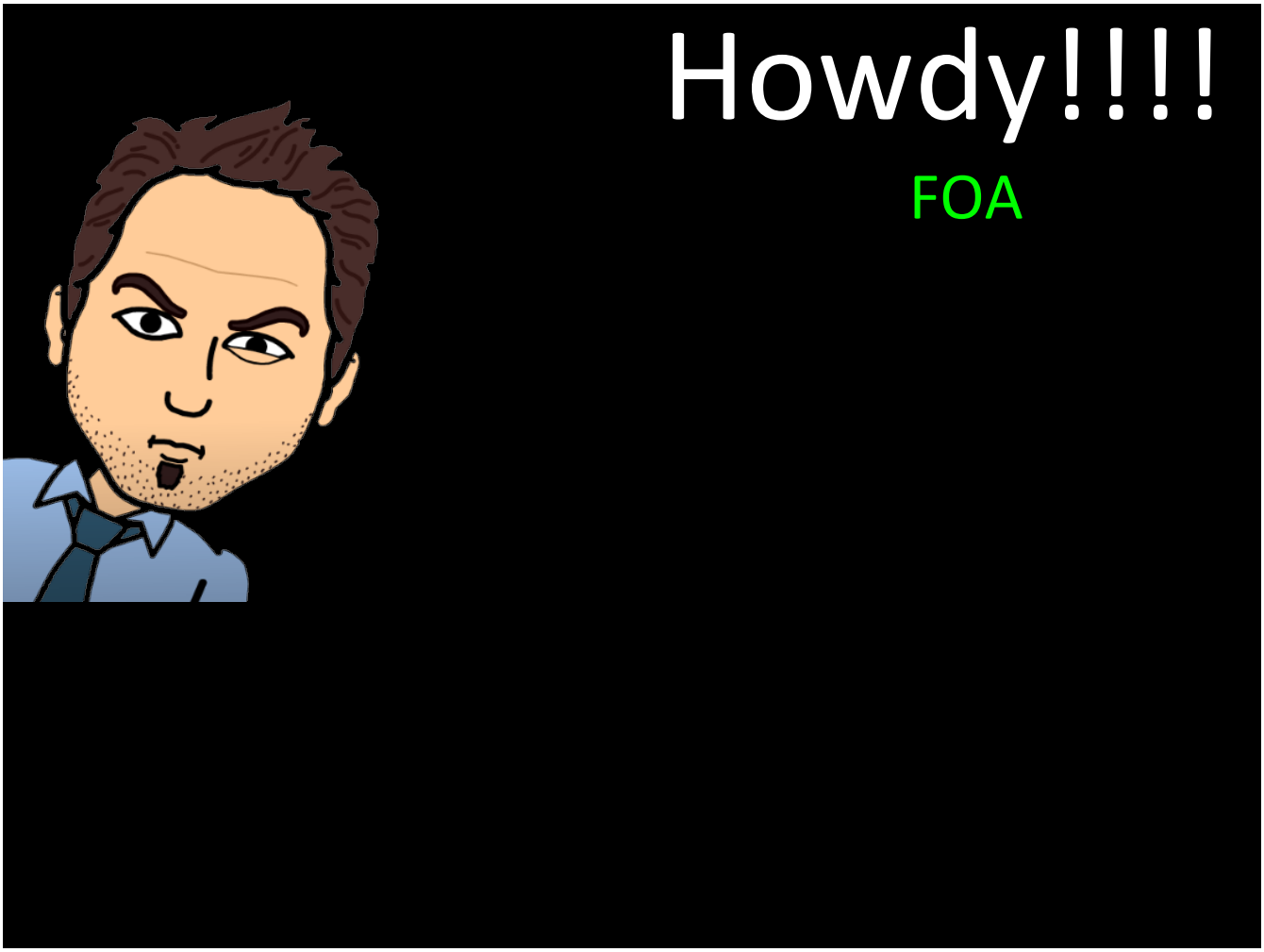

Howdy!!!!
FOA

Vertex Form

Reflect

left + right −

$$y = -a(x-h)^2 + k$$

shrink b/w 0 and 1
stretch bigger than 1

up + down −


Share Video

TODAYS NOTES

Algebra 1 Unit 8: Quadratic Functions Notes

Unit 8: Quadratic Functions

Learning Goal 8.2 - Graphs of Quadratic Functions

After completion of this unit, you will be able to…

- Graph quadratics in vertex, standard, and factored form
- Convert functions between standard, factored, and vertex form
- Calculate the vertex of a function
- Compare equations in multiple forms

Timeline for Unit 8

Monday	Tuesday	Wednesday	Thursday	Friday
20 ***No School***	**21** Day 1 – Transformations of Quadratic Functions	**22** Day 2 – Characteristics of Quadratic Functions	**23** Day 3 – Characteristics of Quadratic Functions	**24** Day 4 – **8.1 Learning Assessment**
27 Day 5 – Graphing in Vertex Form Graphing in Standard Form	**28** Day 6 – Graphing in Factored Form Practice	**29** Day 7 – Writing Equations of Parabolas	**30** Day 8 – Comparing Different Forms of Quadratics	**31** Day 9 – **8.2 Learning Assessment**
3 Day 10 – Average Rate of Change	**4** Day 11 – Applications of the Vertex	**5** Day 12 – Comparing Different Quadratic Functions	**6** Day 13 – Comparing Different Quadratic Functions	**7** Day 14 – **8.3 Learning Assessment**

Tutoring Times

	Monday	Tuesday	Wednesday	Thursday	Friday
AM	Mrs. Jackson 7:45 – 8:15 Room 1210	Mr. Phillips 7:45 – 8:15 Room 1206	Mrs. Jackson & Mr. Webb 7:45 – 8:15 Room 1210 Room 1205	Mr. Watson & Mr. Phillips 7:45 – 8:15 Room 1208 Room 1206	Mr. Watson 7:45 – 8:15 Room 1208
