# Warm-Up

Write down the formulas below. We have learned all of them during our Quadratics Unit so far. Next to each formula, write about the formula. What is it called? When do you use it?

Formulas:

1) -b/(2a)

2) $h=-16t^2+vt+c$

3) $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

4) $b^2-4ac$

# Announcements

Complete Hidden Figures by next FRIDAY

Pass back Factoring Test - test corrections due Thursday. (If you are going to be absent on Thursday for any reason, they need to be turned in sooner)

Thursday is the last day of the quarter

Test next Thursday.  This will be a Quarter 4 grade

# Hidden Figures Due Dates

- 21-23 due March 29 (FRIDAY) → Book completed!

When we have finished the novel,
we will watch the movie!

# Unit Map - Quadratics

~~Tuesday, 3/12/2019 - Standard Form of Graphing Quadratics~~
~~Wednesday, 3/13/2019 - Half-Day, HF Reading Day with Substitute Ms. Krupski~~
~~Thursday, 3/14/2019 - Quadratic Functions~~
~~Friday, 3/15/2019 - Solving Quadratic Equations by Graphing with Substitute Ms. Mitchell~~
~~Monday, 3/18/2019 - Solving Quadratic Equations by Factoring~~
~~Tuesday, 3/19/2019 - Review Day~~
~~Wednesday, 3/20/2019 - The Quadratic Formula~~
**Thursday, 3/21/2019 - Vertex Form**
Friday, 3/22/2019 - Quadratic Word Problems
Monday, 3/25/2019 - Word Problems Continued (NC Check-Ins) with Substitute Ms. Mitchell
Tuesday, 3/26/2019 - Systems of Linear and Quadratic Equations
Wednesday, 3/27/2019 - Review Day
**Thursday, 3/28/2019 - Test Day**
**Friday, 3/29/2019 - Begin watching Hidden Figures**

The Quadratics Test will be the first grade of the 4th Quarter.

# Vertex Form of a Quadratic

3/21/2019

Let’s think about the transformations we know for quadratics from previous units… what do you remember?

# Vertex Form of a Quadratic

*SWBAT graph a quadratic equation in vertex form.*

**Vertex Form:**

Where (h, k) is the vertex

The vertex form of a quadratic function is given by $f(x) = a(x - h)^2 + k$, where $(h, k)$ is the vertex of the parabola.

# Vertex Form of a Quadratic

*SWBAT graph a quadratic equation in vertex form.*

## Vertex Form:

The vertex form of a quadratic function is given by $f(x) = a(x - h)^2 + k$, where $(h, k)$ is the vertex of the parabola.

Where (h, k) is the vertex

When written in "vertex form":

- $(h, k)$ is the vertex of the parabola, and $x = h$ is the axis of symmetry.

- the $h$ represents a horizontal shift (how far left, or right, the graph has shifted from $x = 0$).

- the $k$ represents a vertical shift (how far up, or down, the graph has shifted from $y = 0$).

- notice that the $h$ value is subtracted in this form, and that the $k$ value is added.

  If the equation is $y = 2(x - 1)^2 + 5$, the value of $h$ is 1, and $k$ is 5.

  If the equation is $y = 3(x + 4)^2 - 6$, the value of $h$ is -4, and $k$ is -6.

The vertex form of a quadratic function is given by $f(x) = a(x - h)^2 + k$, where $(h, k)$ is the vertex of the parabola.

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When working with the vertex form of a quadratic function,

$$h = \frac{-b}{2a} \text{ and } k = f(h).$$

The "$a$" and "$b$" referenced here refer to $f(x) = ax^2 + bx + c$.

When working with the vertex form of a quadratic function,

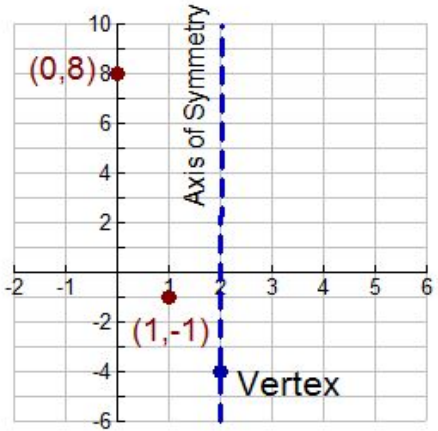
$$h = \frac{-b}{2a} \text{ and } k = f(h).$$

The "$a$" and "$b$" referenced here refer to $f(x) = ax^2 + bx + c$.

