Warmup: Solve Using the Quadratic Formula

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

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

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

a b c

$$\frac{4 \pm \sqrt{(-4)^2 - 4(2)(-17)}}{2(2)} = \frac{4 \pm \sqrt{152}}{4}$$

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

$y = 4x + 2$ "Equation"

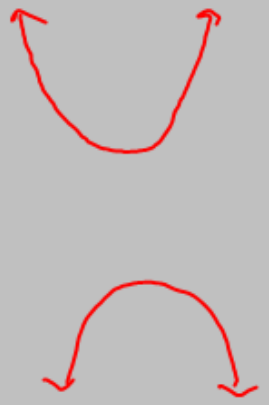
$x = 0$
$y = 2$

x	y
-2	-6
-1	-2
0	2
1	6
2	10

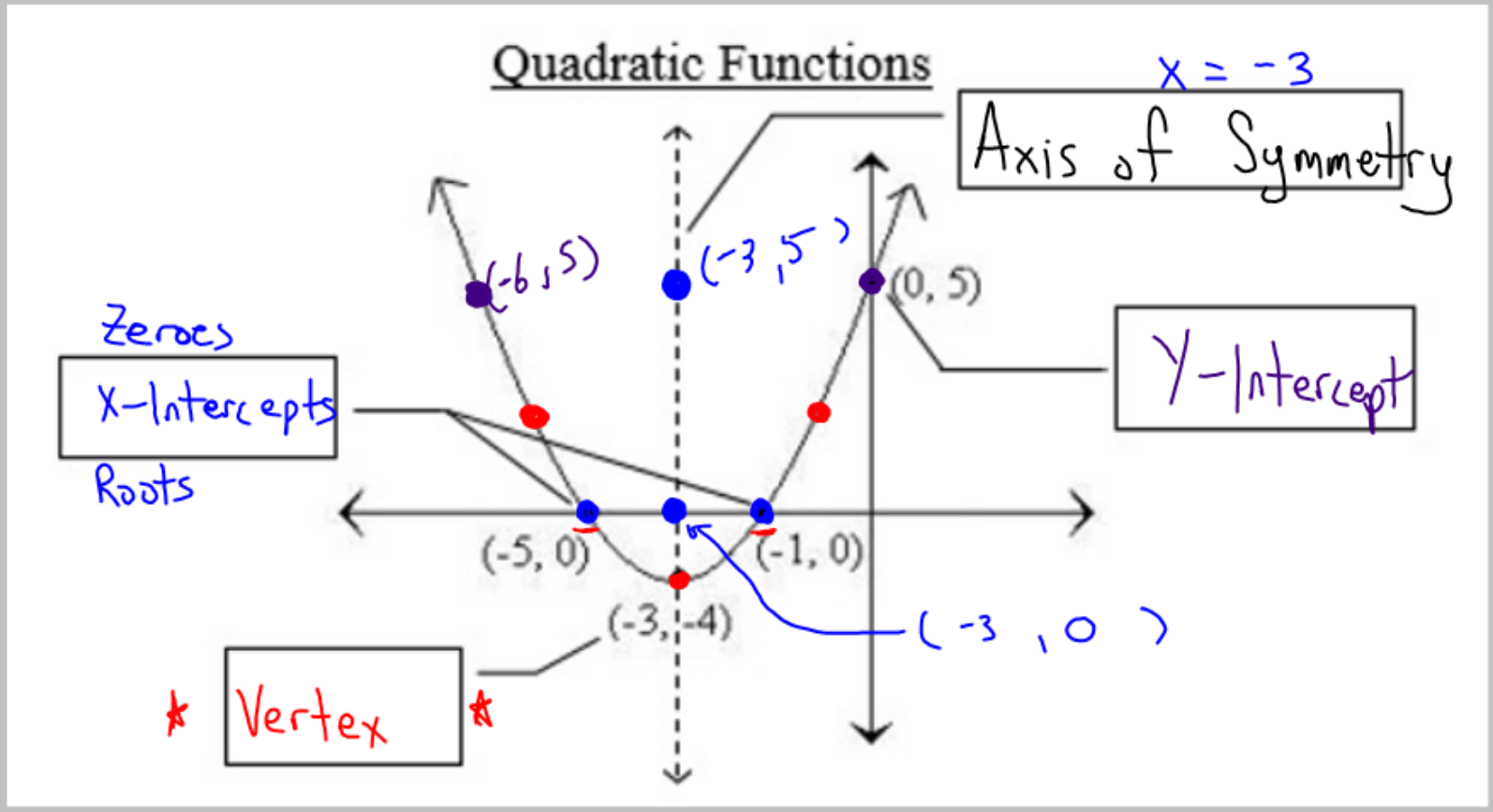
$y = 4(1) + 2$
$= 4 + 2$
$= 6$

E.Q.:

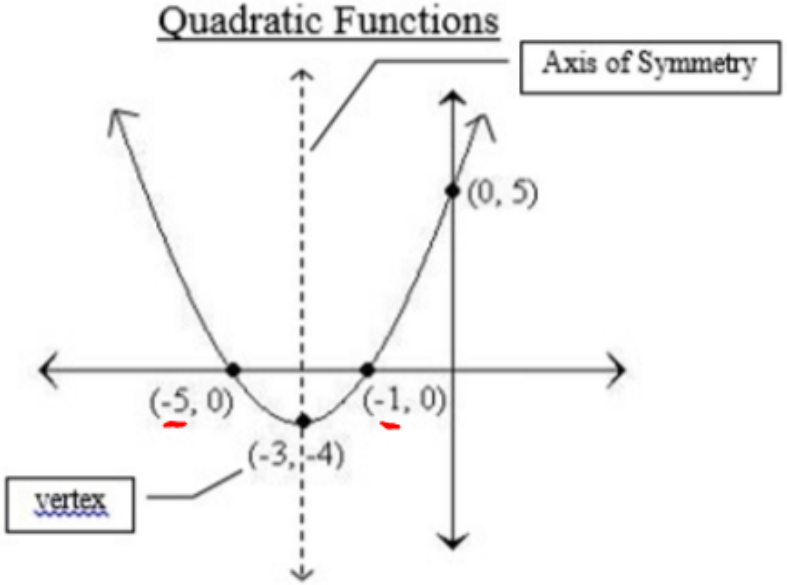
How do we graph quadratic functions, or "parabolas"?



Parts of the "Parabola"



Forms of the "Parabola"



Standard Form

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

y-int.

$y = ax^2 + bx + c$

Factored Form

x-int

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

$y = a(x - r_1)(x - r_2)$

Vertex Form

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

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

Converting to Vertex Form by Completing the Square

$$y = 1x^2 + 6x + 5$$

$-5 \qquad -5$

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

$3^2 = 9$

$y - 5 + 9 = x^2 + 6x + 9$

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

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

$-4 \qquad -4$

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

vertex $(-3, -4)$

Converting to Vertex Form by Completing the Square

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

$-3 \qquad -3$

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

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

$+8$

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

-5

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

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

$(-2)^2 = 4$

vertex

$(2, -5)$

Converting to vertex form using the formula

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

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

x-coor: $\frac{-b}{2a}$

y-coor: plug in the x-coor.

vertex $(-3, -4)$

$a = 1 \quad b = 6$

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

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

$y = -4$

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

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

Converting to vertex form using the formula

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

$a = 2 \quad b = -8$

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

vertex $(2, -5)$

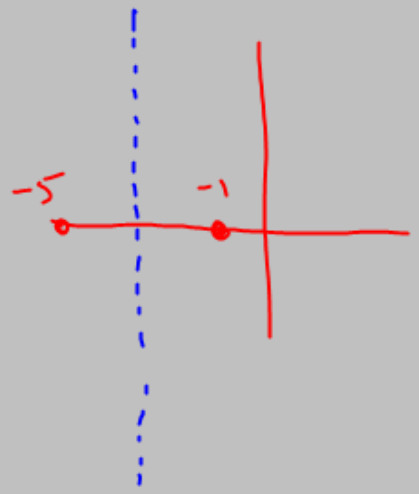
x-coor: $\frac{8}{2(2)} = \frac{8}{4} = 2$