PM	NONE	Mrs. Petersen 3:30 – 4:30 Room 1210	NONE	NONE	NONE

Algebra 1 Unit 8: Quadratic Functions Notes

Day 5 - Graphing Quadratics in Vertex Form

Vertex Form of a Quadratic Function:
$y = a(x - h)^2 + k$

a determines how the graph opens

positive **a**, graph opens up

negative **a**, graph opens down

&

(−h, K) is our vertex.

NOTE: Our vertex is at (h, k), **NOT** (−h, k).

Identifying the Vertex Practice

Find the vertex of the following:

1) $y = (x - 18)^2 + 9$ Vertex = (18, 9)

2) $y = 4(x + 6)^2 - 7$ Vertex = (−6, −7)

3) $y = (x - 2)^2 - 2$ Vertex = (2, −2)

Find the vertex for each of the following quadratics and determine whether the graph opens up or down:

a) $y = (x - 1)^2 - 2$ Vertex = (1, −2) Graph Opens up because a is +

b) $y = -3(x + 4)^2 + 1$ Vertex = (−4, 1) Graph Opens down because a is −

c) $y = 2x^2 + 3$ Vertex = (0, 3) Graph Opens up because a is +

d) $y = -(x - 3)^2$ + 0 Vertex = (3, 0) Graph Opens down because a is −

Algebra 1 Unit 8: Quadratic Functions Notes

Steps for Graphing in Vertex Form

1) Find the vertex (h, k).

2) Use your vertex as the center for your table and determine two x values to the left and right of your h value and substitute those x values back into the equation to determine the y values.

- Using practice problem number 3, let's practice filling in our table.
$y = (x - 2)^2 - 2$

x					
y					

3) Plot your points and connect them from left to right!

