III. Standard Form

$f(x) = ax^2 + bx + c$

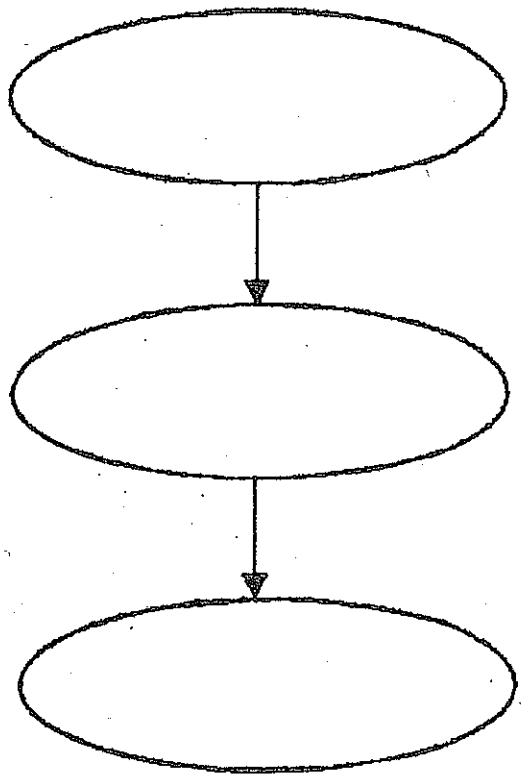
$x = \frac{-b}{2a}$ gives the

_____.

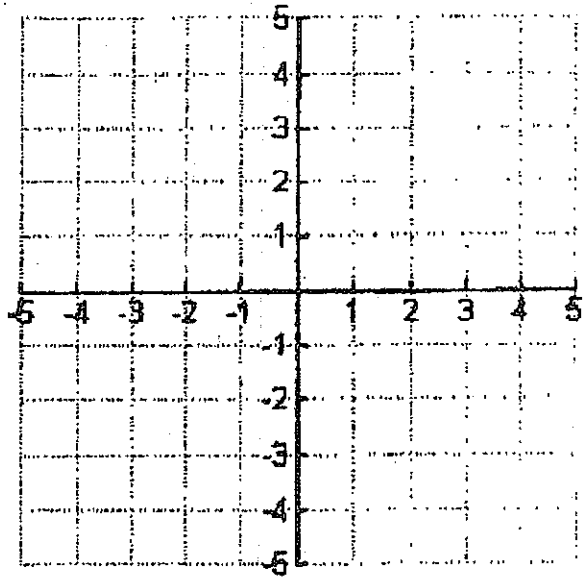
a determines the

_____ and

_____.



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



GOAL 1 GRAPHING A QUADRATIC FUNCTION in Standard Form

CONCEPT SUMMARY — **THE GRAPH OF A QUADRATIC FUNCTION**

The graph of $y = ax^2 + bx + c$ is a parabola with these characteristics:

- The parabola opens up if $a > 0$ and opens down if $a < 0$.

  The parabola is wider than the graph of $y = x^2$ if $|a| < 1$ and narrower than the graph $y = x^2$ if $|a| > 1$.

- The x-coordinate of the vertex is $-\frac{b}{2a}$.

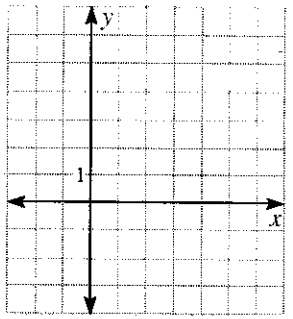
- The axis of symmetry is the vertical line $x = -\frac{b}{2a}$.

EXAMPLE Graphing a Quadratic Function

Graph $y = 2x^2 - 8x + 6$

SOLUTION

Note that the coefficients for this function are $a = 2$, $b = -8$, and $c = 6$. Since $a > 0$, the parabola opens up.