Method 2: Using the "sneaky tidbit", seen above, to convert to vertex form:

| $y = ax^2 + bx + c$ form of the equation. | $y = 2x^2 - 4x + 5$ |
|---|---|
| Find the vertex, $(h, k)$.<br>$h = \frac{-b}{2a}$ and $k = f(h)$.<br>[$f(h)$ means to plug your answer for $h$ into the original equation for $x$.] | $a = 2$ and $b = -4$<br>$h = \frac{-(-4)}{2(2)} = \frac{4}{4} = 1$<br>$k = 2(1)^2 - 4(1) + 5 = 3$<br>Vertex: (1,3) |
| Write the vertex form.<br>$y = a(x - h)^2 + k$ | $y = 2(x - 1)^2 + 3$ |

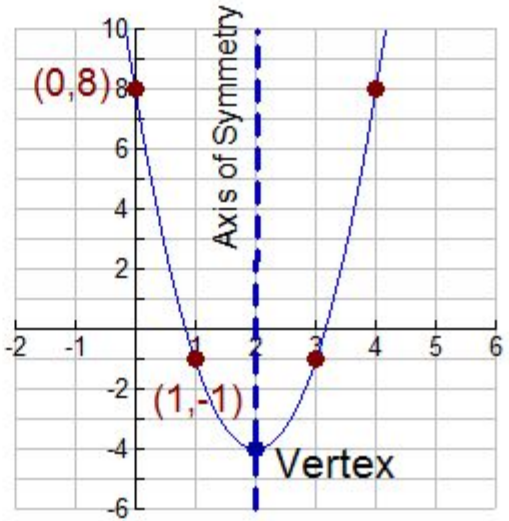
- Graphing a Quadratic Function in Vertex Form:

| | |
|---|---|
| **1.** Start with the function in vertex form: $y = a(x - h)^2 + k$ | $y = 3(x - 2)^2 - 4$ |
| **2.** Pull out the values for $h$ and $k$. If necessary, rewrite the function so you can clearly see the $h$ and $k$ values. $(h, k)$ *is the vertex of the parabola.* Plot the vertex. | $y = 3(x - 2)^2 + (-4)$<br>$h = 2$; $k = -4$<br>Vertex: (2, -4) |
| **3.** The line $x = h$ is the axis of symmetry. Draw the axis of symmetry. | $x = 2$ is the axis of symmetry |
| **4.** Find two or three points on one side of the axis of symmetry, by substituting your chosen $x$-values into the equation.<br><br>For this problem, we chose (to the left of the axis of symmetry):<br><br>$x = 1$; $y = 3(1 - 2)^2 - 4 = -1$<br><br>$x = 0$; $y = 3(0 - 2)^2 - 4 = 8$<br><br>Plot (1, -1) and (0,8) |  |

**5.** Plot the mirror images of these points across the axis of symmetry, or plot new points on the right side.

Draw the parabola.

Remember, when drawing the parabola to avoid "connecting the dots" with straight line segments. A parabola is curved, not straight, as its slope is not constant.



- To Convert from Vertex Form to $y = ax^2 + bx + c$ Form:

Simply multiply out and combine like terms:

$$y = 2(x - 1)^2 + 3$$
$$y = 2(x^2 - 2x + 1) + 3$$
$$y = 2x^2 - 4x + 2 + 3$$
$$y = 2x^2 - 4x + 5$$

# Classwork/Homework

Please complete all questions on the rest of the slide in your notes section.  What you do not finish in class will become your homework tonight.