Graphing in Vertex Form Examples

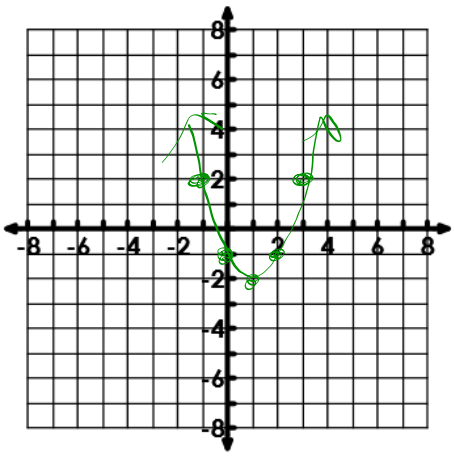
Example 1: Graph $y = (x - 1)^2 - 2$.

Vertex = (1, -2)

$(2-1)^2-2$ $(0-1)^2-2$

$(3-1)^2-2$ $(-1-1)^2-2$

x	-1	0	1	2	3
y	2	-1	-2	-1	2

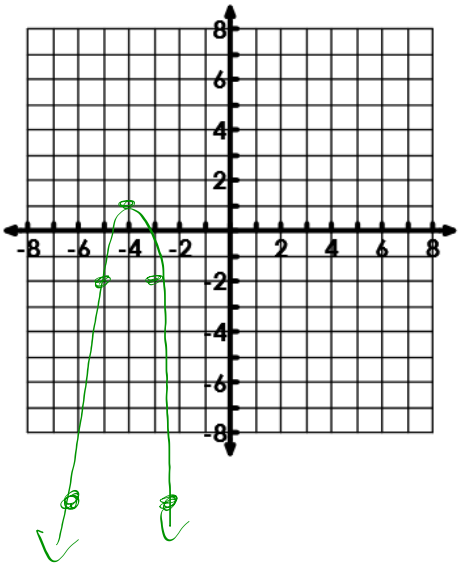


Example 2: Graph: $y = -3(x + 4)^2 + 1$.

Vertex = (-4, 1)

x	-6	-5	-4	-3	-2
y	-11	-2	1	-2	-11

$-3(-6+4)^2+1$

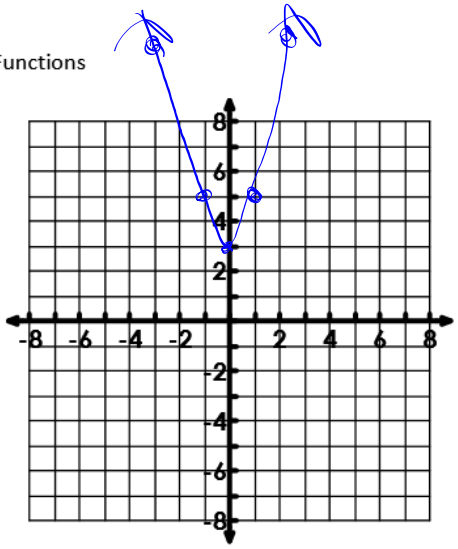


Algebra 1 Unit 8: Quadratic Functions Notes

Example 3: Graph $y = 2x^2 + 3$.

Vertex = (0, 3)

x	-2	-1	0	1	2
y	11	5	3	5	11

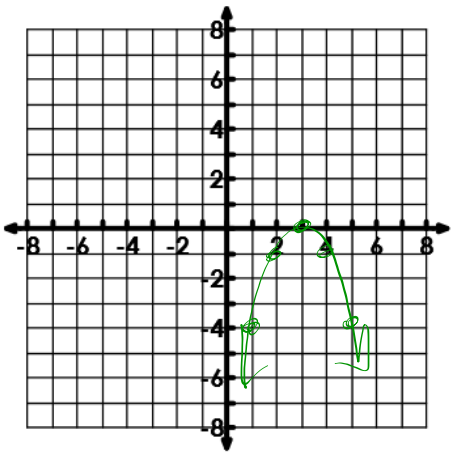


Example 4: Graph: $y = -(x - 3)^2$.

