Warmup: Solve Using the Quadratic Formula

$$\frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$2x^2 - 4x = 17$$

a b c

$$2x^2 - 4x - 17 = 0$$

$$\frac{4 \pm \sqrt{(-4)^2 - 4(2)(-17)}}{2(2)}$$

$$\frac{4 \pm \sqrt{152}}{4}$$

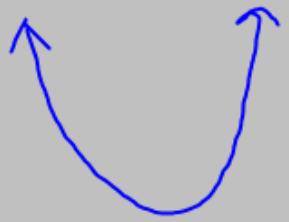
$$\frac{4 \pm 2\sqrt{38}}{4}$$

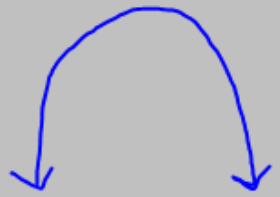
$$\frac{4+2\sqrt{38}}{4} = \frac{2+\sqrt{38}}{2} \qquad \frac{4-2\sqrt{38}}{4} = \frac{2-\sqrt{38}}{2}$$

E.Q.:

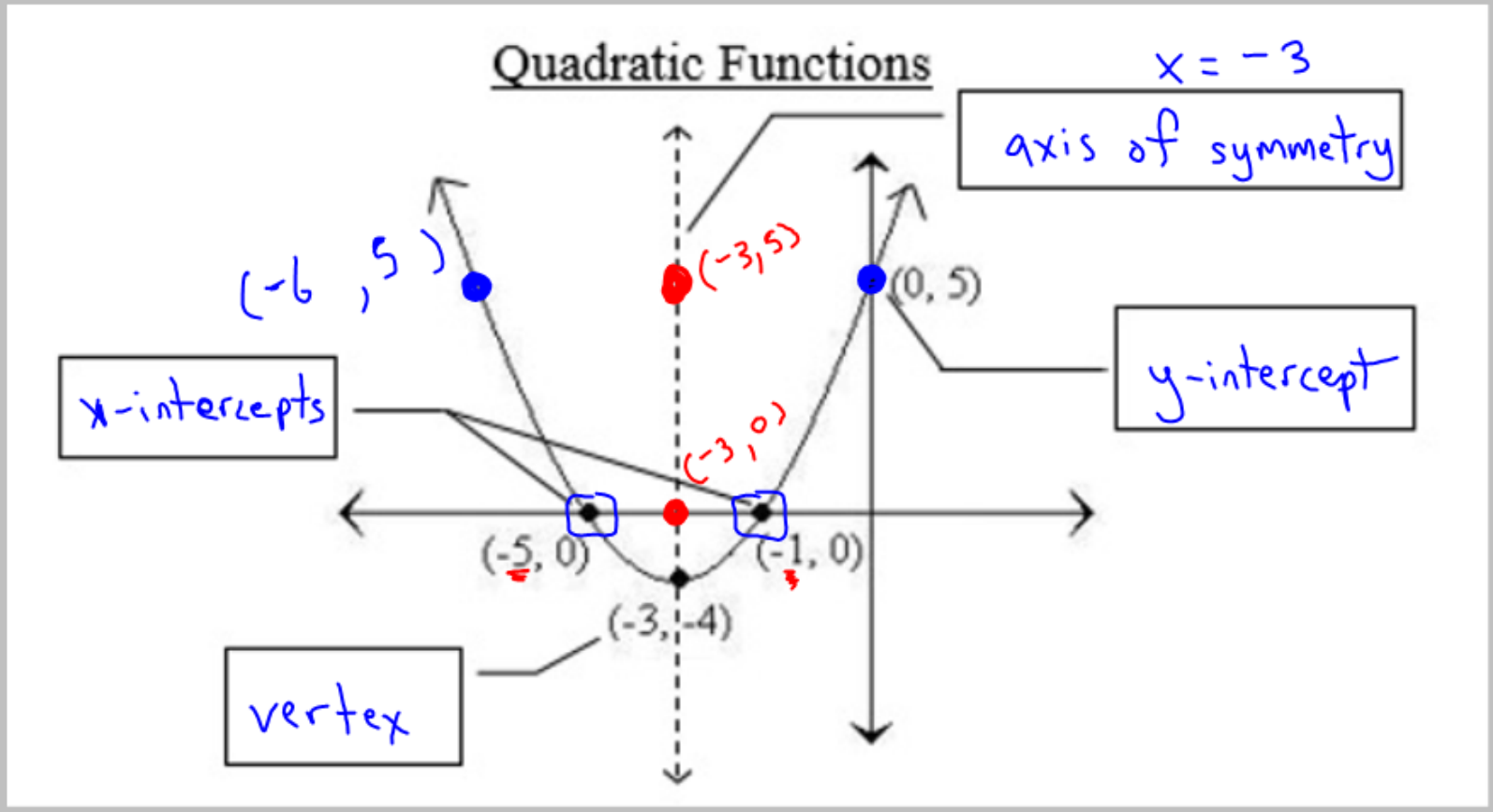
How do we graph quadratic functions, or "parabolas"?

