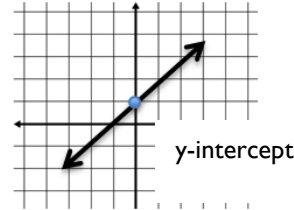
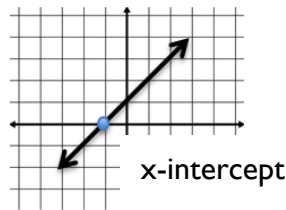


Secondary 2H: UNIT 2

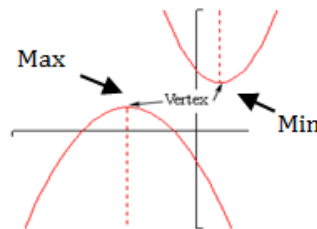
Finding Key Points on the Graph

Vocabulary

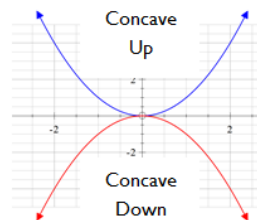
- The **x-intercept (also called zero)** is the point where a graph crosses or touches the x-axis. It is the ordered pair $(x, 0)$, where x is a real number. **The x-intercept is where $y = 0$.**
- The **y-intercept** is the point where a graph crosses or touches the y-axis. It is the ordered pair $(0, y)$, where y is a real number. **The y-intercept is where $x = 0$.**



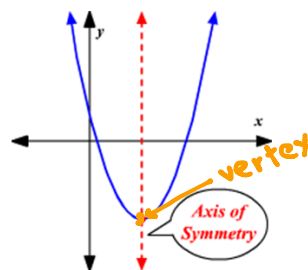
- The **vertex** of a parabola is the **high point or low point in the curve**. The **vertex** is also the **minimum or maximum** value of the parabola.
- A **maximum** occurs when the y-value is greater than all of the y-values near it. A quadratic function has only one **maximum** value.
- A **minimum** occurs when the y-value is less than all of the y-values near it. A quadratic function has only one **minimum** value.



- The parabola will be **concave up** if the leading coefficient is positive or **concave down** if the leading coefficient is negative.

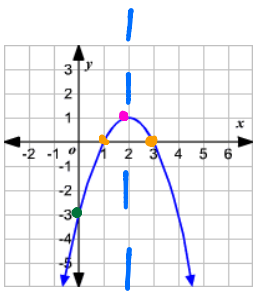


- Every parabola has an **axis of symmetry** which is the line that runs down its 'center.' This line divides the graph into two perfect halves.
- **The axis of symmetry is the x-coordinate of its vertex or the midpoint between the x-intercepts.**
- **Vertex form** of a parabola is $y = (x - h)^2 + k$. **The vertex is (h, k) .** **The axis of symmetry in the equation $x = h$.**

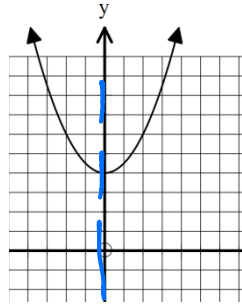


Finding Key Points off of a Graph

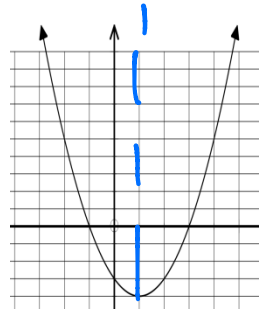
For each graph, find the x and y intercepts and the vertex. Is the vertex a maximum or a minimum? Draw a dotted line for the axis of symmetry and write the equation for the axis of symmetry.