Vertex = (3, 0)

Right 3
Reflect

x	1	2	3	4	5
y	-4	-1	0	-1	-4



Using a Graphing Calculator to Graph Quadratics in Vertex Form

Use a graphing calculator to graph our last example problem, example 4: $y = -(x - 3)^2$

1. Hit **Y =** and enter the equation into y_1.

2. Hit **Graph** (Hit **Zoom**, then **6** to get back to a standard viewing window, if necessary).

3. You can also use the table on the graphing calculator to compare to your table and note the symmetry along the vertex. Hit **2nd** followed by **Graph** (you really want the Table feature). Scroll through the table until you find where the y_1 values stop decreasing and begin increasing, the point it switches at is our vertex.

Algebra 1 Unit 8: Quadratic Functions Notes

Day 5 - Graphing Quadratics in Standard Form

Given the following equation, $y = (x + 3)^2 + 1$, how could we go from that form to $y = x^2 + 6x + 10$?

What about $y = 3(x + 2)^2 + 3$ to $y = 3x^2 + 12x + 15$?

This is how we arrive to the standard form of a quadratic function!

Standard Form of a Quadratic Function:

$y = Ax^2 + Bx + C$

A determines how the graph opens

&

(0, C) is the y-intercept.

Stretch
Shrink
Reflect

y int

Finding the Vertex in Standard Form

Graphing in standard form is similar to graphing in vertex form, but the way we find our vertex is different. We use a special formula to find the x-coordinate of our vertex, and substitute that value in our equation to determine the y - coordinate of our vertex.

The formula is: $x = \frac{-b}{2a}$, then substitute x into equation for y.

For example, say we have $y = x^2 + 2x + 7$, how would we find our vertex?

Algebra 1 Unit 8: Quadratic Functions Notes

Identifying the Vertex Practice

Find the vertex for each of the following quadratics, determine whether the graph opens up or down, and find the y intercept:

A: 2 B: 8 C: 2

1. $y = 2x^2 + 8x + 2$ Vertex = (-2, -6)

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

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

Graph opens up because a is +.

The y-intercept is (0, 2).

A: -1 B: 2 C: 7

2. $y = -x^2 + 2x + 7$ Vertex = (1, 8)

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

$y = -(1)^2 + 2(1) + 7 = 8$

Graph opens down because a is −.

The y-intercept is (0, 7).

3. $y = -4x^2 + 24x$ Vertex = (____, ____)

Graph opens _____ because a is _____.

The y-intercept: _____

4. $y = 7x^2 + 9$ Vertex = (____, ____)

Graph opens _____ because a is _____.

The y-intercept: _____

Steps for Graphing in Standard Form

1) Find the vertex. After using the formula $x = \frac{-b}{2a}$ to find our x- coordinate of our vertex, we substitute that x back into our equation, and our solution is the y-coordinate of our vertex.

2) Use your vertex as the center for your table and determine two x values to the left and right of your x-coordinate and substitute those x values back into the equation to determine the y values.

3) Plot your points and connect them from left to right!

Algebra 1 Unit 8: Quadratic Functions Notes

Graphing in Standard Form Examples

Example 1: Graph $y = x^2 - 2x - 1$. A: 1 B: -2 C: -1

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

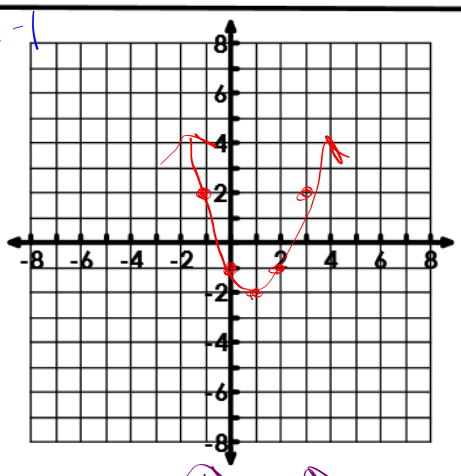
$y = (1)^2 - 2(1) - 1 = -2$

Vertex = (1, ____)

