Name: KEY

Topic: 5.1: Graphing Quadratic Functions

Date: _____

Summary:

Quadratic → x^2

Max. Vertex

Min. Vertex

Axis of Symm.

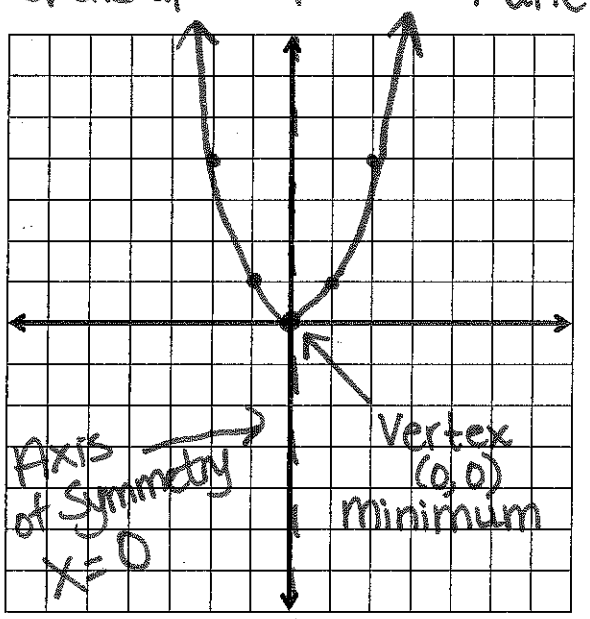
Quadratic Function: $y = ax^2 + bx + c$

Key Information:

- Shape: Parabola
- Vertex: Maximum or minimum
- Axis of Symmetry: Invisible "fold" line - cuts in half
  x=
- Opens **up** if $a > 0$ $a = +$; Opens **down** if $a < 0$ $a = -$

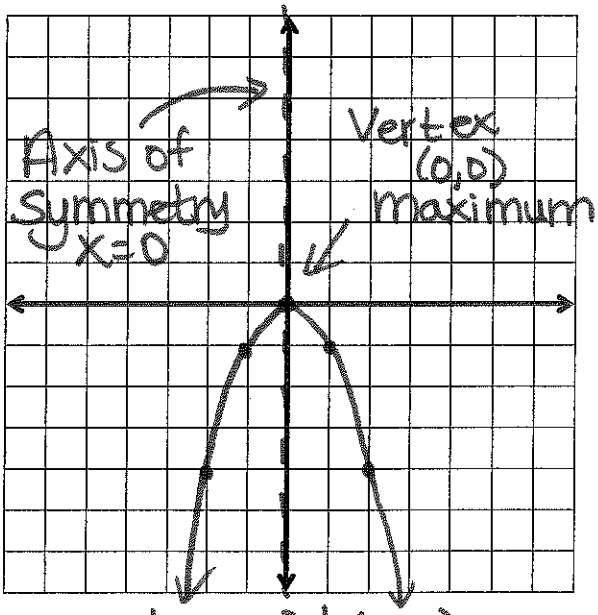
Parent Functions

$a = +1$ opens up $y = x^2$



x	$y=x^2$	(x, y)
-2	$(-2)^2=4$	(-2, 4)
-1	$(-1)^2=1$	(-1, 1)
0	$(0)^2=0$	(0, 0)
1	$(1)^2=1$	(1, 1)
2	$(2)^2=4$	(2, 4)

$y = -x^2$ $a = -1$ opens down



x	$y=-x^2$	(x, y)
-2	$-(-2)^2=-4$	(-2, -4)
-1	$-(-1)^2=-1$	(-1, -1)
0	$-(0)^2=0$	(0, 0)
1	$-(1)^2=-1$	(1, -1)
2	$-(2)^2=-4$	(2, -4)

Standard Form	Vertex Form
$y = ax^2 + bx + c$	$y = a(x-h)^2 + k$
*C = y-Intercept	a = Slope

Characteristics of the graph of a quadratic function:

Calculate $x = \frac{-b}{2a}$

To find y, use the x-Coordinate, and plug it back into the original equation.

	Standard Form	Vertex Form
Vertex *(x, y)*	$\left(x = \frac{-b}{2a}, y\right)$	(h, k)
Axis of Symmetry (Invisible Line)	$x = \frac{-b}{2a}$	$x = h$ (opposite of how it appears)

- Keep in mind, the vertex is a point (x,y). You need to have an x-Coordinate and a y-Coordinate.
- The axis of symmetry is a Vertical line. This needs to be in the form x = .