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

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

Converting to Vertex Form

Using Factoring



std. form. $(-3)^2 + 6(-3) + 5$

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

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

find roots

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

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

vertex: $\frac{-1 + -5}{2} = \frac{-6}{2}$

$x = -3$

$(-3, -4)$

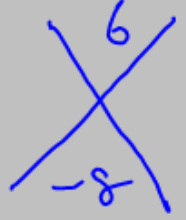
$y = (-3 + 5)(-3 + 1)$

$2 \cdot -2$

-4

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

Converting to Vertex Form Using Factoring



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

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

$(1)^2 - 4(1) - 5$

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

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

y-int

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

$-2 \cdot 4$

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

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

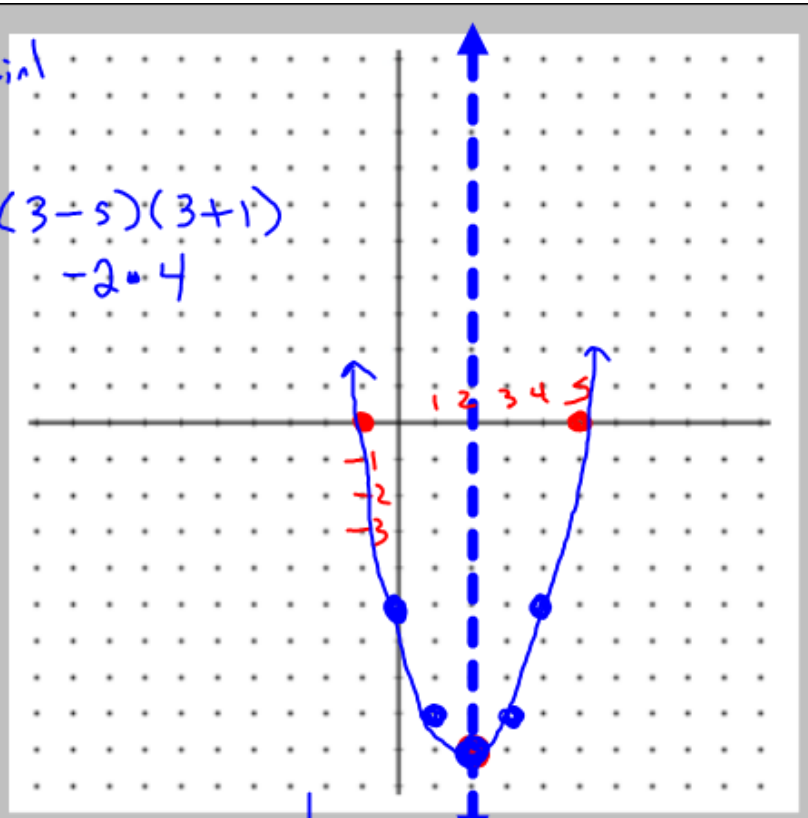
$x_{\text{vertex}} = \frac{5 + -1}{2} = \frac{4}{2} = 2$

Vertex $(2, -9)$

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

$-3 \cdot 3$

-9



-5, -5, 1, -4

x	y
0	-5
1	-8
2	-9
3	-8
4	-5

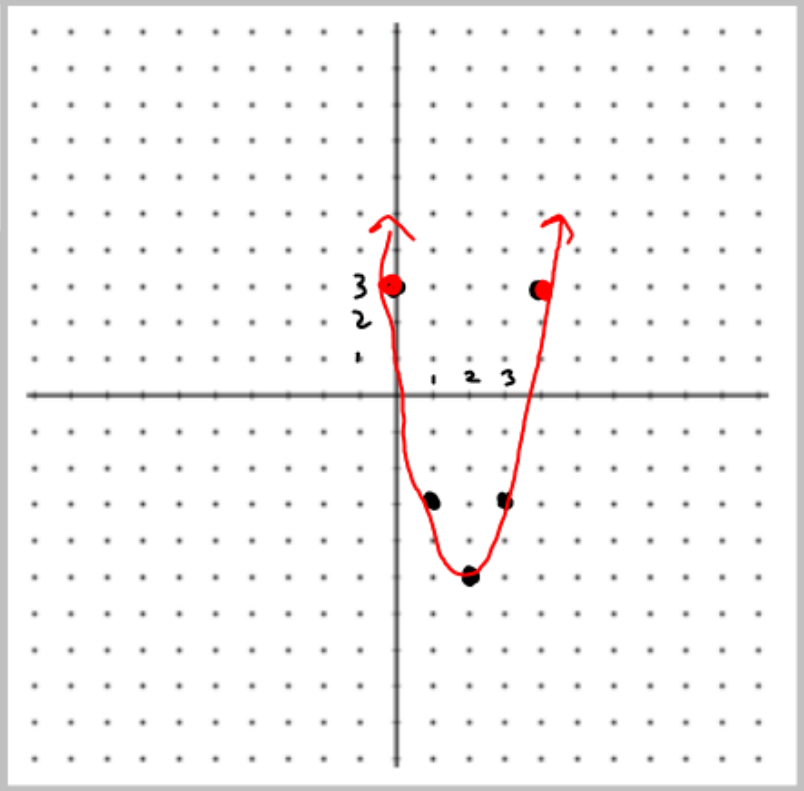
$$y = 2x^2 - 8x + 3$$

"complete the sq"

