**Algebra 2 Chapter 4 Calendar**                    Name: _____

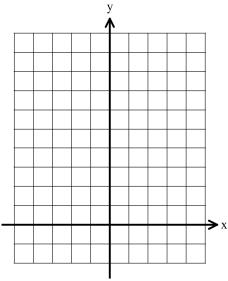| Day | Date | Assignment (Due the next class meeting) |
|---|---|---|
|  | See Teams | 4.1 Worksheet<br>*Graphing quadratics in (h,k) form* |
|  | See Teams | 4.2 Worksheet<br>*Rewriting Quadratic Functions into vertex (h,k) form* |
|  | See Teams | 4.3 Worksheet<br>*Solving from (h,k) form using square roots* |
|  | See Teams | 4.3 Worksheet<br>*Solving from (h,k) form using square roots* |
|  | See Teams | 4.4 Worksheet<br>*More graphing - identify key features of quadratics* |
|  | See Teams | Ch 4 Review and Foldable<br>*Converting to standard, vertex, and intercept form* |
|  | See Teams | Ch 4 Practice Test |
|  | See Teams | **Ch 4 Test**<br>5.1 Worksheet<br>*Adding/Subtracting Polynomials* |

✹  Be prepared for daily quizzes.
✹  Every student is expected to do every assignment for the entire unit.
✹  Try www.khanacademy.org if you need help outside of school hours.
✹  Students who complete 100% of their homework for the semester will receive a 2% bonus!

# 4.1: Graphing in *(h,k) form* or *vertex form*

The Parent Function of the Quadratic:
$$y = x^2$$

| x | $y = x^2$ |
|---|---|
|   |   |
|   |   |
|   |   |
|   |   |
|   |   |

$$\boxed{y = a(x - h)^2 + k}$$

## This is called <u>*vertex form*</u> or <u>*(h, k) form*</u> or <u>*graphing form*</u>!

**Examples:**

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

Transformations?

Vertex:                    y-intercept:

Max/Min:

Domain:          Range:

Axis of symmetry:

2. $y = -(x - 3)^2 + 6$
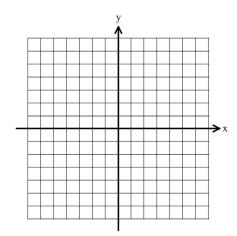
Transformations?

Vertex:                    y-intercept:

Max/Min:

Domain:          Range:

Axis of symmetry:

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

Transformations?

Vertex:                    y-intercept:

Max/Min:

Domain:          Range:

Axis of symmetry:

**4.** $y = -x^2 + 6$
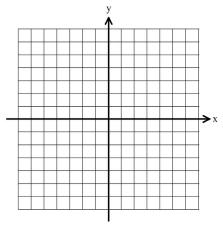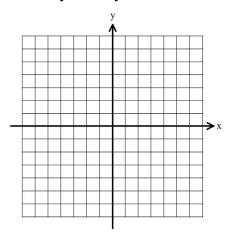
Transformations?

Vertex:                    y-intercept:

Max/Min:

Domain:          Range:

Axis of symmetry:

_You try!!!_

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

Transformations?

Vertex:                    y-intercept:

Max/Min:

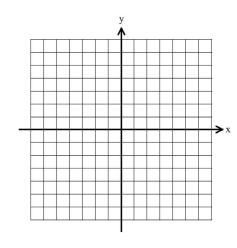Domain:          Range:

Axis of symmetry:

b) $y = -(x-2)^2 + 1$
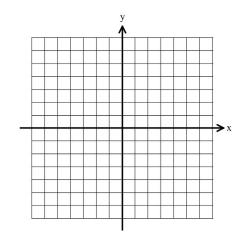
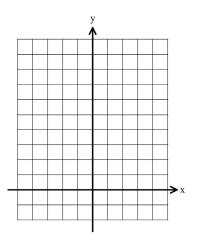Transformations?