"u" shape

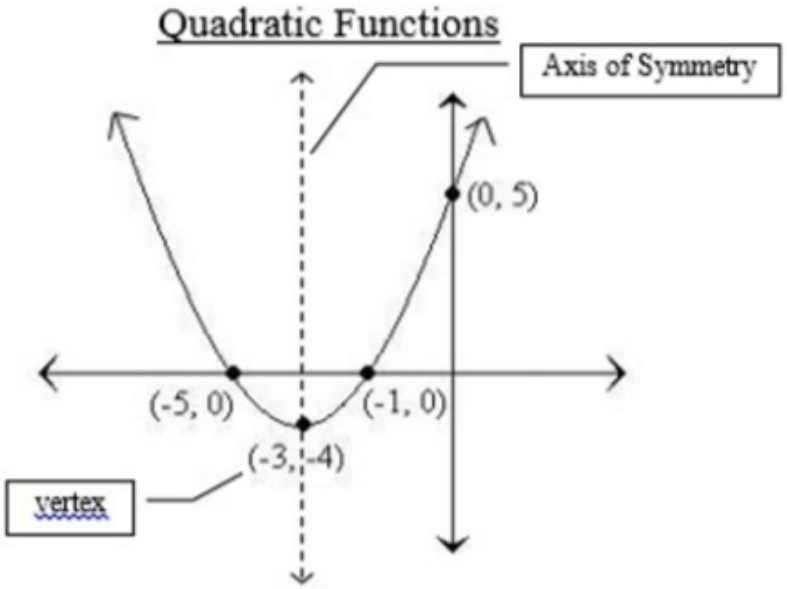




Parts of the "Parabola"



Forms of the "Parabola"



Standard Form

$$y = x^2 + 6x + 5$$

Factored Form

$$y = (x + 5)(x + 1)$$

Vertex Form

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

Converting to Vertex Form by Completing the Square

$$y = x^2 + 6x + 5$$

-5 $\qquad$ -5

$\frac{6}{2} = 3$

$3^2 = 9$

$y - 5 = x^2 + 6x + \underline{9}$

$+9$

$y + 4 = x^2 + 6x + 9$

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

-4 $\qquad$ -4

vertex : $(-3, -4)$

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

Converting to Vertex Form by Completing the Square

2, -5
-2, -5
~~4~~, -5
~~4~~, -10

$$y = 2x^2 - 8x + 3$$

-3 $\quad$ -3

$y - 3 = 2x^2 - 8x$

$y - 3 = 2(x^2 - 4x + \underline{4})$

$+\underline{8}$

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

-5 $\quad$ -5

$y = 2(x-2)^2 - 5$

$\frac{-4}{2} = -2$

$(-2)^2 = 4$

$x - 2 = 0$

$x = 2$

Vertex $(2, -5)$

Converting to vertex form using the formula

$y = x^2 + 6x + 5$

$a = 1 \quad b = 6$

vertex = (x, y)

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

$x = \frac{-b}{2a} = \frac{-6}{2(1)} = \frac{-b}{2} = -3$

y = plug in the x-coordinate!