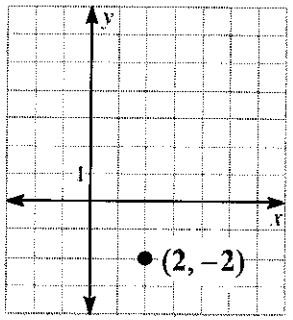
EXAMPLE Graphing a Quadratic Function

Graph $y = 2x^2 - 8x + 6$

Find and plot the vertex.

The x-coordinate is: $x = -\frac{b}{2a} = -\frac{-8}{2(2)} = 2$

The y-coordinate is: $y = 2(2)^2 - 8(2) + 6 = -2$



So, the vertex is $(2, -2)$.

EXAMPLE Graphing a Quadratic Function

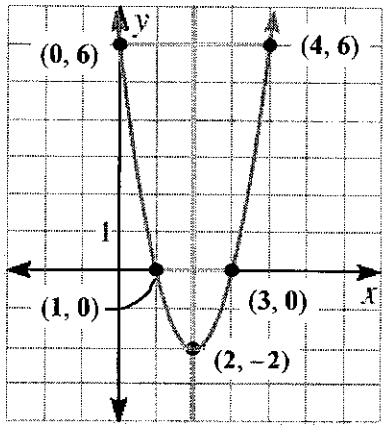
Graph $y = 2x^2 - 8x + 6$

Draw the axis of symmetry $x = 2$.

Plot two points on one side of the axis of symmetry, such as $(1, 0)$ and $(0, 6)$.

Use symmetry to plot two more points, such as $(3, 0)$ and $(4, 6)$.

Draw a parabola through the plotted points.



Name: Date: Period:

Practice Worksheet: Graphing Quadratic Functions in Standard Form $f(x) = ax^2 + bx + c$

1] For any quadratic of the form $y = ax^2 + c$, the axis of symmetry is always the line _____.

2] If the axis of symmetry of a quadratic is $x = 2$ and $(-1, 3)$ is on the graph, then the point (____, ____) must also be on the graph.

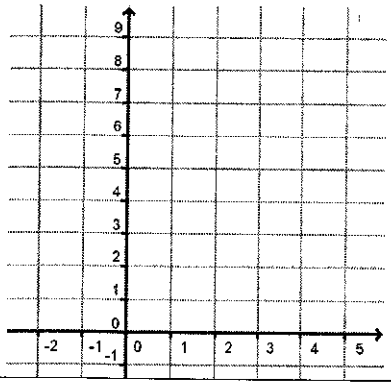
3] For any quadratic of the form $y = ax^2 + c$, the y-intercept is always the same point as the _____.

4] The graph of $y = 2x^2 + 4x + 3$ passes through the point (1, _____) and (-1, _____).

For #5-12, label the axis of symmetry, vertex, y-intercept, and at least three more points on the graph.

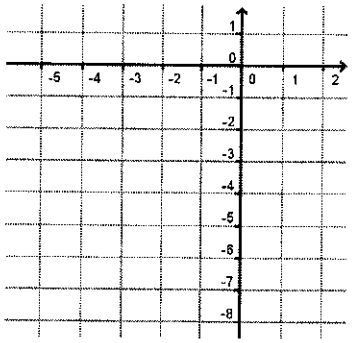
5] $y = x^2 - 4x + 8$
a = b = c =
Opens up or down?
Is vertex a max or min?
y-intercept:
Axis of Symmetry is x=_____

Vertex: (_____, _____)



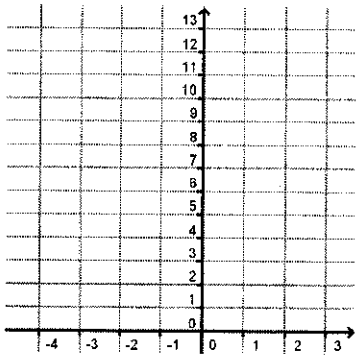
6] $y = 2x^2 + 8x$
a = b = c =
Opens up or down?
Is vertex a max or min?
y-intercept:
Axis of Symmetry is x=_____