Vertex:                    y-intercept:
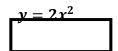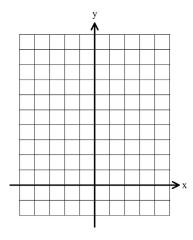
Max/Min:

Domain:          Range:

Axis of symmetry:

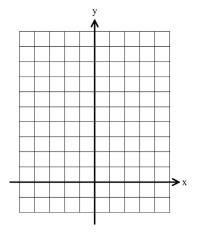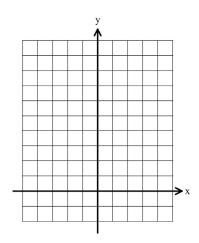When $a = 1$ $or$ $a = -1$, there's no stretch or compression.... $\boxed{y = x^2}$

$y$

$x$

When $a = 2$... $\boxed{y = 2x^2}$

$y$

$x$

When $a = 4$... $y = \boxed{4x^2}$

$y$

$x$

When $a = \frac{1}{2}$... $y = \boxed{\frac{1}{2}x^2}$

$y$

$x$

When $a > 1$, $a$ is said to be <u>STRETCHED</u>.

When $0 < a < 1$, $a$ is said to be <u>COMPRESSED</u>.

**Examples:**

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

Transformations?

Vertex:                    y-intercept:

Max/Min:

Domain:          Range:

Axis of symmetry:

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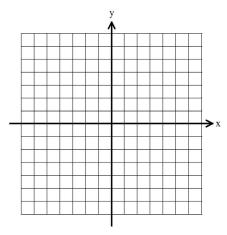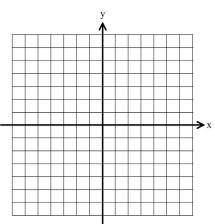
Transformations?

Vertex:                    y-intercept:

Max/Min:

Domain:          Range:

Axis of symmetry:

3. $y = \frac{1}{2}(x + 4)^2 - 1$
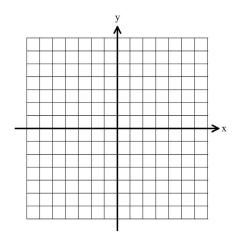
Transformations?

Vertex:                    y-intercept:

Max/Min:

Domain:          Range:

Axis of symmetry:

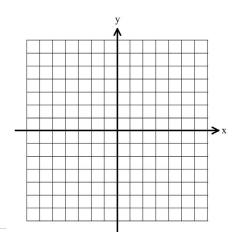4. $y = -\frac{1}{3}x^2$

Transformations?

Vertex:                    y-intercept:

Max/Min:

Domain:          Range:

Axis of symmetry:

# 4.2: Rewriting Quadratic equations into vertex (h, k) form

ESQ: Can you rewrite a quadratic equation in vertex form?

**Vertex Form:**

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

Vertex: (h, k)

**Standard Form:**

$$y = ax^2 + bx + c$$

Vertex: $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$

**Example 3: Rewrite the equation in vertex form.**

$$y = 4x^2 - 24x + 31$$

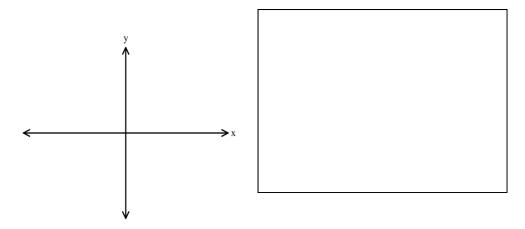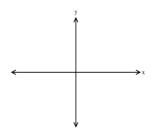| Steps to writing an equation in vertex form: |
|---|
| 1) Put the equation in _____ form. <br><br> $$y = ax^2 + bx + c$$ |
| 2) Identify a, b, and c. |
| 3) Find the x-coordinate of the vertex using the equation <br><br> $$h = -\frac{b}{2a}$$ |
| 4) Find the y-coordinate of the vertex by evaluating <br><br> $$k = f(-\frac{b}{2a})$$ |
| 5) Substitute a, h, and k into the equation. <br><br> $$y = a(x - h)^2 + k$$ |

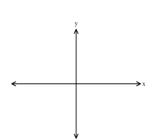**Example 4:** Write the following equations in (h, k) form, then write the vertex and draw a sketch.