# State the vertex of a function given in vertex form

**Example 1:** State the vertex of the following functions.

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

b) $y = (x+3)^2 - 2$

c) $y = -(x+6)^2$

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

# Write the equation in vertex form given information

**Example 2:** Write the equation in vertex form with the given information.

a) Vertex: (-6, 5); a = 12
b) Vertex: (4, -2); a = -3
c) Vertex: (-3, -8); a = 1

d) Vertex: (7, 2); a = .06
e) Vertex: (0, -8); a = 12
f) Vertex: (-6, 0); a = -9

# Graph from vertex form

**Example 3:** Graph each of the following.

a) $y = 1/2(x-6)^2 - 3$

Opens: _____

AOS: _____

Vertex: _____

Y-Int: _____

b) $y = -3(x+4)^2 + 7$

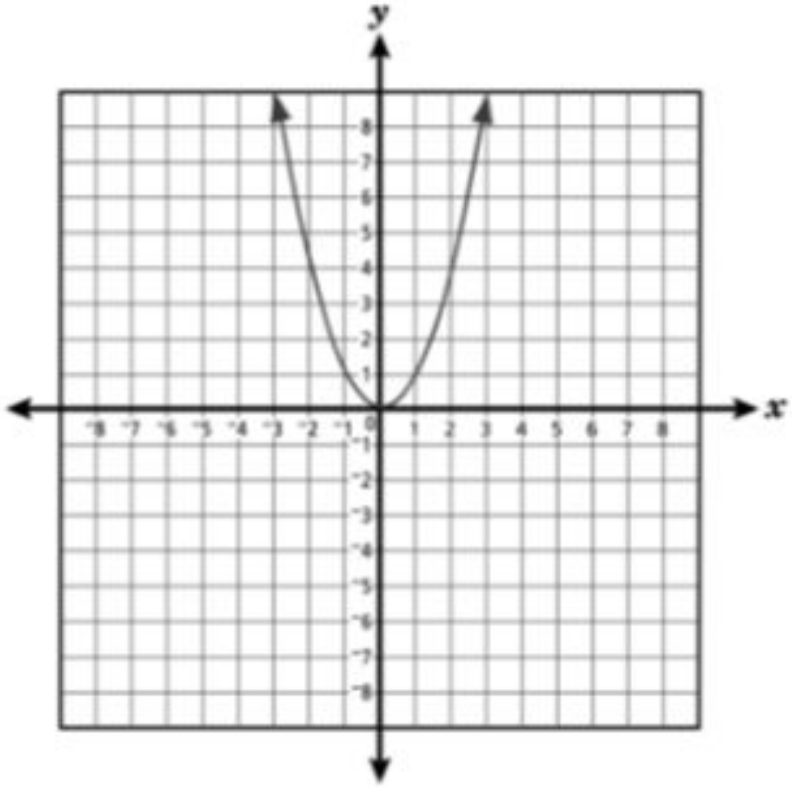
Opens: _____

AOS: _____

Vertex: _____

Y-Int: _____

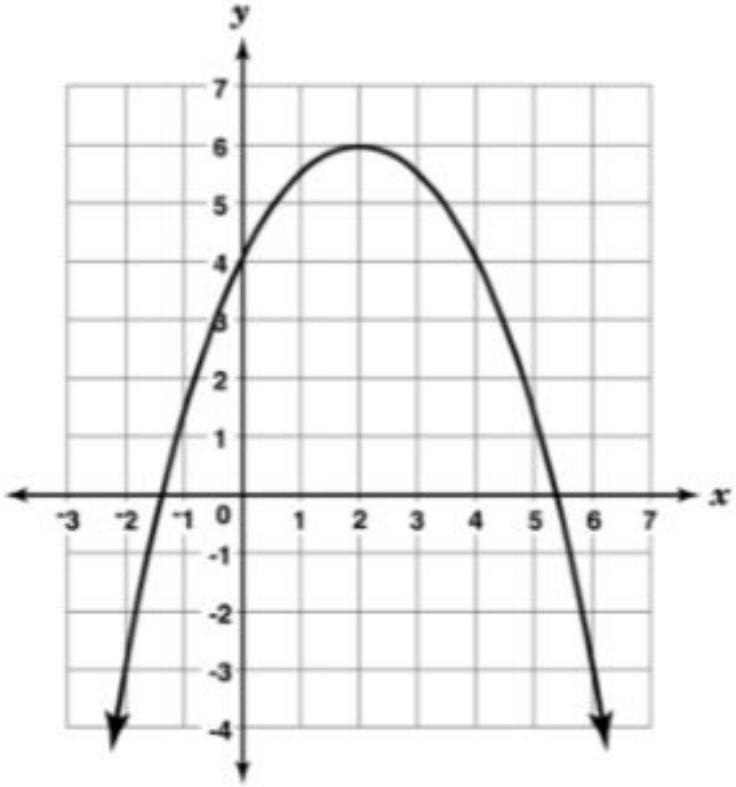
Study the graph of $y = x^2$, shown below.




