**Questions/Work**

**Vocabulary**

* Standard form of a quadratic function:

**Find the Vertex of a Quadratic Function in Standard Form**

* The standard form of a quadratic function is y = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ where a, b, and c are real numbers, and $a\ne 0$. Use vertex form to derive the standard form.

$y=a\left(x-h\right)^{2}+k$ Write the vertex form of a quadratic equation.

$y=a\left(x-h\right)\left(x-h\right)+k$

$y=\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_$ FOIL.

$y=\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_$ Simplify.

The equation $y=ax^{2}-2ahx+ah^{2}+k$is a quadratic function in \_\_\_\_\_\_\_\_\_\_\_\_\_\_ form with **a =** \_\_\_\_\_\_\_, **b =**  \_\_\_\_\_\_\_\_\_\_\_\_\_, and **c =** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The vertex of a quadratic function is \_\_\_\_\_\_\_\_\_\_\_, so to determine the x-coordinate of the vertex, solve b = -2ah for \_\_\_\_\_\_:

b = -2ah => $h=-\frac{b}{2a}$

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| **Quick Tip to Find Vertex**To find the x-value of the vertex (which is h), use the formula h = $-\frac{b}{2a}$To find the y-value of the vertex, use the x-value obtained and plug into the original function. This y-value is the k in the coordinates (h, k). |

**Example 1**

What is the vertex of the function $f\left(x\right)=x^{2}-6x+10?$

**Step 1** Identify the coefficients a, b, and c. $a=\\_\\_\\_\\_\\_$ **b =**\_\_\_\_\_\_\_, and **c =**\_\_\_\_\_\_\_\_

**Step 2** Solve for h, the x-coordinate of the vertex. $h= -\frac{b}{2a}=$

**Step 3** Substitute the value of h into the equation for x to find k, the y-coordinate of the vertex.

$$f\left(3\right)=\left(3\right)^{2}-6\left(3\right)+10= $$

The vertex of the function is (h, k) = \_\_\_\_\_\_\_\_\_\_

 **Name**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **Period**: \_\_\_\_ **Date**: \_\_\_\_\_\_\_\_\_\_\_\_\_

**Topic**: Standard Form of a Quadratic Function

**Essential Question**: What key features can you determine about a quadratic function from an equation in standard form?

**I CAN…**

 **Level 4**: Construct a real-world scenario that is modeled by a quadratic function and write/graph the quadratic function

 Level 3: Write and graph quadratic functions in standard form.

 Level 2: Understand key terminology as well as well as understand the basic processes of the lesson

 Level 1: With help, I can understand key terminology and work with basic processes of the lesson

**Notes 2-2**

**p.1**

**Try It!**

**1.** What is the vertex of the graph of the function $f\left(x\right)=x^{2}-8x+5?$

**Graph a Quadratic Function in Standard Form**

**Example 2**

How can you use key features to graph $f\left(x\right)=x^{2}-4x+8?$

**Step 1** Find the vertex and the axis of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the quadratic function.

$$h= -\frac{b}{2a}=$$

The vertex is \_\_\_\_\_\_\_\_\_\_, and the axis of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is x = \_\_\_\_\_\_\_

**Step 2** Find the y-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the quadratic function.

This feature occurs at x = 0: $f\left(0\right)=$

Note: If the y-intercept is the same as the vertex, choose a different point!

|  |  |
| --- | --- |
| **Step 3** Find a point \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the y-intercept across the axis of symmetry. Since (0,8) is a pint on the parabola 2 units to the left of the axis of symmetry, then this means the point \_\_\_\_\_\_\_\_\_\_\_\_\_\_ will be a point on the parabola 2 units to the right of the axis of symmetry. |  |

**Step 4** Sketch the graph.

Once you have 3 points associated with quadratic function, you can sketch based on knowledge of the general shape.