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



b.) $y = x^2 - 8x + 25$

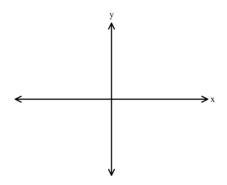c.) $y = 3x^2 - 6x - 2$





What is the range in example b?

What is the max/min in example c?

What are the transformations in example b?

What is the y-intercept in example c?

_**You try!!!**_
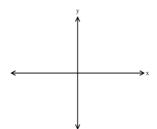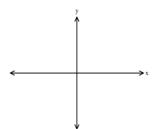d.) $y = x^2 + 8x + 12$

**Example 5:**  Write the following equations in (h, k) form, then write the vertex and draw a sketch.
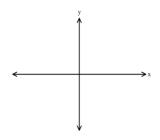
a.) $y = x^2 + 18x + 4$                                    b.) $y = 2x^2 + 20x + 6$

c.)  $y = -2x^2 - 8x + 5$                                 d.) $y = -x^2 + 18x + 4$

*You try!!!*

e.) $y = 2x^2 + 8x + 12$

**Example 6:**

What are the transformations on the function $y = 2x^2 + 12x + 19$?

## 4.3: Solving Quadratics Using Square Roots

*Can you solve an equation by square rooting?  Can you graph a function including the vertex AND the x-intercepts?*

Work with a partner to solve the following quadratics by Square Rooting.  If needed, write answers in terms of $i$, and simplify radical answers.

1) $x^2 + 25 = 0$ 

2) $-3x^2 - 30 = 6$

3) $(x - 2)^2 - 9 = 0$ 

4) $\frac{1}{4}(y - 6)^2 = 8$

## Solving Quadratics by Square Rooting

- We can have _____ solution, _____ solution (0), or _____ solutions.

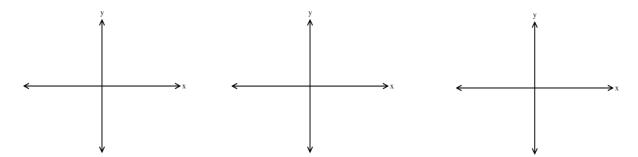Now that we can change a quadratic function from standard form to vertex form, we can easily find the **vertex**. In order to find the **solutions** (roots, x-intercepts, zeros), all we need to do is solve by using **square roots**.

**Example 1)** Solve $y = x^2 - 8x - 33$ by rewriting in vertex form and graph completely.

| Steps to solving in vertex (h, k)form |
| --- |
| 1) Rewrite the equation in vertex form. |
| 2) Graph the vertex |
| 3) Set y = 0 and solve by using square roots. |
| 4) graph x-intercepts (solutions) |

**Example 2)** Solve $y = -x^2 - 2x + 3$ by rewriting in vertex form and graph completely.

y

x

Vertex:                           Solutions:

Domain:                        Range:

Max/Min:                      y-intercept:

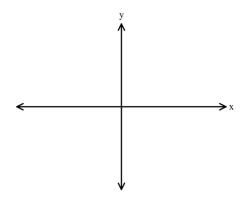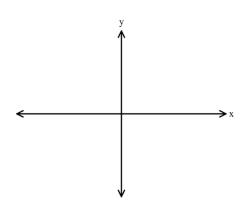**Example 3)** Solve $y = x^2 + 6x + 9$ by rewriting in vertex form and graph completely.

y

x

Vertex:                           Solutions:

Domain:                        Range:

Max/Min:                      y-intercept:

*You try!!!*
a) $y = x^2 - 4x - 21$



Vertex:                     Solutions:

Domain:                     Range:

Max/Min:                    y-intercept:

**Example 4)** A football is kicked in the air, and its path can be modeled by the equation $f(x) = -16(x - 5)^2 + 21$, where x is the horizontal distance (in feet) and f(x) is the height. What is the maximum height of the football?