x	-1	0	1	2	3
y	2	-1	-2	-1	2

$(2)^2 - 2(2) - 1$

$(3)^2 - 2(3) - 1$



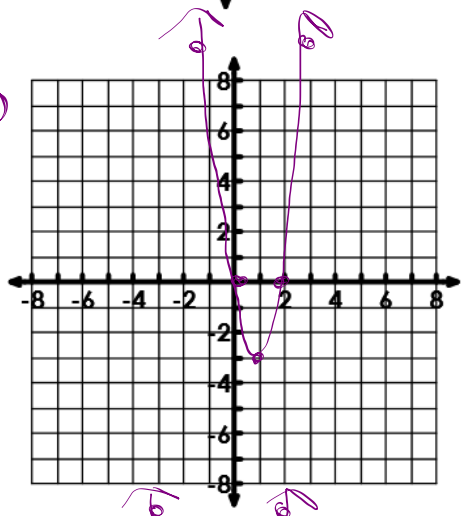
Example 2: Graph: $y = 3x^2 - 6x$. A: 3 B: -6 C: 0

$x = \frac{-b}{2a} = \frac{6}{2(3)} = \frac{6}{6} = 1$

$y = 3(1)^2 - 6(1) = -3$

Vertex = (1, -3)

x	-1	0	1	2	3
y	9	0	-3	0	9



Example 3: Graph $y = 2x^2 + 3$. A: 2 B: 0 C: 3

$x = \frac{-b}{2a} = \frac{0}{2(2)} = \frac{0}{4} = 0$

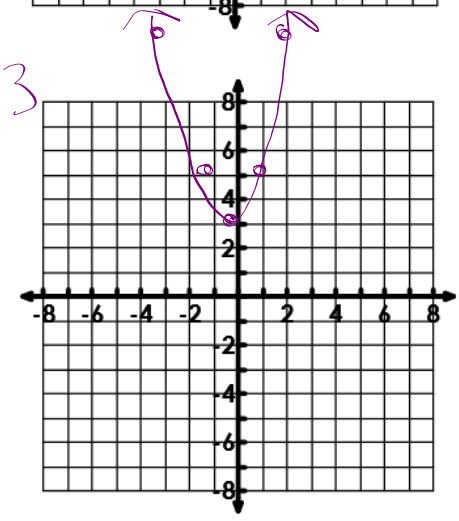
$y = 2(0)^2 + 3$

Vertex = (0, 3)

x	-2	-1	0	1	2
y	11	5	3	5	11

$2(1)^2 + 3$

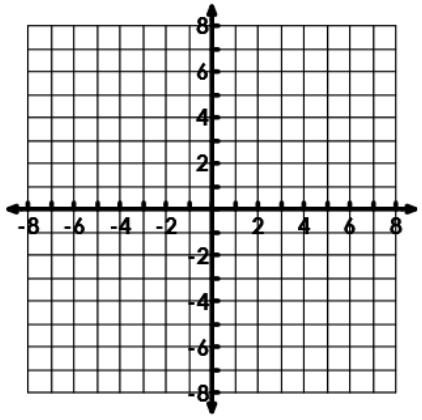
$2(2)^2 + 3$



Algebra 1 Unit 8: Quadratic Functions Notes

Example 4: Graph: $y = -x^2 + 6x - 9$.