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

vertex $(2, -5)$

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



$2(1)^2 - 8(1) + 3$

$2(1) - 8 + 3$

$2 - 8 + 3$

$-6 + 3$

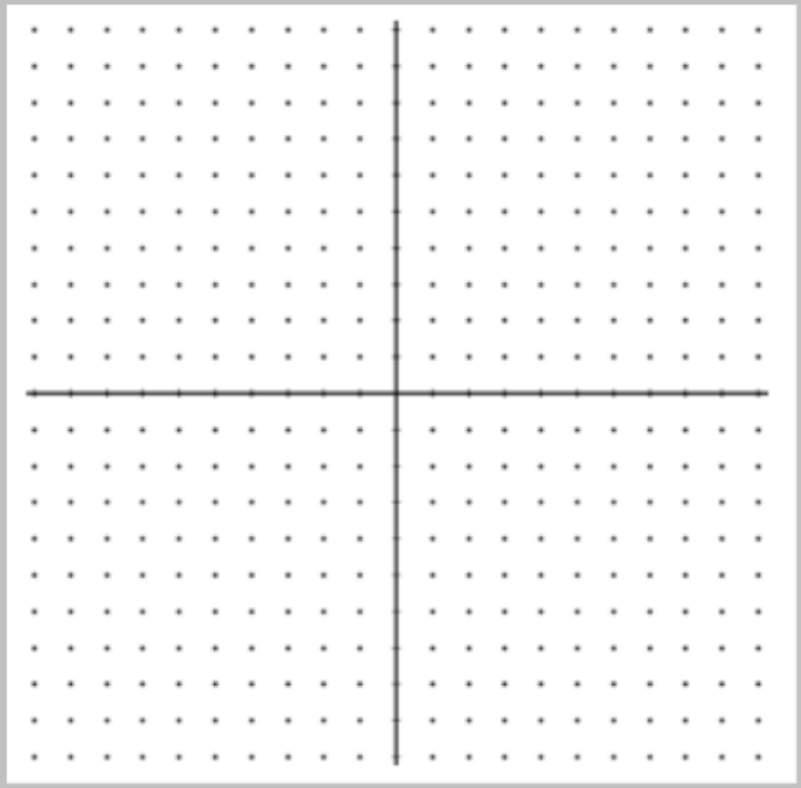
To Graph a Quadratic in Factored Form:

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.

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

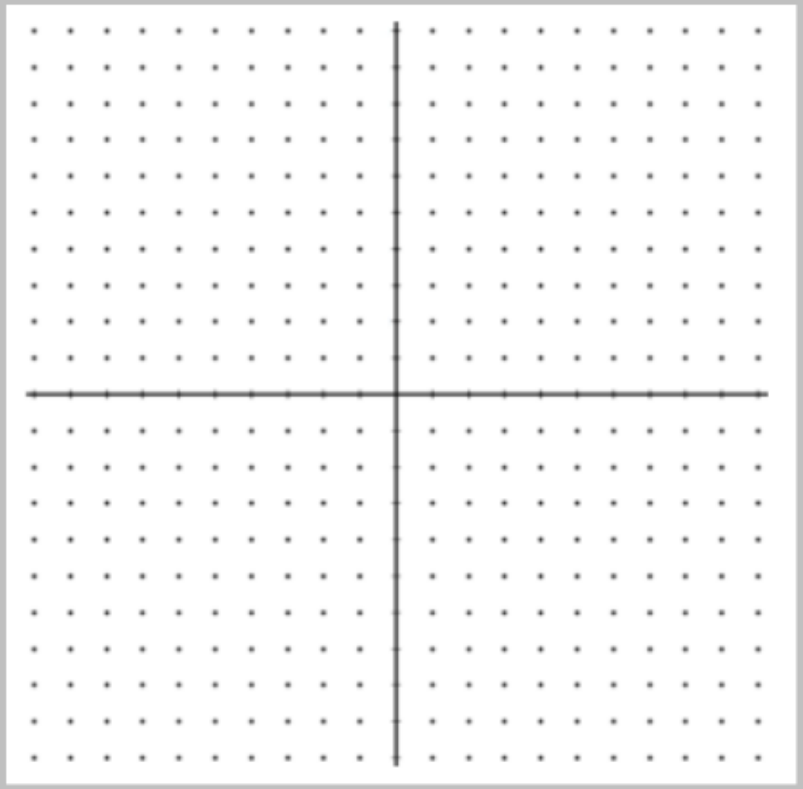


To Graph a Quadratic in Vertex Form:

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