**Example 5)** A rocket is launched off a platform with an initial velocity of 19.6 meters per second. The path of the rocket can be modeled by the equation $h = -4.9(t - 2)^2 + 78.4$ where $h$ is the height of the rocket, and $t$ is the time in seconds.

What is the maximum height the rocket reaches?

After how many seconds will the rocket hit the ground?

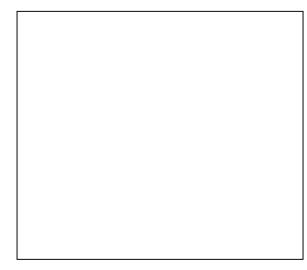**Example 6)** Given the function $f(x) = x^2 + 2x + 7$, state whether the parabola opens up or down and the maximum or minimum. What do you need to find the maximum or minimum?
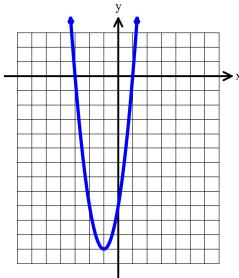
## 4.4: More Graphing - Key Features of Quadratics

*Can you identify key features of a quadratic and analyze....*

With a partner, fill in the tables...

1.) If $(x + 3)(x - 1) = (x - h)^2 + k$, then what is the value of k?

2.) Find the vertex from #1

3.) What is the vertex of the function $y = 3.2(x + 4)^2 - 5.1$?

4.) What is the y-intercept of the function $f(x) = -2(x - 3)^2 + 10$?

5.) What are the zeroes of the function $h(x) = -3(x + 4)^2 + 3$?

6.) What are the x-intercepts of the function $y = x^2 + 6x - 27$?

7.) A parabola has a vertex of $(-1, -5)$ and passes through the point $(3, -37)$. In the $y = a(x - h)^2 + k$ form of the parabola, what is the value of $a$?

8.) A parabola has a vertex of $(5, 2)$ and passes through the point $(6, 3)$. In the $y = a(x - h)^2 + k$ form of the parabola, what is the value of $a$?
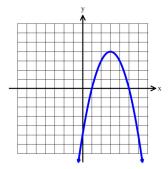
*You try!*

9.) A parabola has a vertex of $(-4, 3)$ and passes through the point $(-2, 19)$. In the $y = a(x - h)^2 + k$ form of the parabola, what is the value of $a$ ?

10.) If $g(x) = -x^2 + 10x - 21 = a(x - h)^2 + k$, then what is the value of $k$?

11.) Which of the following functions have the range $[\,4, \infty\,)$ ?

A) $y = 2(x + 3)^2 + 4$               C) $y = (x + 2)^2$

B)               D) $f(x) = 2x^2 + 6x + 4$

12.) The graph $f(x) = x^2$ has a vertical stretch by a factor of 5 and is reflected vertically. What is the equation of the function after the transformation?

13.) Describe in words how the graph of $g(x) = \frac{1}{2}(x + 4)^2 - 3$ would be transformed from the parent function $f(x) = x^2$.

14.) The graph $f(x) = x^2$ is compressed by a factor of $\frac{2}{3}$, shifted 3 units to the left, and 6 units up. What is the equation of the function after the transformation?

15.) When evaluating the function f(x) = $-2(x + 1)^2 + 3$ for any real number x, what must be true about the value of f(x) ?

**Example 16:** The storage building shown can be modeled by the graph of the function $y = -x^2 + 24x - 44$ where $x$ is the horizontal distance and $y$ is the height (in cm). What is the maximum height of the building?



What is the width of the building at the base?

17.) Compare the two functions represented below. Determine which of the following statements is true.

| Function $f(x)$ | Function $g(x)$ |
|---|---|
|  | $g(x) = (x - 1)^2 + 6$ |

I. $f(x)$ and $g(x)$ have the same y-intercept.

II. $f(x)$ and $g(x)$ have the same roots.

III. $f(x)$ and $g(x)$ have the same axis of symmetry.

IV. $f(x)$ and $g(x)$ have the same range.