

3.1: Graphing Quadratic Functions

I can graph in standard form, vertex form, and intercept form

I can find the vertex from a quadratic function in standard, vertex or intercept form.

Vocabulary

Quadratic Function: A function in the form $y = ax^2 + bx + c$ where the highest power is 2.

Standard Form	Intercept Form	Vertex form
$y = ax^2 + bx + c$	$y = a(x-p)(x-q)$	$y = a(x-h)^2 + k$
Axis of symmetry: the <u>line</u> of <u>reflection</u> of the graph		
Vertex: the <u>maximum</u> or <u>minimum</u> of the parabola		

Standard Form:

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

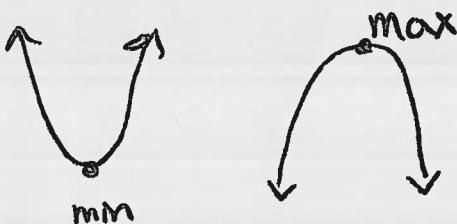
a:
Vertical reflection, stretch, shrink

c:
y intercept
(value when $x=0$)

Axis of symmetry:
 $x = -\frac{b}{2a}$
Vertex:
 $(-\frac{b}{2a}, f(-\frac{b}{2a}))$

Vertex always is a minimum or a maximum

Depends on whether the graph opens up or down.



Max or Min Value:
the y value
(height of graph)

EX 1: Graph: $y = 2x^2 - 8x + 6$

① $x = \frac{-b}{2a} = \frac{-(-8)}{2(2)} = 2$

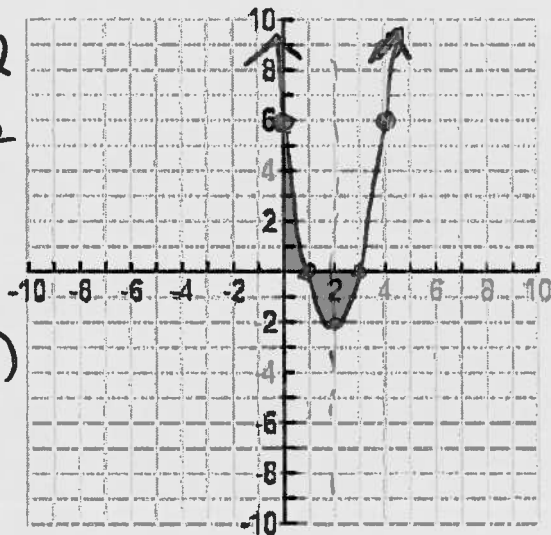
$f(2) = 2(2)^2 - 8(2) + 6 = -2$

vertex (2, -2)

② $c = 6$ y int

③ $x = 1$ (close to vertex)

$y = 2(1)^2 - 8(1) + 6 = 0$
(1, 0)



Steps:

1. Find Vertex and Axis of Symmetry
 $x = -b/2a, y = f(-b/2a)$ (Sketch)
2. Find y-Intercept (c) (Sketch and Reflect)
3. Find another Point
Input another x value near vertex (Sketch and Reflect)
4. Sketch Parabola (U shape, not V)

Do & Discuss

1. Is the vertex of $y = 3x^2 - 18x + 20$ a maximum or a minimum? Find the max or min value.

minimum



vertex $x = \frac{18}{2(3)} = 3$

$y = 3(3)^2 - 18(3) + 20$
 $y = -7$

Min: -7

Vertex Form:

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



a:
Vertical
reflection, stretch,
shrink

h:
horizontal
shift

k:
vertical
shift

Axis of Symmetry:
 $x = h$
Vertex:
 (h, k)

EX 2: Graph: $y = -\frac{1}{4}(x+2)^2 + 5$

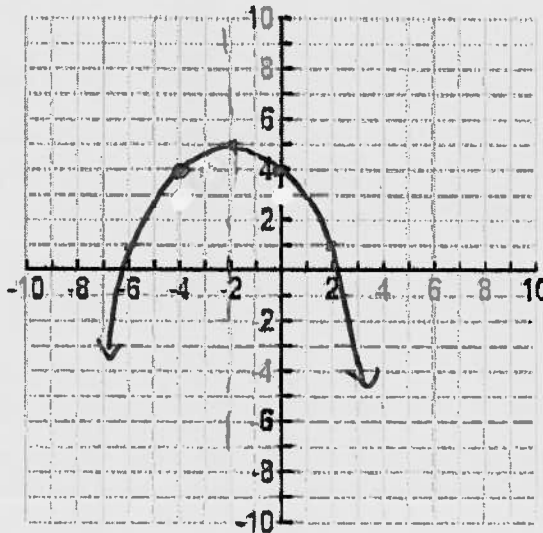
① vertex $(-2, 5)$

② $x=0$ $y = -\frac{1}{4}(2)^2 + 5$

$y = 4$

$x=2$ $y = -\frac{1}{4}(4)^2 + 5$

$y = 1$



Steps:

1. Sketch Vertex and Axis of Symmetry
2. Find 2 other Points – evaluate for 2 values of x (Sketch and Reflect)
3. Sketch Parabola (U shape, not V)

