

4-2

Standard Form of a Quadratic Function

Name: Key
Date: _____ Hour: _____

A quadratic function is a function that can be written in the form $f(x) = ax^2 + bx + c$ where $a \neq 0$.

The graph of $f(x) = ax^2 + bx + c$ is a PARABOLA. $\uparrow \downarrow$

If $a > 0$, the parabola opens \uparrow (min) If $a < 0$, the parabola opens \downarrow max.

The axis of symmetry is the vertical line that goes through the vertex and its equation is $x = \frac{-b}{2a}$.

The x-coordinate of the vertex is $-\frac{b}{2a}$. Plug that X value into the equation to find the y coordinate of the vertex.

The y-intercept of the graph is $(0, c)$.

Example 1

1. Identify the vertex, the axis of symmetry, the maximum or minimum value, and the range of the function.

$y = 2x^2 - 4x + 2$

$y = 2x^2 - 4x + 2$

$y = 2(1)^2 - 4(1) + 2$

Axis of Symmetry: $x = \frac{-b}{2a} = \frac{4}{2(2)} = \frac{4}{4} = 1$

$y = 2 - 4 + 2$

Vertex: $(1, 0)$

The vertex is the (max or min) value of the function.

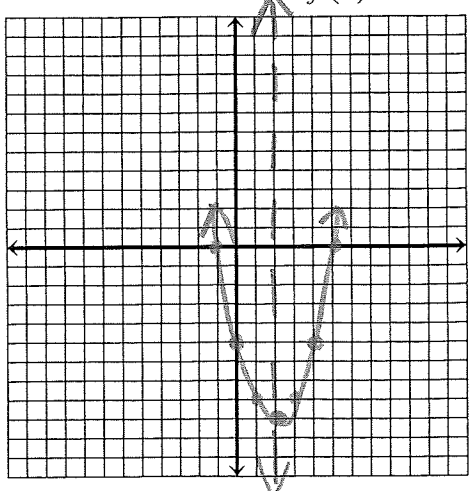
The y intercept is $(0, 2)$ Domain: all Range: $y \geq 0$

To graph a quadratic equation:

- 1) Write the equation in standard form
- 2) Find the AOS and x-coordinate of the vertex by using: $(x = \frac{-b}{2a})$
- 3) Put that x-coordinate in the middle of the t-chart and choose the next two integers greater and less than the x-coordinate
- 4) Substitute those x values into the equation and find y. (Notice the symmetry.)
- 5) Graph the ordered pairs

What is the axis of symmetry, vertex, maximum and minimum values, up or down, y intercept and domain and range of the function:

$f(x) = x^2 - 4x - 5$



X	Y
1	-8
2	-9
3	-8

The axis of symmetry is: $x = \frac{-b}{2a}$ Axis of sym: $x = \frac{4}{2(1)} = 2$

Substitute that x value to find the y value. Vertex: $(2, -9)$

$y = 2^2 - 4(2) - 5$
 $y = 4 - 8 - 5$

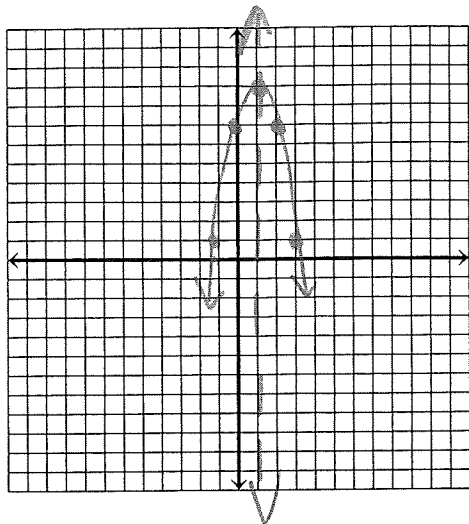
Max/Min: Up/Down

The y intercept is found by evaluating for $x=0$. Y intercept: $(0, -5)$

Domain: all Range: $y \geq -9$

**Problem 2** Graphing a Function of the Form $y = ax^2 + bx + c$

What is the axis of symmetry, vertex, maximum and minimum values, up or down, y intercept and domain and range of the function: $f(x) = -2x^2 + 4x + 7$



x	y
-1	1

The axis of symmetry is: $x = \frac{-b}{2a}$ Axis of sym: $x = \frac{-4}{2(-2)} = 1$

$$y = -2(1)^2 + 4(1) + 7$$

$$= -2 + 4 + 7$$

Substitute that x value to find the y value. Vertex: $(1, 9)$

Max/Min: _____ Up/Down: \downarrow

The y intercept is found by evaluating for $x=0$. Y intercept: $(0, 7)$

Domain: _____ Range: _____

**Problem 3** Converting Standard Form to Vertex Form

Got It? What is the vertex form of $y = -x^2 + 4x - 5$?

Use the justifications at the right to find the vertex.

$$y = (-1)x^2 + (4)x + (-5)$$

Write the function in the form $y = ax^2 + bx + c$.

$$x = \frac{-b}{2a} = \frac{-4}{2(-1)} = 2$$

Find the x-coordinate of the vertex.

$$y = -1(2)^2 + 4(2) - 5$$

$$= -4 + 8 - 5$$

Substitute the x-coordinate value into the equation and simplify.

