Algebra 2 Lesson 5-2: Properties of Parabolas Mrs. Snow, Instructor

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PARABOLA STANDARD FORM:
$y = ax^2 + bx + c$
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- 1. When b=0, the function is: $y = ax^2 + c$. When graphed, the parabola will be symmetric around the y-axis. Therefore, the **axis of symmetry is:** x = 0, and the **vertex of the graph is the y-intercept, (0,c).**
- 2. If a>0 the parabola will open upward. a<0, open downward.
- 3. The larger **a**, the narrower the parabola. The smaller **a**, the wider the parabola.
- 4. Setting $x = 0 \rightarrow y = c$ \therefore *c* is the *y* intercept!

To graph a quadratic equation in the form $y = ax^2 + c$:

- 1. The vertex is at (0,c). Note that this is also the y-intercept.
- 2. The sign of "a" tells us it opens up (+) or down (-).
- 3. Pick at least 3 points on one side of the vertex, solve for y and then find the **corresponding** points using symmetry to graph the other side.



Well, what if the equation is in standard form: $y = ax^2 + bx + c$?

- 1. The sign of the coefficient of **a** still tells us whether the parabola opens up (+) or down (-).
- 2. Axis of symmetry is now found from the coefficients of the equation, hence the axis is the line: $x = \frac{-b}{2a}$
- 3. The vertex of the parabola is at the point: $x = \frac{-b}{2a}$, $y = f\left(\frac{-b}{2a}\right)$;

basically when
$$x = \frac{-b}{2a}$$
, what is y?

4. Now, the parabola will be translated along the x-axis; however, the **y-intercept** is at **(0,c)**.

Example: Graph the function: $y = 3x^2 + 6x - 4$



Calculator Minimums and Maximum:

- **1.** Hit **Y=** type in the quadratic equation. **Remember:** must be in the "y=" form.
- **2. GRAPH** if the parabola is off the view screen: **WINDOW** adjust the minimum and maximum values for x and y. **GRAPH** and view the parabola.
- 2nd TRACE choose 3-minimum if the parabola is opening up or choose 4-maximum if the parabola is opening down. Question: left bound? Arrow over so that asterisk is flashing on the left side of the min or max ENTER right bound? Arrow over so that the asterisk is flashing on the right side of the min or max. ENTER Guess? ENTER the x and y values will be given at the bottom of the view screen.



Application:

The number of bacteria in a refrigerated food is given by $n(t) = 20t^2 - 20t + 120$, for $-2 \le t \le 14$ and where t is the temperature of the food in Celsius. At what temperature will the number of bacteria be a minimum?

Nike Shoes estimates that its monthly profit P in hundreds of dollars can be modeled by the formula $P = -2x^2 + 4x + 6$, where x is the number of shoes produced per month in thousands How many shoes should be produced per month to earn the maximum profit? What is the maximum monthly profit?

A company's weekly revenue in dollars is given by $R(x) = 2000x - 2x^2$, where x is the number of items produced during a week. What amount of items will produce the maximum revenue?