$y = (-3)^2 + 6(-3) + 5$

$y = -4$

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

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

Converting to vertex form using the formula

$a = 2 \qquad b = -8$

$$y = 2x^2 - 8x + 3$$

$$\text{vertex} = \left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$$

x-coor: $\frac{8}{2(2)} = \frac{8}{4} = 2$

y-coor: $y = 2(2)^2 - 8(2) + 3 = -5$

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

$y = 2(x-2)^2 - 5$

Converting to Vertex Form

Using Factoring

$$y = x^2 + 6x + 5$$

$y = (x+5)(x+1)$

$0 = x+5$ $\quad$ $0 = x+1$

$x = -5$ $\quad$ $x = -1$

$\frac{-5+-1}{2} = \frac{-6}{2} = -3$ x-coor.

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

5 5 1 6

middle

-5 -1

(-3, -4)

symmetry

$y = (-3)^2 + 6(-3) + 5 = -4$

- or -

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

$2 \cdot -2 = -4$

Converting to Vertex Form Using Factoring

$$y = 2x^2 - 8x + 3$$

Sometimes we can't factor!
- either use completing the square
or the $\frac{-b}{2a}$ formula

$\frac{-b}{2a}$ = x-coor of vertex

plug in the x to find y.

To Graph a Quadratic in Standard Form:

1) Find the Vertex

- Complete the Square (Convert to Vertex Form)
- Find the Roots (Factor and Solve) and use symmetry
- Use the Formula: $x = -b/(2a)$ $y = f(-b/(2a))$

2) Make a table of Values

- Start with the vertex
- Use 2 points on either side of the vertex (x and y intercepts?)

3) Plot Your Points

$$y = 1x^2 - 4x - 5$$

-5
-5 +1
-4

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

$x - 5 = 0$ $\quad$ $x + 1 = 0$

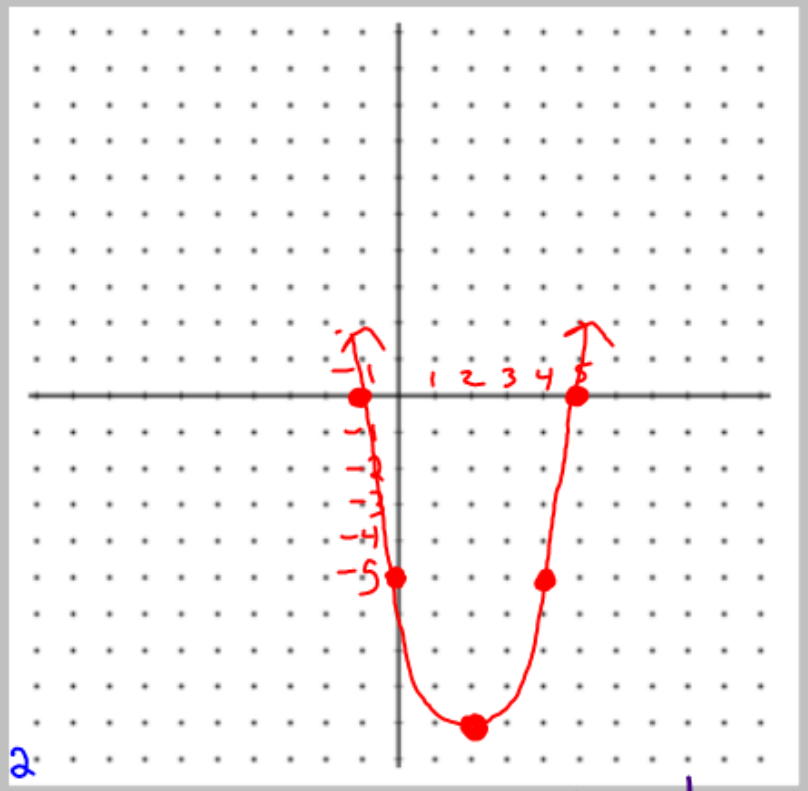
$x = 5$ $\quad$ $x = -1$

vertex: x-coor: $\frac{5 + -1}{2} = \frac{4}{2} = 2$

y-coor: $y = (2 - 5)(2 + 1)$

$y = -3 \cdot 3$

$y = -9$



vertex:

