the point we get when we choose  $x = 0$ .

### Maximum Value

The y-coordinate of the vertex represents the **maximum value** of the quadratic relation when the graph opens **down**.

### Minimum Value

The y-coordinate of the vertex represents the **minimum value** of the quadratic relation when the graph opens **up**. The maximum or minimum value is always "q."



In each of the following examples, we will graph the quadratic relations, using a graphing calculator. After graphing each function, we will use a graphing calculator to determine the y-intercepts, the maximum/minimum values, and the zeros of the functions (where possible).



## Student Handout: Unit 3, Lesson 2

### Topic 1: Graphing Calculator Procedures

To find the y-intercept, maximum or minimum value, or the zeros of the function, follow these steps.

#### **For y-Intercept:**

1. Press ZOOM, “6” This resets the window to a fairly normal scale.
2. Press “Y =” and input the left side of the equation as a function for  $Y_1$ .
3. Press GRAPH. If you see a graph, go to Step 4.
4. If you can not see the graph, press ZOOM, “3” then ENTER. This should fix things. If it doesn’t, try again. If it still doesn’t work, talk to your teacher.
5. Press “2<sup>nd</sup>”, TRACE, “1”, and enter the value “0” after the X=, then ENTER.
6. Read the values from the bottom of the screen. The x value will be 0 and the y value indicates where the y-intercept is for that graph.

#### **For maximum or minimum value:**

7. Press “2<sup>nd</sup>”, TRACE, “3” if the graph opens up. If it opens down, go to Step 9.
8. Then press ENTER three times.
9. Again, read the values from the bottom of the screen. The y value represents the minimum value. The x value represents when the minimum value occurs. Go to Step 12.
10. Press “2<sup>nd</sup>”, TRACE, “4” if the graph opens down.
11. Then press ENTER three times.
12. The y value on the screen represents the maximum value in this graph. The x value represents when the maximum value occurs.

#### **For x-intercepts or zeros of the function:**

13. Look at your graph. Does it touch the x-axis? If not, this means there are no zeros of the function and you have finished. If it does touch the x-axis, continue on.
14. Press “2<sup>nd</sup>”, TRACE, “2”. Press the left arrow until the cursor is to the left of the **left-hand side of the x-intercept**. Press the right arrow until the cursor is just right of the **right-hand side of the x-intercept**. Then press ENTER two times.
15. The values at the bottom of the screen will represent one of the zeros of the function. Now we find the other zeros of the function.
16. Press “2<sup>nd</sup>”, TRACE, “2”. Press the left arrow until the cursor is to the left of the **left-hand side of the x-intercept**. Press the right arrow until the cursor is just right of the **right-hand side of the x-intercept**. Then press ENTER twice.
17. The values at the bottom of the screen will represent one of the zeros of the function.



## Student Handout: Unit 3, Lesson 2

### Topic 2: Practice Chart

Use a graphing calculator and the routines from the previous page to fill in the following chart.

Relation	Direction of Opening	y-Intercept	Maximum or Minimum Value	x-Intercept(s)
$y = 2x^2 + 3$				
$y = \frac{1}{2}x^2 + 4$				
$y = x^2 - 3x + 5$				
$y = -2x^2 + 2x + 1$				
$y = \frac{2}{3}(x-1)^2 + 3$				
$y = -3(x+2)^2 - 1$				



### Assessment and Evaluation: Unit 3, Lesson 2

For each of the following quadratic functions, use a graphing calculator to determine y-intercept, the maximum/minimum value, and the zeros of the functions (where possible).

Relation	Direction of Opening	y-Intercept	Maximum or Minimum Value	x-Intercepts	Sketch
$y = 3x^2 - 4$					
$y = -\frac{2}{3}x^2 + 1$					
$y = 2x^2 + x + 4$					
$y = -5x^2 - 2x + 1$					
$y = (x - 1)^2 + 1$					
$y = -\frac{1}{2}(x + 2)^2 - 1$					