If the graph is moved up 3 units, what equation will it represent?

a) $y = x^2 + 3$ b) $y = (x + 3)^2$ c) $y = (x - 3)^2$ d) $y = x^2 - 3$

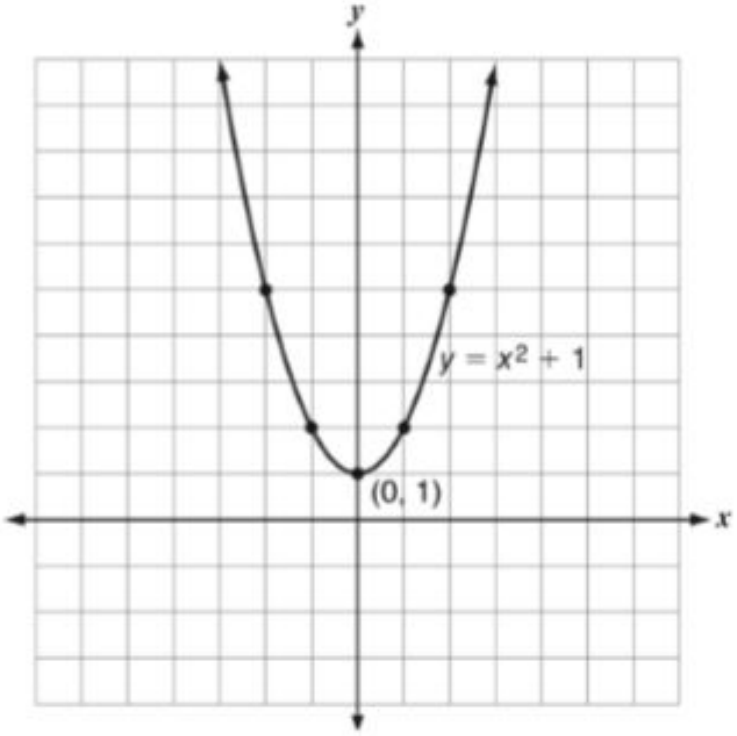
Look at the graph below.




Which of these terms describes the $y$-coordinate of the point $(2, 6)$?

a) zero b) intercept c) minimum d) maximum

Beth and Jacob are graphing two equations on a coordinate grid. Beth has graphed the equation $y = x^2 + 1$.




If Jacob graphs $y = x^2 + 3$, where will his graph be in relation to the graph Beth made?

a) 2 units up

b) 3 units up

c) 2 units to the left

d) 3 units to the right

Which of the following statements describes the graph of the parabola with the equation $y = -3x^2$?

a) The graph opens upward, and the vertex is $(0, 0)$.

b) The graph opens upward, and the vertex is $(0, -3)$.

c) The graph opens downward, and the vertex is $(0, 0)$.

d) The graph opens downward, and the vertex is $(0, -3)$.

In which table is $y$ a nonlinear function of $x$?

a)

| $x$ | $y$ |
|---|---|
| 1 | 5 |
| 2 | 6 |
| 3 | 7 |

b)

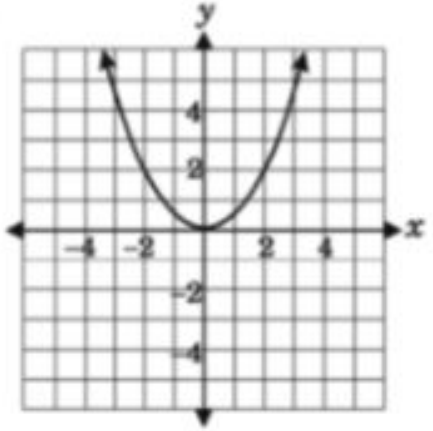
| $x$ | $y$ |
|---|---|
| 1 | 4 |
| 2 | 7 |
| 3 | 12 |

c)