• Intercept Form:

$$y = a(x-p)(x-q)$$



a :

Vertical reflection,
stretch, shrink

p and q :

x intercepts

(x value when $x-p=0$
and $x-q=0$)

Vertex and Axis of Symmetry:

$$x = \frac{p+q}{2}$$

$$\left(\frac{p+q}{2}, f\left(\frac{p+q}{2}\right) \right)$$

EX 3: Graph: $y = 2(x+3)(x-1)$

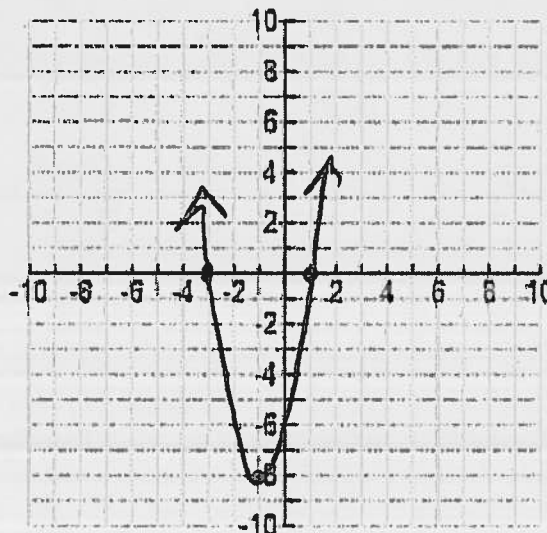
① x int: -3 and 1

② $x = \frac{-3+1}{2} = -1$

$y = 2(-1+3)(-1-1)$

$= 2(2)(-2) = -8$

$(-1, -8)$



Steps:

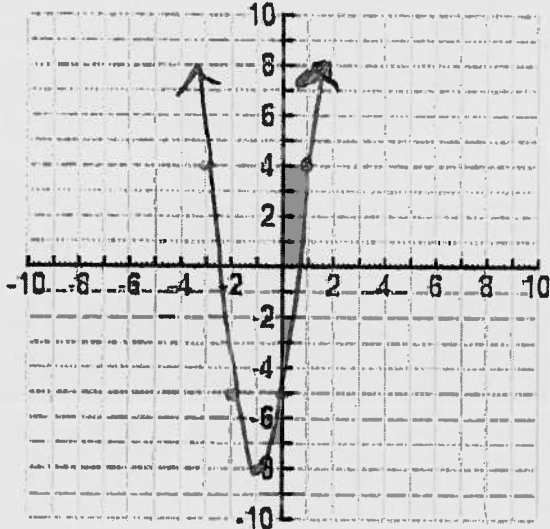
1. Identify x -intercepts (Sketch)
2. Find the Coordinates of the Vertex (Sketch) and Sketch Axis
3. Sketch Parabola (U shape, not V)

Check point:

Graph:

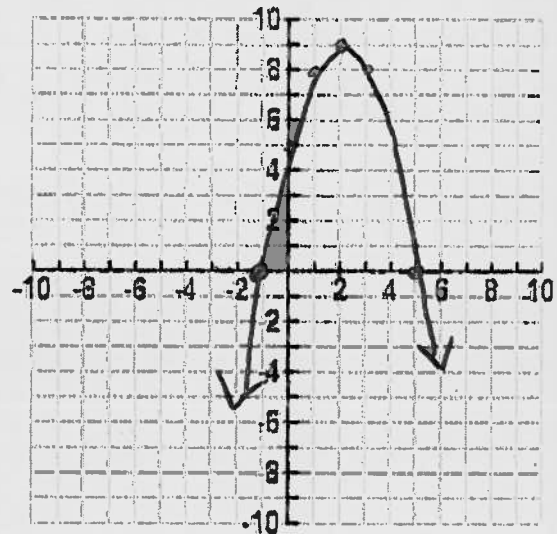
2. $y = 3x^2 + 6x - 5$

$x = \frac{-b}{2a} = -1$
 $y = 3(-1)^2 + 6(-1) - 5 = -8$



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

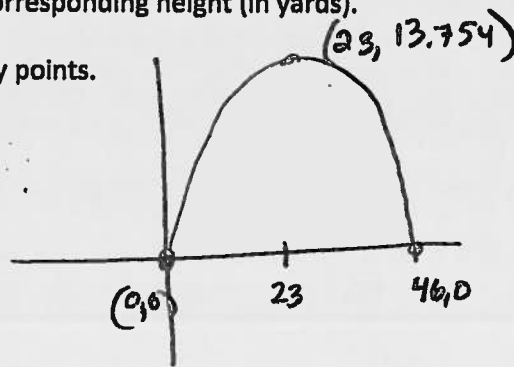
$x = 2$
 $y = -(2+1)(2-5) = 9$



Do & Discuss:

4. The path of a placekicked football can be modeled by the function $y = -0.026x(x - 46)$ where x is the horizontal distance (in yards) and y is the corresponding height (in yards).

a. Draw a sketch of the function. Label key points.



b. How far is the football kicked?

46 yds

c. What is the football's maximum height?

13.754 yds.