What is the vertex (x,y) and axis of symmetry x = for the following functions?

a. $y = -x^2 + x + 12$ Standard Form

$a = -1 \quad b = 1 \quad c = 12$

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

$y = -\left(\frac{1}{2}\right)^2 + \frac{1}{2} + 12 = 12\frac{1}{4}$

$\boxed{\text{Vertex} = \left(\frac{1}{2}, 12\frac{1}{4}\right)}$

$\boxed{\text{Axis of Symmetry: } x = \frac{1}{2}}$

b. $y = 2(x-1)^2 + 3$ Vertex Form

Vertex = (h,k)

$\boxed{\text{Vertex} = (1, 3)}$

$\boxed{\text{Axis of Symmetry: } x = 1}$

c. $y = 2x^2 - 8x + 6$ Standard Form

$a = 2 \quad b = -8 \quad c = 6$

$x = \frac{-b}{2a} = \frac{-(-8)}{2(2)} = \frac{8}{4} = 2$

$y = 2(2)^2 - 8(2) + 6 = -2$

$\boxed{\text{Vertex} = (2, -2)}$

$\boxed{\text{Axis of Symmetry: } x = 2}$

d. $y = -\frac{1}{2}(x+3)^2 + 4$ Vertex Form

Vertex = (h,k)

$\boxed{\text{Vertex} = (-3, 4)}$

$\boxed{\text{Axis of Symmetry: } x = -3}$

5.1

Now let's put the pieces together and graph these functions!

$y = 2x^2 - 8x + 6$ *Standard Form

$a=2$ $b=-8$ $c=6$

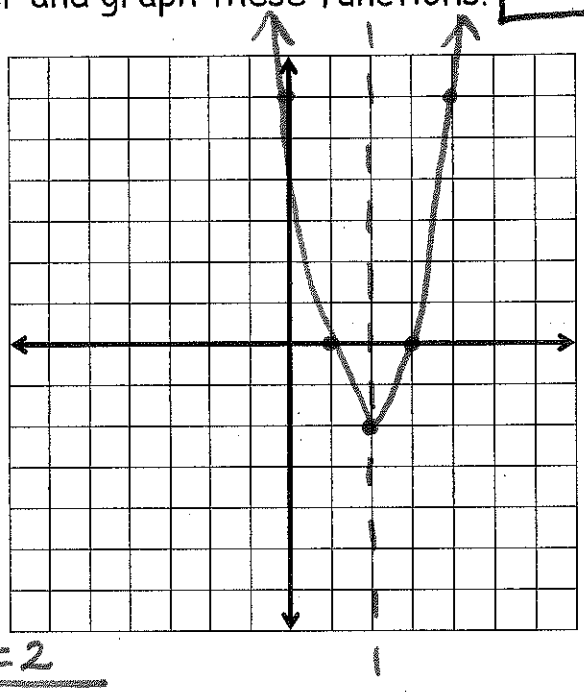
+ opens up

Vertex: $x = \frac{-b}{2a} = \frac{-(-8)}{2(2)} = 2$

$y = 2(2)^2 - 8(2) + 6 = -2$

$\boxed{\text{Vertex} = (2,-2)}$

$\boxed{\text{Axis of Symmetry: } x=2}$



Finish Graph: (Slope)

	$a=2$
1a	$1(2)=2=\frac{2}{1}$
3a	$3(2)=6=\frac{6}{1}$
5a	$5(2)=10=\frac{10}{1}$

$c=6$

y-Intercept: $(0,6)$

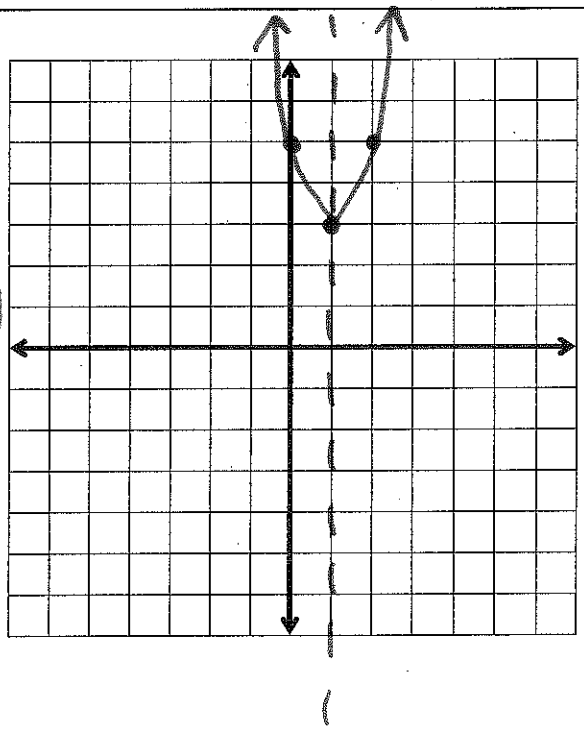
$y = 2(x-1)^2 + 3$ *Vertex Form

+ opens up

Vertex: (h,k)