**p. 2**

**Questions/Work**

**Try It!**

**2.** Use the key features to graph the function $f\left(x\right)=x^{2}-6x-1$.

|  |  |
| --- | --- |
| Vertex: \_\_\_\_\_\_\_\_\_\_\_ Axis of Symmetry: x = \_\_\_\_\_\_\_\_\_Y-intercept: \_\_\_\_\_\_\_\_\_\_\_Point symmetric to y-intercept: \_\_\_\_\_\_\_\_\_\_\_ |  |

**Interpret the Graph of a Quadratic Function**

**Example 3**

|  |  |
| --- | --- |
| The graph of the function $f\left(x\right)=-10x^{2}+700x-6000$ shows the profit a company earns for selling headphones at different prices. What is the maximum profit the company can expect to earn? The x-axis shows selling price and y-axis shows profit. The maximum y-value of profit occurs at the \_\_\_\_\_\_\_\_\_\_\_ of its parabola. Find the vertex of the parabola.  |  |
| Find the x-coordinate of the vertex using the formula for h.  | $$h= -\frac{b}{2a}=$$ |
| Find the y-coordinate of the vertex by plugging in the value of h into the function for x.  | $$y= -10x^{2}+700x-6000$$$$y=$$$$y=$$Vertex: \_\_\_\_\_\_\_\_\_\_\_ |

**Interpretation**

The selling price of $\_\_\_\_\_ per item gives the maximum profit of $\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Try It!**

|  |  |
| --- | --- |
| **3.** A water balloon was thrown from a window. The height of the water balloon over time can be modeled by the function $y=-16x^{2}+160x+50$. What was the maximum height of the water balloon after it was thrown?  |  |

**p. 3**

**Questions/Work**

**p. 4**

**Questions**

**Write the Equation of a Parabola Given Three Points**

**Example 4**

What is the equation of a parabola that passes through the points (-2,32), (1,5), and (3,17)?

**Step 1** Write three equations by substituting the given x- and y-values into the standard form of a parabola equation, y = $ax^{2}+bx+c$.

|  |  |
| --- | --- |
|  (-2, 32) | 32 = $a\left(-2\right)^{2}+b\left(-2\right)+c$32 = 4a $- $2b + c |
| (1, 5) | 5 = 5 =  |
| (3, 17) | 17 = 17 =  |

|  |  |
| --- | --- |
| **Step 2** Solve the System | Solve (M) for a: 15 = 5a => a = \_\_\_\_\_\_\_Plug in a = 3 into (N), solve for (b):  6 = 4 (3) + b => 6 = 12 + b => b = \_\_\_\_\_\_\_\_Plug into a = 3, b = -6 into (O), solve for c: 17 = 9 (3) + 3 (-6) + c c = \_\_\_\_\_\_  |
| **Step 3**Substitute valuesof a, b, and c in the **Solution:** y = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_standard form.  |

**p. 5**

**Questions**

**Try It!**

**4.** What is the equation of a parabola that passes through the points (2, -12), (-1,-15), and (-4, -90)?

|  |  |  |
| --- | --- | --- |
| **STANDARD FORM** | $$y=ax^{2}+bx+c$$ | $$y= -2x^{2}-8x+1$$ |
| **KEY FEATURES** | **Vertex** x-coordinate of vertex: h = Substitute h for x and solve for \_\_\_\_\_\_ to find the \_\_\_\_\_\_-coordinate of the vertex.**Axis of Symmetry**x = **y-intercept** (0, \_\_\_\_\_\_\_\_) | h = y = Vertex is \_\_\_\_\_\_\_\_\_\_\_\_\_\_.X = \_\_\_\_\_\_\_(0, \_\_\_\_\_\_) |
| **GRAPHS** |  |  |

**P. 6**

**Written Summary:**

**EQ:** What key features can you determine about a quadratic function from an equation in standard form?

**Questions**

**Questions**

**P. 7**

**P. 8**

**Questions**

**Questions**