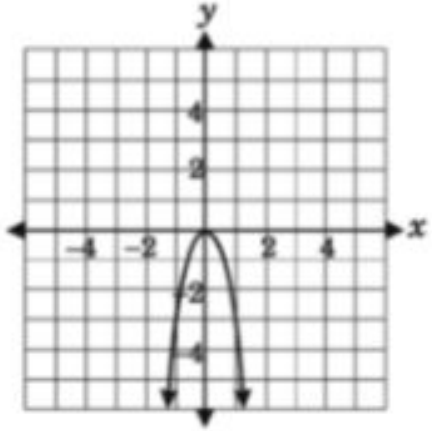
| $x$ | $y$ |
|---|---|
| 1 | 2 |
| 2 | 4 |
| 3 | 6 |

Each graph below represents an equation of the form $y = ax^2$. Which graph represents the equation with the greatest value for $a$?

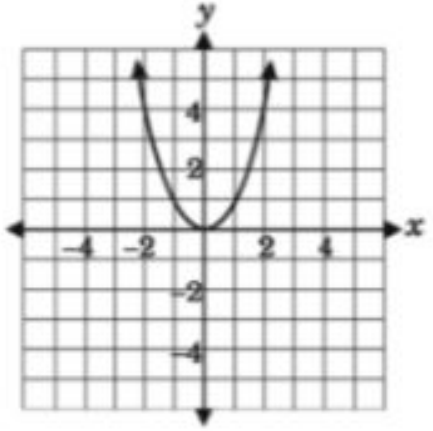
a)



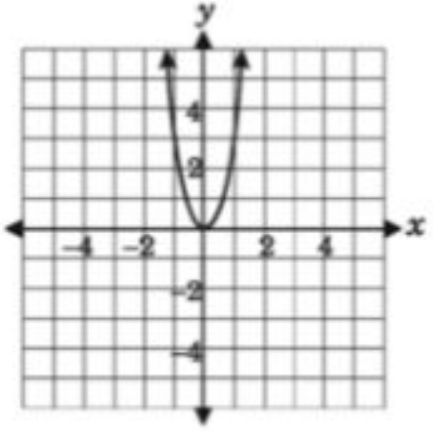

b)




c)

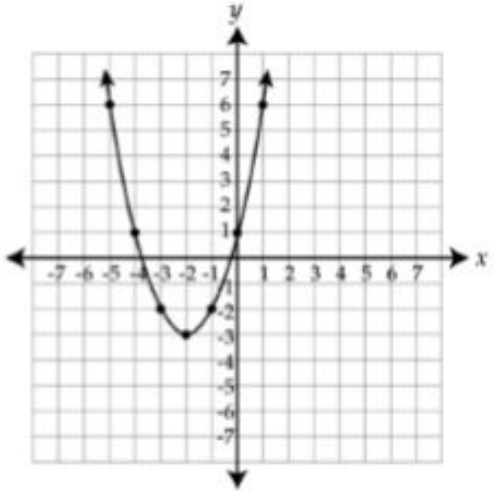



d)

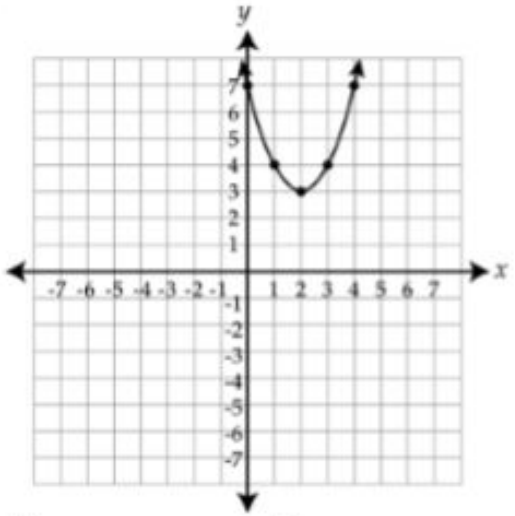


Which graph represents the function $y = -(x-2)^2 + 3$?