Vertex = (_____ , _____)



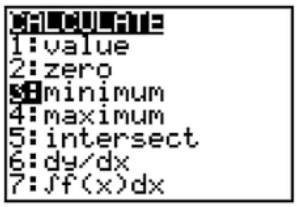
x					
y					

Using a Graphing Calculator to find the Vertex of Quadratics in Standard Form

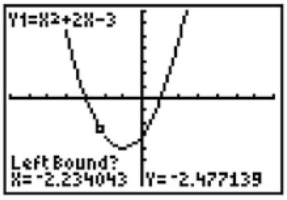
We already know how to graph quadratics, so let's try and find the vertex of these equations using our graphing calculators! Graph $y = x^2 + 2x - 3$

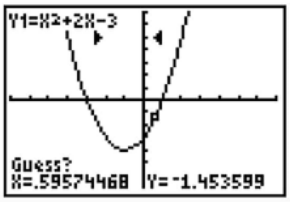
1. Hit **Y =** and enter the equation into y_1.

2. Hit **2nd** followed by **Trace** (you really want the calc function). If your parabola OPENS UP select 3: minimum, if your parabola OPENS DOWN select 4: maximum.

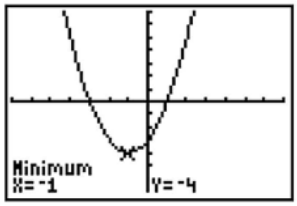


3. (You may have to move the spider left and right using your arrow buttons).
The calculator will ask you "left bound?" hit **Enter**. The calculator will then ask you "right bound?" hit **Enter**. The calculator will then ask you "guess?" hit **Enter**.





4. Your maximum or minimum coordinates will be displayed on the screen and that is your vertex!



Class Practice

Algebra 1 Unit 8: Quadratic Functions Practice

Day 5 – Graphing in Vertex Form
Practice Assignment

Name: _____

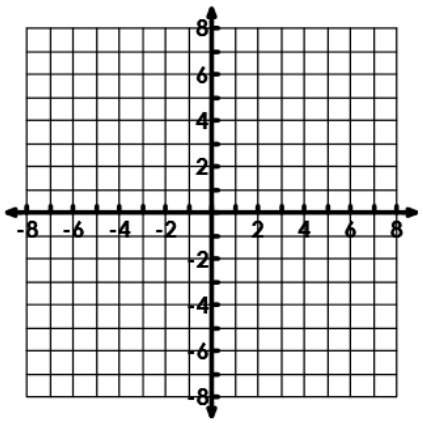
Date: _____ **Block:** _____

Find the vertex of the following equations:

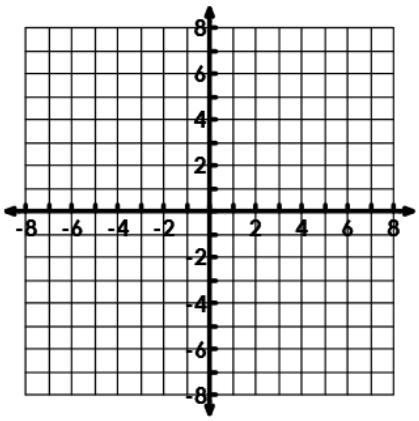
a. $y = 2(x - 28)^2 + 72$ b. $y = (x + 500)^2 - 250$ c. $y = -(x + 22)^2 + 22$

Graph the following quadratic functions:

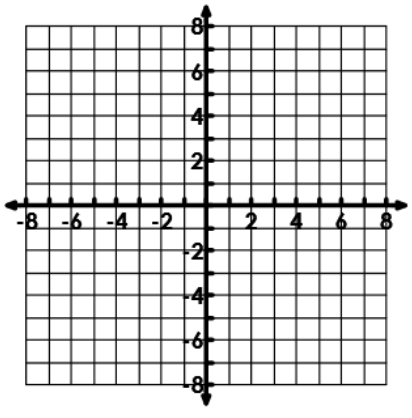
1. $y = (x - 1)^2 + 1$



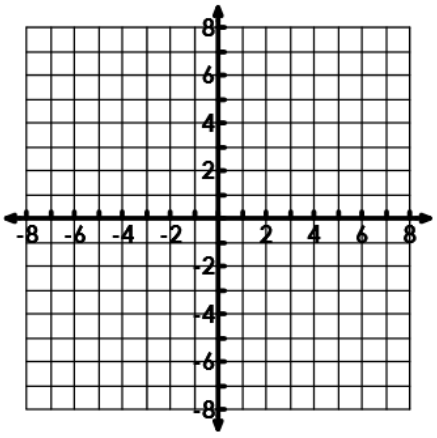
2. $y = (x + 3)^2 + 3$



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



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

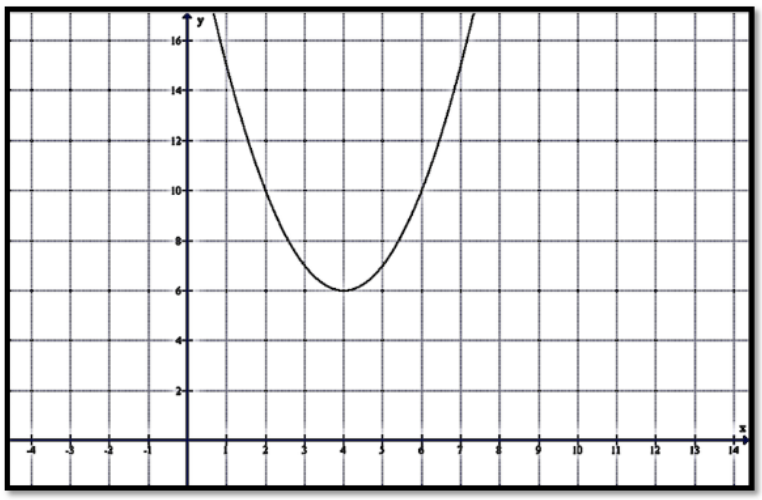


Algebra 1 Unit 8: Quadratic Functions Practice

Match the graph of a quadratic to an equation:

Answer: _____

Equations:
a. $y = -(x + 4)^2 + 6$
b. $y = (x - 4)^2 + 6$
c. $y = 2(x - 4)^2 - 6$
d. $y = (x + 4)^2 + 6$



Review: Factor the following expressions completely.

a. $2x^2 + 16x$

b. $x^2 - 12x + 36$

c. $x^2 - 7x + 6$

d. $5x^2 - 10x - 15$

e. $x^2 + x - 2$

f. $7x^2 - 17x + 10$

g. $3x^2 + 16x + 20$

h. $3x^2 + x - 4$

i. $5x^2 - 12x + 4$

Class Practice

Algebra 1 Unit 8: Quadratic Functions Practice

Day 5 – Graphing in Standard Form **Name:** _____

Practice Assignment **Date:** _____ **Block:** _____

Convert the following equations from vertex to standard form and find the y-intercept:

a. $y = (x - 2)^2 - 8$

b. $y = 2(x + 7)^2 + 1$

Find the vertex of the following:

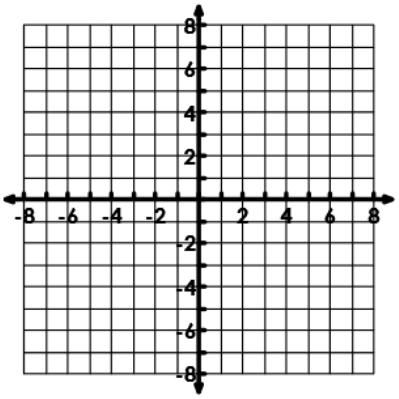
c. $y = 3x^2 - 18x + 17$

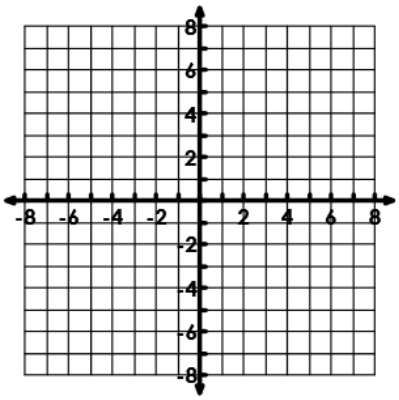
d. $y = -x^2 + 8x - 10$

Graph the following quadratic functions. You must show how you calculated the vertex.