Vertex: (_____, _____)



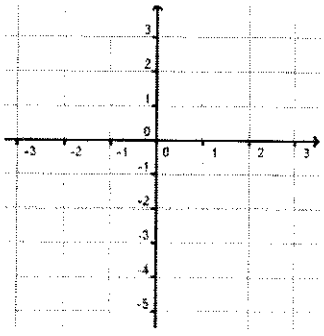
7] $y = -3x^2 - 12x + 1$
a = b = c =
Opens up or down?
Is vertex a max or min?
y-intercept:
Axis of Symmetry is x=_____

Vertex: (_____, _____)



8] $y = -\frac{3}{2}x^2 + 3$
a = b = c =
Opens up or down?
Is vertex a max or min?
y-intercept: (0, ___)
Axis of Symmetry
is x=_____

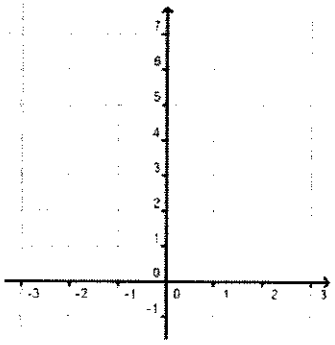
Vertex: (_____, _____)



Find the coordinates (2, _____) and (-2, _____) to guide the shape of the parabola.

9] $y = 2x^2 - 1$
a = b = c =
Opens up or down?
Is vertex a max or min?
y-intercept: (0, ___)
Axis of Symmetry
is x=_____

Vertex: (_____, _____)



Find the coordinates (2, _____) and (-2, _____) to guide the shape of the parabola.

Graphing Quadratic Functions in Standard Form

Name:_____ Date _____

Example: Graph $y = x^2 - 4x - 5$

Step 1: Find the axis of symmetry

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

Use $x = -\frac{b}{2a}$. Substitute 1 for a and -4 for b.

Simplify

Note: this is a vertical line

Step 2: Find the vertex

$$y = x^2 - 4x - 5$$
$$y = 2 - 4(2) - 5$$
$$y = 4 - 8 - 5$$
$$y = -9 \quad \text{(When x=2)}$$

The x-coordinate of the vertex is 2. Substitute 2 for x

The y-coordinate is -9. So the point is (2, - 9)

Step 3: Find the y-intercept

$$y = x^2 - 4x - 5$$
$$y = a^2 + bx + (c)$$
$$y = x^2 - 4x + (-5)$$
$$c = -5$$

Identify c in the equation $y = a^2 + bx + (c)$

So the point is (0, - 5)

Step 4: Find two more points on the same side of the axis of symmetry as the point containing the y-intercept.

$$y = x^2 - 4x - 5$$
$$y = a^2 + bx + c$$
$$y = x^2 - 4x + (-5)$$

Since the axis of symmetry is x=2, choose values less than 2.

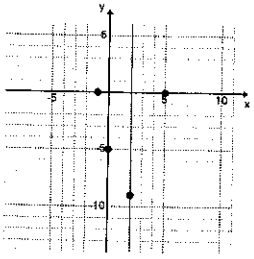
This will allow us to use the symmetry of the parabola to sketch the graph.

Let x=1
y=1²- 4(1) - 5
=1 -4 -5
=-8

Let x= - 1
y=(-1)2- 4(-1) -5
=1 +4 -5
=0

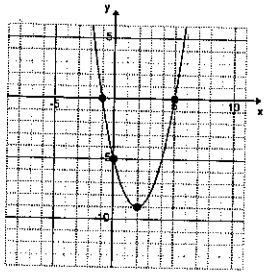
Two other points are (1,-8) and (-1,0)

Step 5: Graph the axis of symmetry, the vertex, the point containing the y-intercept and two other points



Step 6: Reflect the points across the axis of symmetry.