$\boxed{\text{Vertex: } (1,3)}$

$\boxed{\text{Axis of Symmetry: } x=1}$



Finish Graph: (Slope)

	$a=2$
1a	$(1)(2)=2=\frac{2}{1}$
3a	$3(2)=6=\frac{6}{1}$
5a	$5(2)=10=\frac{10}{1}$

5.1

$y = -x^2 + 2x + 8$ *Standard Form

$a = -1$ $b = 2$ $c = 8$

$-$

opens down

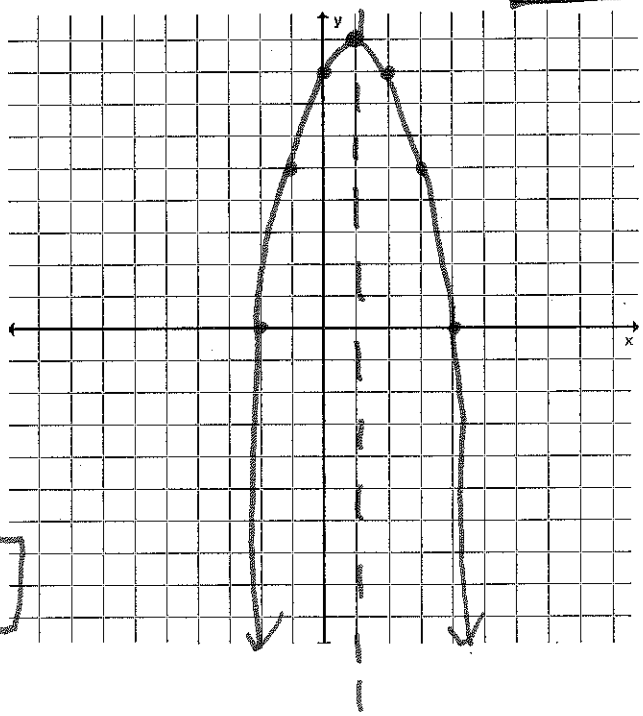
Vertex:

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

$y = -(1)^2 + 2(1) + 8 = 9$

$\boxed{\text{Vertex} = (1, 9)}$

$\boxed{\text{Axis of Symmetry: } x = 1}$



Finish Graph: (Slope)

	$a = -1$
1a	$1(-1) = \frac{-1}{1}$
3a	$3(-1) = \frac{-3}{1}$
5a	$5(-1) = \frac{-5}{1}$

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

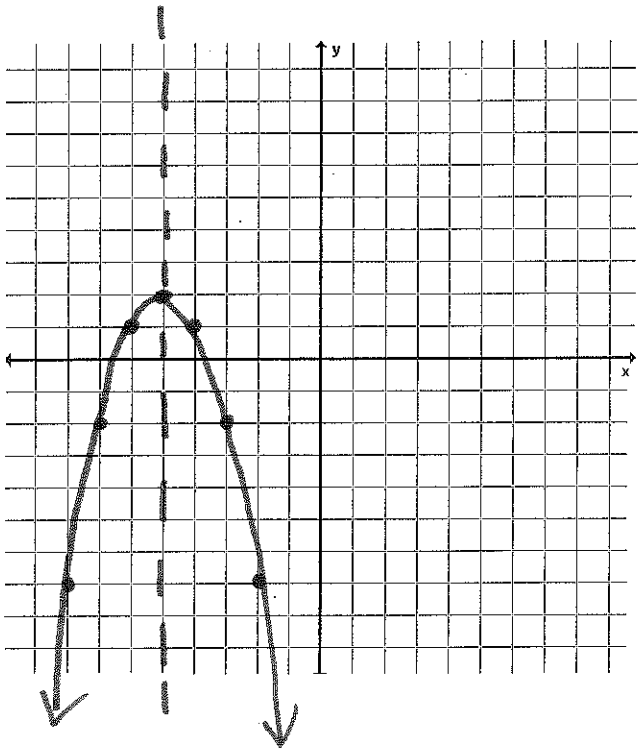
$-$

opens down

Vertex: (h, k)

$\boxed{\text{Vertex: } (-5, 2)}$

$\boxed{\text{Axis of Symmetry: } x = -5}$



Finish Graph: (Slope)

	$a = -1$
1a	$1(-1) = -1 = \frac{-1}{1}$
3a	$3(-1) = -3 = \frac{-3}{1}$
5a	$5(-1) = -5 = \frac{-5}{1}$