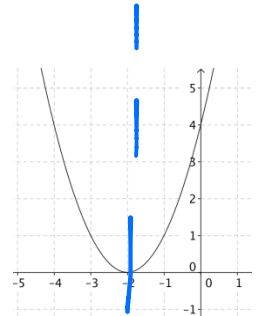
y-intercept: $(0, -3)$
 x-intercept(s): $(1, 0)$ & $(3, 0)$
 vertex: $(2, 1)$ *max value is 1*
 MAX or MIN when x is 2.
 axis of symmetry: $x = 2$



y-intercept: $(0, 4)$
 x-intercept(s): NA
 vertex: $(0, 4)$ *min value is 4*
 MAX or MIN when x is 0.
 axis of symmetry: $x = 0$



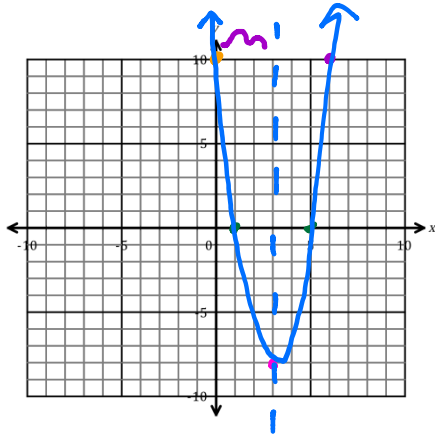
y-intercept: $(0, -3)$
 x-intercept(s): $(-1, 0)$ & $(3, 0)$
 vertex: $(1, -4)$ *min value is -4*
 MAX or MIN when x is 1.
 axis of symmetry: $x = 1$



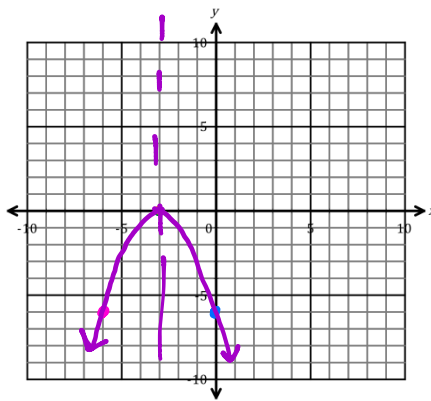
y-intercept: $(0, 4)$
 x-intercept(s): $(-2, 0)$
 vertex: $(-2, 0)$ *min value is 0*
 MAX or MIN when x is -2.
 axis of symmetry: $x = -2$

Sketch the graph of the quadratic functions given the key features. Label the key features on your graph.

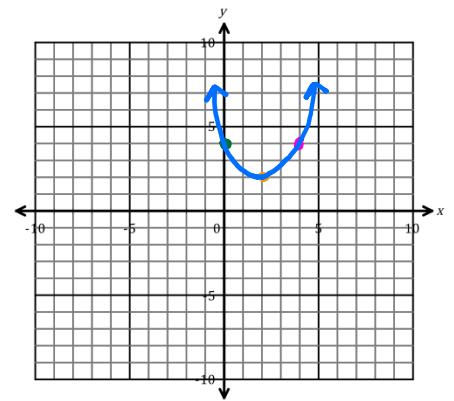
1. x-intercepts: $(1, 0)$ & $(5, 0)$
 y-intercept: $(0, 10)$
 minimum: $(3, -8)$



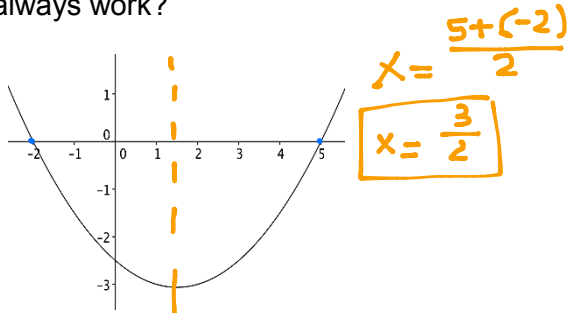
2. x-intercept: $(-3, 0)$
 y-intercept: $(0, -6)$
 maximum: $(-3, 0)$



3. x-intercept: none
 y-intercept: $(0, 4)$
 minimum: $(2, 2)$



You are presented with the graph below. How could you find the exact coordinates of the vertex? Will this method always work?



axis of symmetry

Finding Key Points off of a Table

Find the **minimum point (vertex)** of the function given a table of values.

1. Look for the lowest y-value.
2. Check if the lowest y-value is "evenly sandwiched" between the same value.

Find the **maximum point (vertex)** of the function given a table of values.