1. $y = x^2 + 6x + 6$

2. $y = -x^2 - 4x - 3$

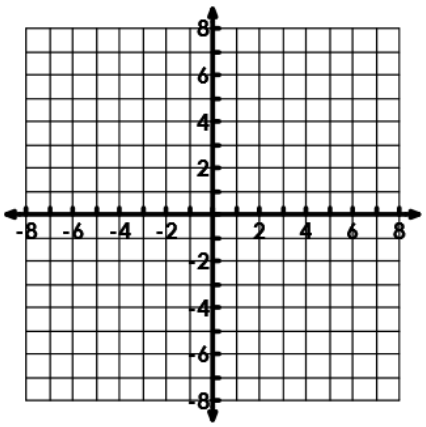


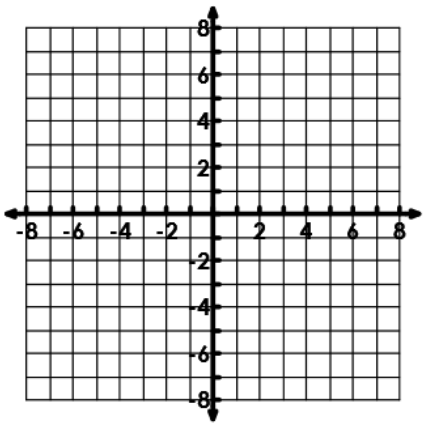


Algebra 1 Unit 8: Quadratic Functions Practice

3. $y = 3x^2 + 6x$

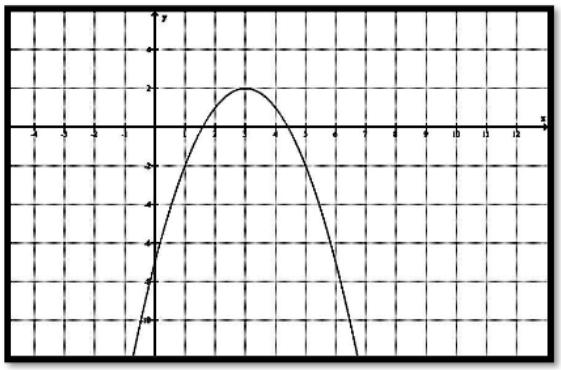
4. $f(x) = -2x^2 - 4x + 1$

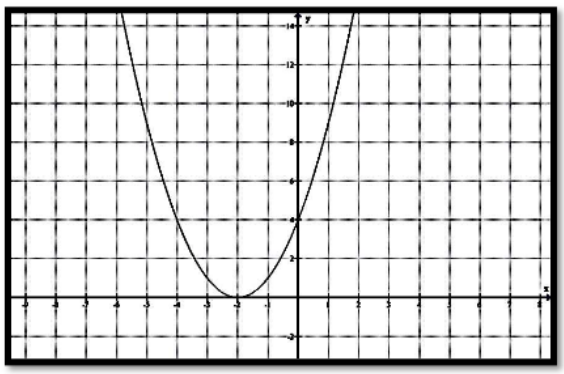




Match the graph of a quadratic to an equation (there will be two answers per graph):

Equations:
a. $y = (x + 2)^2$
b. $y = (x + 3)^2 + 2$
c. $y = -x^2 + 6x - 7$
d. $y = (x + 2)^2 + 1$
e. $y = x^2 + 4x + 4$
f. $y = -(x - 3)^2 + 2$





Answer (top graph)

_____

Answer (bottom graph)

_____