Connect the points with a smooth curve.

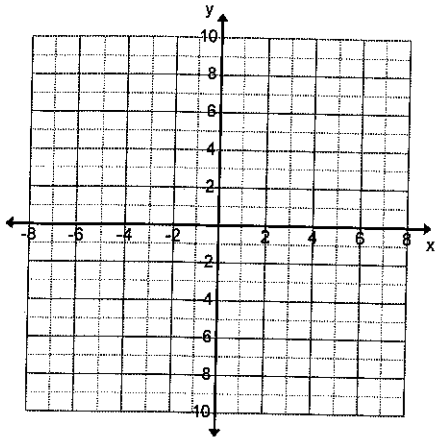


Graphing Quadratic Functions in Standard Form Worksheet #1

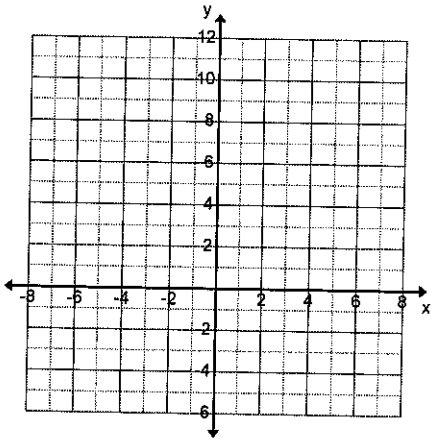
Name:_____ Period_____ Date _____

Directions: Graph these equations. Identify the axis of symmetry, vertex, and y-intercept.

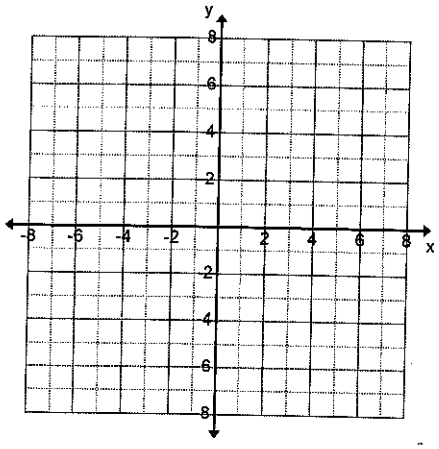
1.) $y = x^2 - 2x - 3$



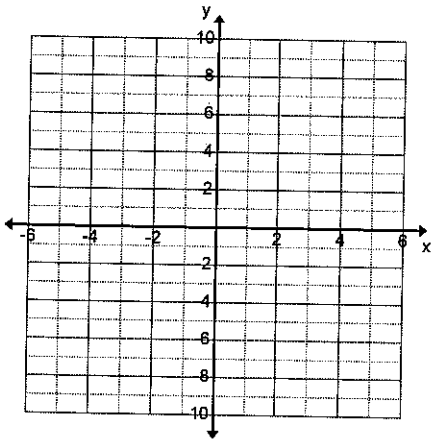
2.) $y = 3x^2 + 12x + 9$



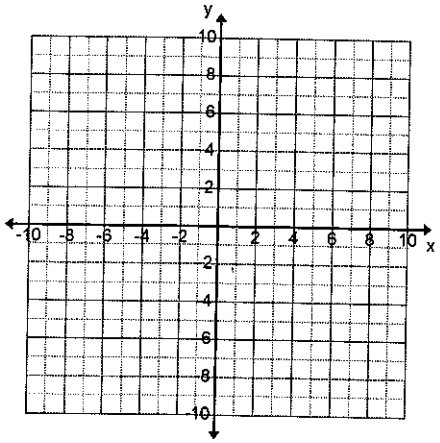
3.) $y = -x^2 + 6x - 4$



4.) $y = -4x^2 + 8$



5.) $y = \frac{1}{4}x^2 + x - 6$



6.) $y = 2x^2 - 2x - 5$