1. Look for the highest y-value.
2. Check if the highest y-value is "evenly sandwiched" between the same value.

Use the table to identify the x and y intercepts and the vertex. Is the vertex a maximum or a minimum? Write an equation for the axis of symmetry.

1.

x	y
0	5
1	0
2	-3
3	-4
4	-3
5	0
6	5

y-intercept: $(0, 5)$
 x-intercept(s): $(1, 0)$ & $(5, 0)$
 vertex: $(3, -4)$
 MAX or MIN $\text{min value is } -4 \text{ when } x \text{ is } 3$
 axis of symmetry: $x = 3$
 concave up or down? **concave up**



2.

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

y-intercept: $(0, 0)$
 x-intercept(s): $(0, 0)$
 vertex: $(0, 0)$
 MAX or MIN $\text{min value is } 0 \text{ when } x \text{ is } 0$
 axis of symmetry: $x = 0$
 concave up or down? **concave up**



3.

x	y
-2	1
-1	6
0	9
1	10
2	9
3	6
4	1

y-intercept: $(0, 9)$
 x-intercept(s):
 vertex: $(1, 10)$
 MAX or MIN $\text{max value is } 10 \text{ when } x \text{ is } 1$
 axis of symmetry: $x = 1$
 concave up or down? **concave down**



Finding Key Points off of an Equation

When given an equation, we can find the key points algebraically. We will cover this in more depth Unit 4, but for now:

- To find the **y-intercept**, we **set $x=0$ and solve for y** .



- To find the **x-intercept(s)**, we **set $y=0$ and solve for x** .



Practice:

Find the intercepts.

1. $y = x^2 - 9$

y-intercept: $(0, -9)$
 $y = 0^2 - 9$
 $y = 0 - 9$
 $y = -9$

2. $y = x^2$

y-intercept: $(0, 0)$
 $y = 0^2$
 $y = 0$

3. $y = 3(x-1)^2 + 7$

y-intercept: $(0, 10)$
 $y = 3(0-1)^2 + 7$
 $y = 3(-1)^2 + 7$
 $y = 3(1) + 7$
 $y = 3 + 7$
 $y = 10$

4. $y = 16x^2 + 59x + 3$

y-intercept:

x-intercept(s): $(3, 0)$ & $(-3, 0)$

$0 = x^2 - 9$
 $\sqrt{9} = \sqrt{x^2}$ $x = \pm 3$

x-intercept(s): $(0, 0)$

$0 = x^2$
 $\sqrt{0} = x$

x-intercept(s): NA

$0 = 3(x-1)^2 + 7$
 $-7 = 3(x-1)^2$
 $\frac{0}{3} = (x-1)^2$

x-intercept(s):

EXAMPLES:

Julie wadded up a piece of paper while sitting at her desk and threw it in the garbage can across the room. The graph represents the height and time of the paper wad during its flight.



a. What does the x-intercept on the graph represent?

When the paper wad hits the ground.

b. What does the y-intercept on the graph represent?

How high the paper wad was when Julie threw it.



Suppose you throw a ball straight up in the air. The height (in feet) of the ball after time (in seconds) is modeled by the equation $h(t) = -16t^2 + 48t$. The table below shows how the height of the ball changes as it goes up and then returns to the ground.



a. Describe how the height of the ball changes over the 3-second time period.

The ball starts at 0 feet, after .5 seconds the ball is at 20 feet. The ball increases to 36 feet at 1.5 seconds. The ball starts its descent after 1.5 seconds until it hits the ground at 3 seconds.

t	h(t)
0	0
.5	20
1	32
1.5	36
2	32
2.5	20
3	0

b. Describe the shape of the graph. Use vocabulary words. 😊

The graph is a concave down parabola because the y-values increase and then decrease and the leading coefficient is negative. The vertex is (1.5, 36) because the y-value is evenly sandwiched between 32. The vertex is a maximum point.

c. When does the ball reach its maximum height?

At 1.5 seconds the ball reaches its maximum height of 36 feet.