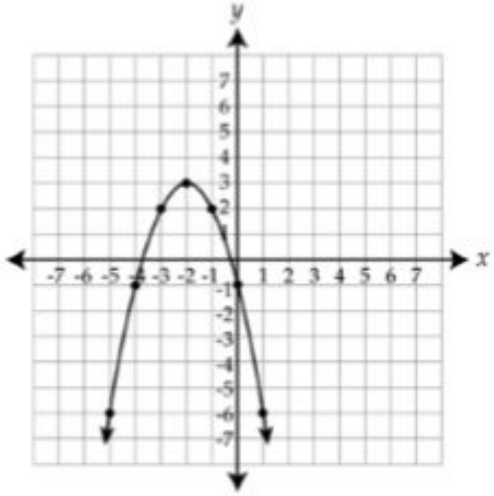
a)



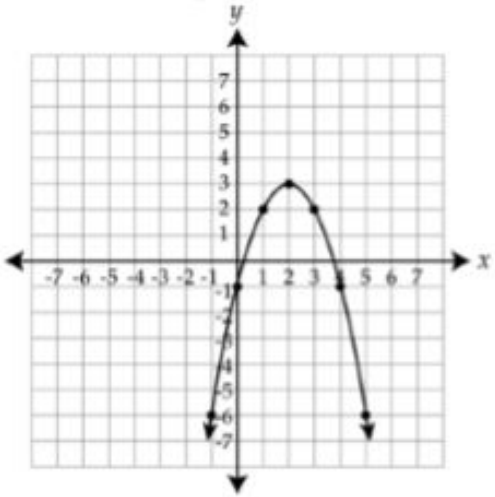
b)



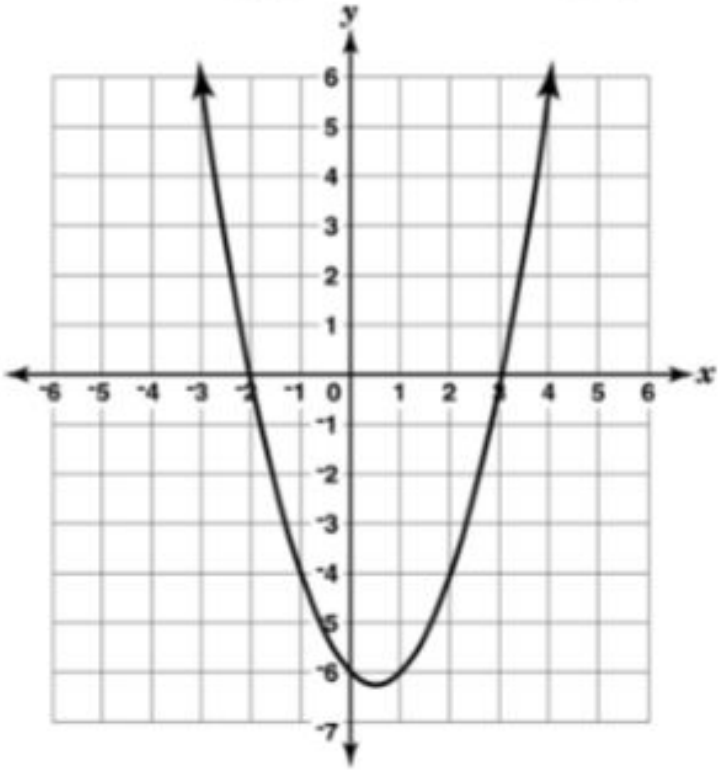
c)



d)



The function $f(x) = x^2 - x - 6$ is graphed on the grid below.




What are the zeros of this function?

a) $-2$ and $3$ b) $0$ and $-6$ c) $\frac{1}{2}$ and $-6\frac{1}{4}$ d) $-\frac{1}{2}$ and $6\frac{1}{4}$

**If you finish early…**

Grab a Hidden Figures book and do some reading

**If you do not finish…**

This is your homework tonight