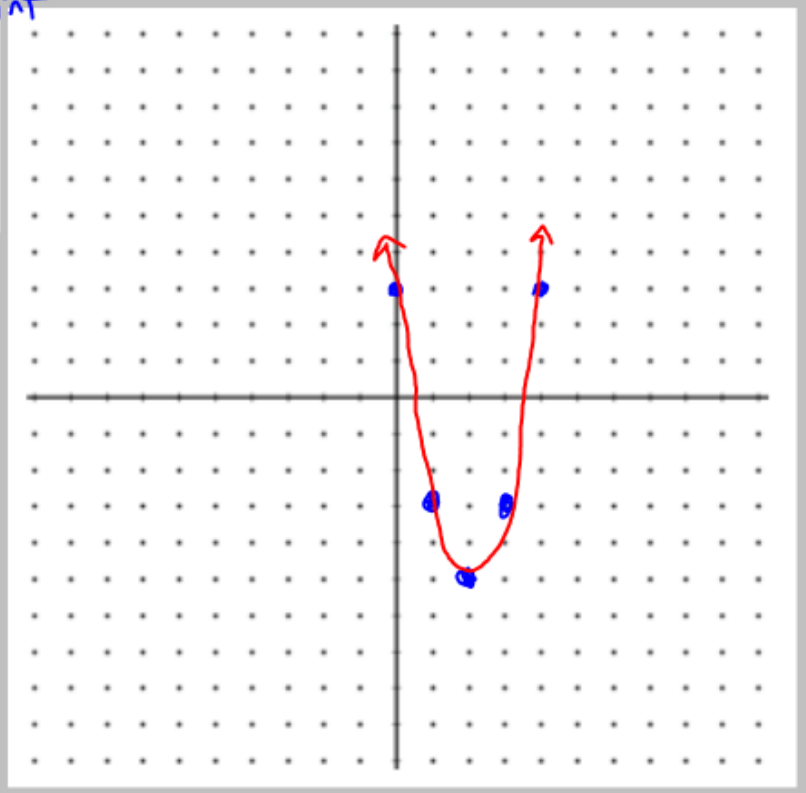
x	y
-1	0
0	-5
2	-9
4	-5
5	0

$a=2$ $b=-8$ y-int

$$y = 2x^2 - 8x + 3$$

x-coor: $\frac{-b}{2a} = \frac{8}{2(2)} = \frac{8}{4} = 2$

$y = 2(2)^2 - 8(2) + 3 = -5$



X	y
0	3
1	-3
2	-5
3	-3
4	3

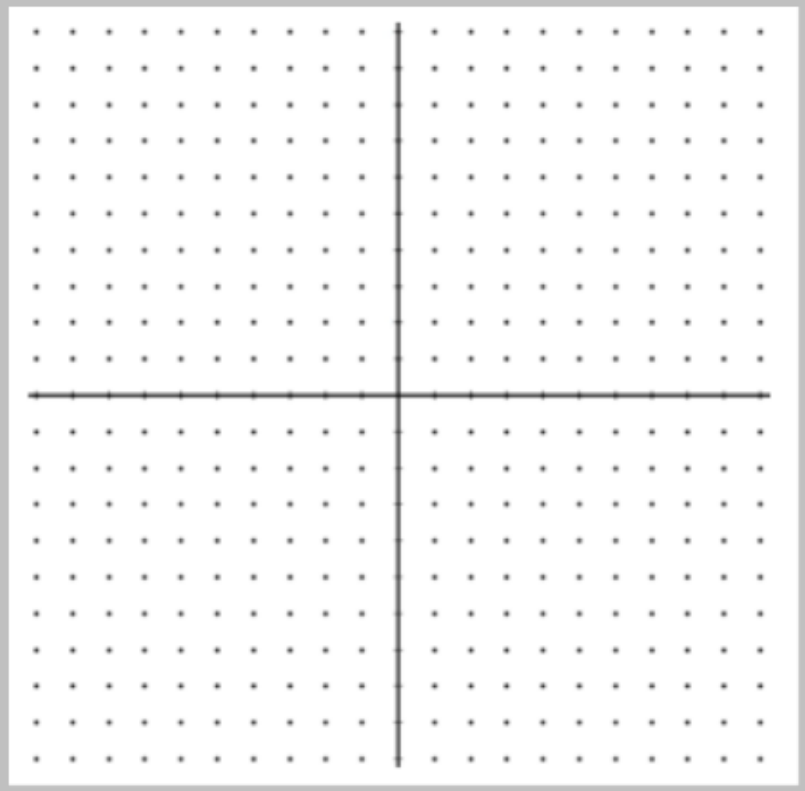
To Graph a Quadratic in Factored Form:

1) Use the zero product property to find the roots.
- Set each factor equal to 0 and solve for x.

2) Use the roots and symmetry to find the vertex.
