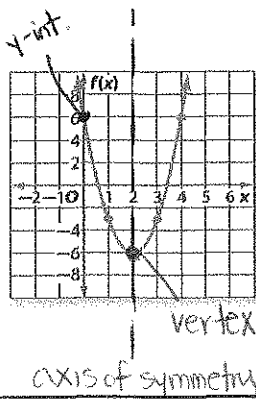


Graphing using the Axis of Symmetry

LT 3.2

Axis of Symmetry is a line through the graph of a parabola that divides the graph into two congruent halves. Each side of the parabola is a reflection of the other side.

The axis of symmetry will intersect a parabola at only one point, called the vertex.



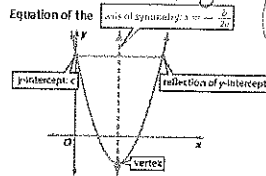
Formula

Key Concept: Graph of a Quadratic Function—Parabola

Words

- Consider the graph of $y = ax^2 + bx + c$, where $a \neq 0$.
- The y-intercept is $a(0)^2 + b(0) + c$ or c .
- The equation of the axis of symmetry is $x = -\frac{b}{2a}$.
- The x-coordinate of the vertex is $-\frac{b}{2a}$.
- The y-coordinate of the vertex is $a\left(-\frac{b}{2a}\right)^2 + b\left(-\frac{b}{2a}\right) + c$.

Model



- Graph the quadratic function.

Y-intercept:
Where the graph crosses the y-axis.
(0, y)

Y-intercept

where it crosses (graph)

the y-axis only

so $x=0$.

Rule: axis of symmetry $x = -\frac{b}{2a}$
x-coordinate of the vertex

Steps

1) Find the y-intercept ($x=0$ or c term)

1. Terms: a, b, c

- Find the y-intercept
- Find the equation of the axis of symmetry, vertex
- Find the x-coordinate of the vertex
- Find the y-coordinate of the vertex
- Graph the quadratic function.

Ex 1: $f(x) = ax^2 + bx + c$
 $f(x) = 1x^2 + 4x - 3$
 $a = 1 \quad b = 4 \quad c = -3$

Ex 1. $f(x) = x^2 + 4x - 3$

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

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

$$a = 1 \quad b = 4 \quad c = -3$$

1. y-intercept: (0, y)

$$f(0) = 1(0)^2 + 4(0) - 3$$

$$f(0) = 1(0) + 0 - 3$$

$$f(0) = 0 + 0 - 3 = -3$$

(0, -3)

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

$$a = 1 \quad b = 4 \quad c = -3$$

$$\text{Vertex} = x = -2$$

3. Find the y-coordinate of the vertex

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

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

$$f(-2) = 4 - 8 - 3$$

$$f(-2) = -4 - 3 = -7$$

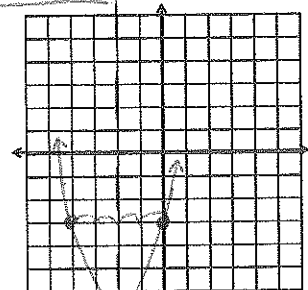
(-2, -7)

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

③ $f(-2) = (-2)^2 + 4(-2) - 3$

4. Graph the quadratic function.

axis of symmetry



vertex

Example 2

GP: $f(x) = -5x^2 - 10x + 6$.

1. Find the y-intercept
2. Find the equation of the axis of symmetry.
3. Find the x-coordinate of the vertex
4. Find the y-coordinate of the vertex
5. Graph the quadratic function.

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

$$f(x) = -5x^2 - 10x + 6$$

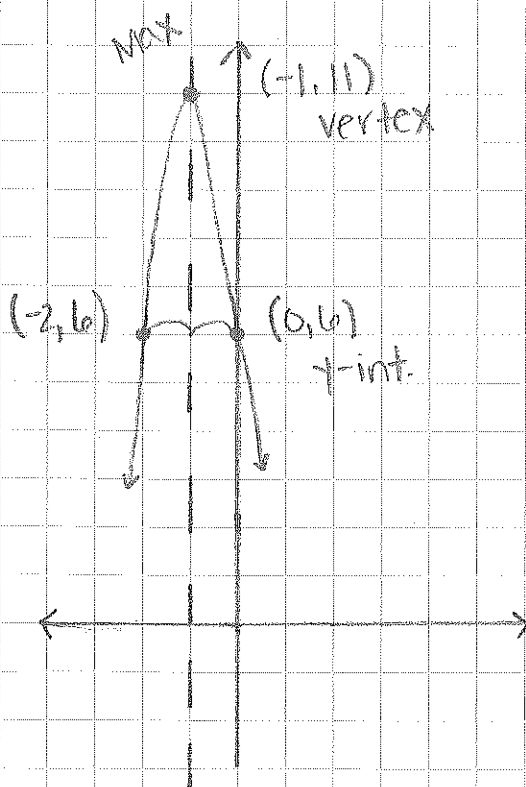
$a = -5$ $b = -10$ $c = 6$ use this ex later

① $f(0) = -5(0)^2 - 10(0) + 6$
 $f(0) = 6$
 $(0, 6)$: y-intercept

② $x = -b/2a = -(-10)/2(-5)$
 $x = \frac{10}{-10} = -1$

③ $f(-1) = -5(-1)^2 - 10(-1) + 6$
 $f(-1) = -5 + 10 + 6 = 5 + 6 = 11$

vertex : $(-1, 11)$



Example 3

Guided Practice

Now let us use the axis of symmetry to help us plot points and graph a parabola.

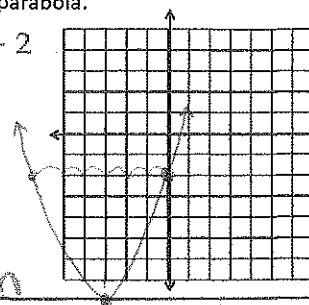
$$y = x^2 + 6x - 2$$

$$a = 1$$

$$b = 6$$

$$c = -2$$

min



① $f(0) = (0)^2 + 6(0) - 2$
 $f(0) = -2$
 $(0, -2)$: y-intercept

② $x = -b/2a = -6/2(1) = -3$

③ $f(-3) = (-3)^2 + 6(-3) - 2$
 $= 9 - 18 - 2$
 $= -9 - 2 = -11$

vertex $(-3, -11)$