The vertex is $(2, -1)$.

$$y = -1(x-2)^2 - 1$$

Use the general form of the equation, $y = a(x-h)^2 + k$. Substitute for a, h, and k.

$$y = -1[x - (2)]^2 + (-1)$$

The vertex form of the function is

$$y = -1(x-2)^2 - 1$$

**Problem 3** Converting Standard Form to Vertex Form

Got It? What is the vertex form of $y = -x^2 + 4x - 5$?

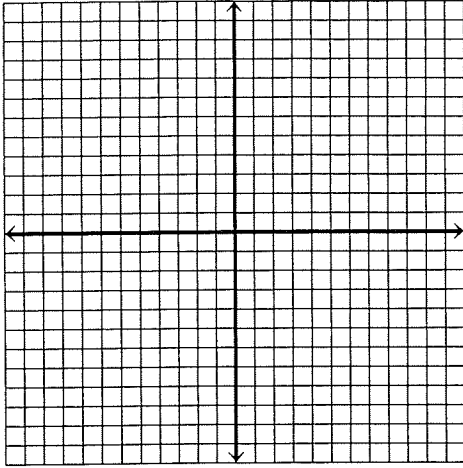
$$y = -1(x-2)^2 - 1$$

4.2 Homework:

Name _____

Identify the vertex, the axis of symmetry, the maximum or minimum value, up or down, the y intercept, the domain and range of each parabola. Graph each function at the bottom. Be Neat! Show your work! What is the axis of symmetry, vertex, maximum and minimum values, up or down, y intercept and domain and range of the function:

1. $f(x) = -x^2 + 2x + 1$



Axis of symmetry: _____

Vertex: _____

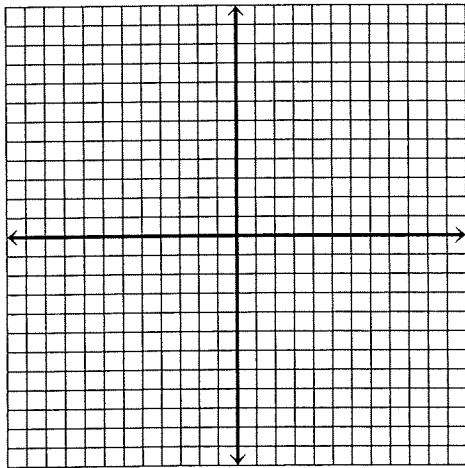
Max/Min: _____ Up/Down: _____

Y intercept: _____

Domain: _____

Range: _____

2. $f(x) = 2x^2 + 4x - 7$



Axis of symmetry: _____

Vertex: _____

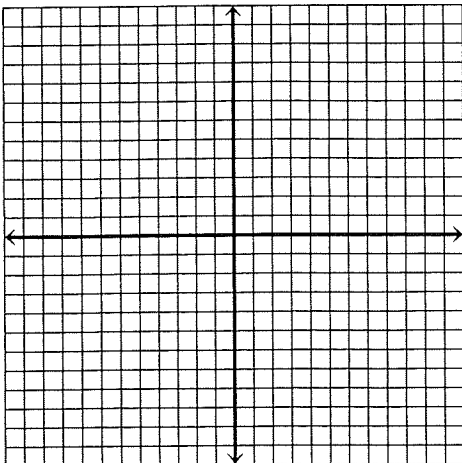
Max/Min: _____ Up/Down: _____

Y intercept: _____

Domain: _____

Range: _____

3. $f(x) = -2x^2 + 4x + 5$



Axis of symmetry: _____

Vertex: _____

Max/Min: _____ Up/Down: _____

Y intercept: _____

Domain: _____

Range: _____

Write each function in vertex form.

4. $f(x) = x^2 + 2x + 5$

5. $f(x) = 2x^2 - 4x + 3$

6. $f(x) = -x^2 + 6x - 5$

7. $f(x) = -2x^2 + 4x + 6$

8. $f(x) = 3x^2 + 12x - 4$

9. $f(x) = 4x^2 - 16x + 2$

10. $f(x) = -2(x-3)^2 + 7$

Vertex: _____

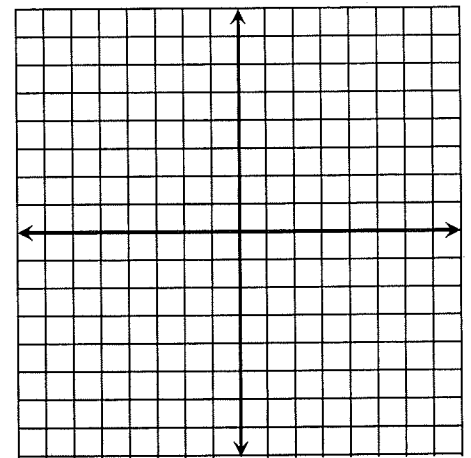
AOS: _____

Max / Min: _____

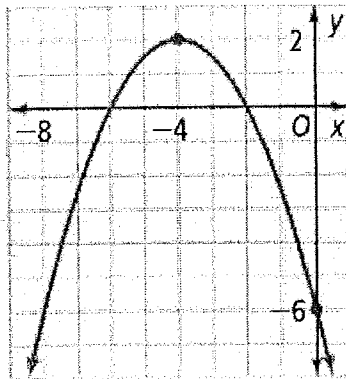
Domain: _____

Range: _____

x	y



Write a quadratic function for each.



11.

12. Given a vertex at (3, 7) and another ordered pair of (9, 4) on a parabola.