- Add the roots and divide by 2 to get the x coordinate of the vertex.
- Plug the x into the equation to find the y coordinate.

3) Make a table to find two other points to graph.

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

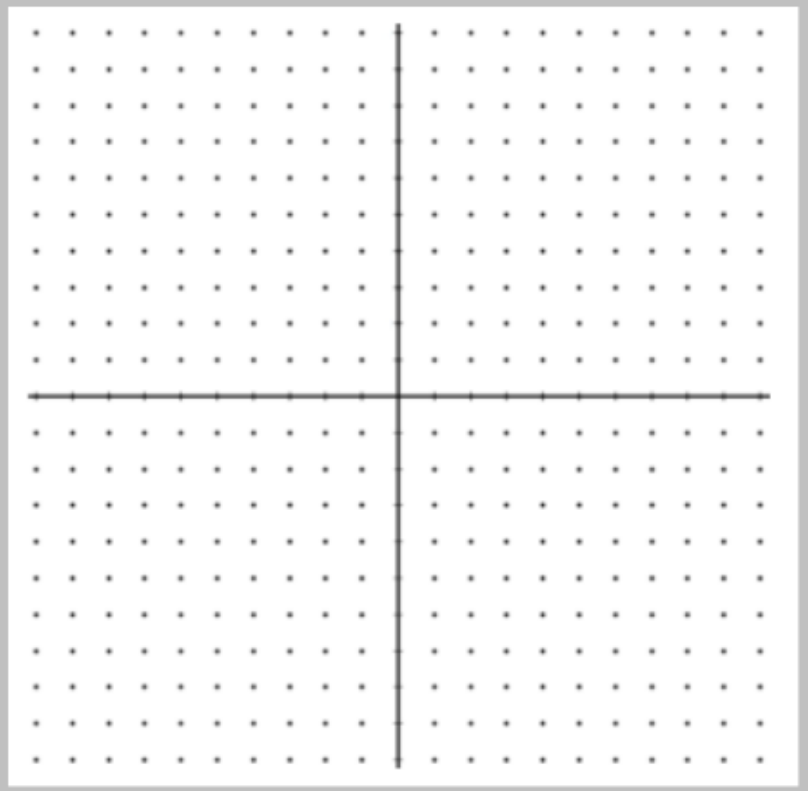


To Graph a Quadratic in Vertex Form:

1) Use vertex form to find the vertex.

2) Make a table of values to find 4 other points on the parabola.

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



HW #8:

Graphing Quadratic Equations in Standard Form