*Max Richter*

**“Curve Appeal”**

**Mini-Project on Parabolas and Quadratic Functions**

**Write-Up**

**1) Trace or model at least one key “parabola” in your original work into a piece of graph paper.**

**2) Define the following Key Features of a Parabola in your own words**. (You can reuse the definitions you started in the “Parabolas in Art and Architecture” activity that we did in class). **Specify where the following features can be found in your parabola.** Make sure you **clearly label** the coordinate points or equations in the table below, and on your sketch. **Where applicable, make sure you describe the significance of this feature in your product.** (Note: Hints to find the focus and directrix are given in the last page.)

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| --- | --- | --- | --- |
| **Key Features of a Parabola:** | **My Definition** | **Location in my Parabola (coordinate points or equation of line)** | **Significance of this****feature in my product** |
| **Vertex** | The point in which the parabola begins to curve | (0,-4) | This is the point in which the object will lay. |
| **Minimum or Maximum Value** | The minimum and maximum decide on what direction the parabola is pointing | (0,-5) | Shows which direction our parabola is pointing. |
| **Axis of Symmetry** | The reflection of the parabola from the vertex.  | x=-4 | Where our hammock begins to sack and change directions. |
| **y-intercept** | The point in which the parabola touches the y-axis. | (1,0) | Shows where we hang our parabola from. |
| **x intercept or “roots”** | The points in which the parabola touches the x-axis. | (0,1) | Determines if the hammock is a parabola. |
| **Focus** | A [fixed](http://www.mathwords.com/f/fixed.htm) [point](http://www.mathwords.com/p/point.htm) on the [interior](http://www.mathwords.com/i/interior.htm) of a parabola used in the formal definition of the [curve](http://www.mathwords.com/c/curve.htm). | (0,1) | Determines if the hammock creates a true parabola. |
| **Directrix** | The line underneath the parabola. | n/a | Determines if the x-coordinates are equal to the focus. |

**3) Find the exact equation of the parabola that best fits the one in your project.** Use the online graphing calculator DESMOS ([**www.desmos.com**](http://www.desmos.com)**)** to **print out a graph of your parabola.**

***Hints****:*

* Use what you now know about the **“vertex form”** of a parabola: **y= a(x - h)2+k** to get the **exact equation of your parabola** by changing the values of h, and k.
* Then **plug in the coordinates of the y-intercept** to **find the exact value of “a”**

**Equation of my parabola in vertex form is:** *y = (x-0)²-4*

**4) Rewrite the equation** of your parabola **in Standard Form. Explain** how an equation of a parabola can be changed from “vertex form” to “standard form” and vise versa.

**The equation of my parabola in Standard Form is:** *y = x² - 0 - 4*

**5a.) A “root” of a quadratic function is** the point where a function interacts with the x-axis.

**How many “roots” or “x-intercepts” does your parabola have?** 2 X-intercepts (Roots)

**Explain** how you know**:** Because they are the only points that touch the x-axis.

**5b.) Find or verify the exact “roots” or “x-intercepts” of your parabola.**

***Hints:***

 ***Option 1***: If your quadratic function is a perfect square, rewrite the equation in Factored Form, and set the function equal to zero to find when “y” will be zero. Then use the Zero Product Property to solve for the “zeros,”

 ***Option 2***: If your quadratic function is not a perfect square, use “completing the squares” to prove how the Quadratic Formula is derived. Then use it to find the solution(s) to the quadratic function.)

***Option 1:***

**The equation of my parabola in Factored Form is:** *y = x² - 4*

**Therefore, the solution or roots of my Quadratic Function are:** *2 and -2*

**6) Find the coordinate point for the focus and the equation for the directrix of the parabola that you used to model your curve.**

 ***Hints:***  \_**1\_**

* We define **p = 4a**  where the absolute value of **"p" is the distance from the vertex to the focus, and the vertex to the directrix.**
* So if the parabola is **opening** **upwards**, then the **focus is the point** **(h, k+p).** In other words, simply add the value of "p" to the y-coordinate of the vertex to get the focus.  The **directrix** **is the equation y = k – p.**
* If the parabola is **opening downwards, then it would be the opposite**: the **focus** is the point **(h, k-p),** and the **directrix** is the equation **y= k + p.**

**The distance (p) from my vertex to the focus (and from the vertex to the directrix) is:** (1/4)

**The focus of my parabola is: (**0,-3.75**)**

**The equation of the directrix of my parabola is:** y=-1/4

**Is the curve in your project a true parabola,** or is it a catenary, or a part of a circle, or any other kind of curve? **Explain how you know,** by using the formal definition of a parabola.

The length of our hammock is a catenary, but the two ends form a parabola; they’re not hanging on their own weight. The y-axis is where the focus is where the stress lays.

**For your final deliverable, staple and submit the following with your Original Parabola:**

* This completed worksheet. Make sure you show all your work either by typing it in or by attaching a separate piece of paper.
* The sketch of your parabola on graph paper
* The printout of the equation and the graph of your parabola from the graphing calculator.
* A one-page summary display that you will display with your Original Parabola. (Instructions for this will be given separately.)