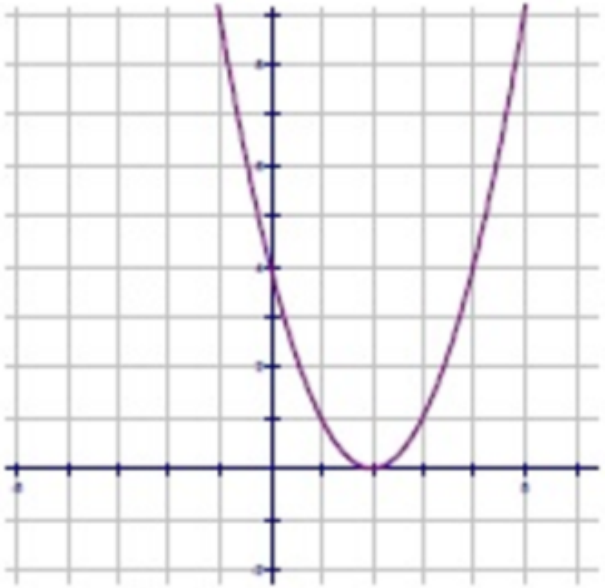
# Warmup:

Identify the following characteristics of the graph below:



D: $(-\infty, \infty)$ R: $[0, \infty)$

Interval of Increase: $(2, \infty)$

Interval of Decrease: $(-\infty, 2)$

Axis of Symmetry: $x = 2$

Vertex: $(2, 0)$

Max or Min? Min at 0

End Behavior: As $x \to -\infty$, $y \to \infty$ As $x \to \infty$, $y \to \infty$

x-intercept: 2 y-intercept: 4

Positive: $(-\infty, 2) \cup (2, \infty)$ Negative: N/A

# Quiz #9

E.Q.:

How do we write the equation of a quadratic function?

# Recall our different forms:

Standard Form

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

Factored Form

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

Vertex Form

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

Generally when asked to write an equation we will be given:

- the vertex
- another point on the graph.

For that reason, we will use vertex form to write an equation of a parabola.

We can always convert to other forms from there!!

$y = mx + b$

line goes through pts (3, 6) & (5, 14)

$y = 4x + b$

$6 = 4(3) + b$

$6 = 12 + b$

$-12 \quad -12$

$b = -6$

slope $= m = \frac{14 - 6}{5 - 3} = 4$

$y = 4x - 6$

## Vertex Form

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

In order to write the equation we must:

- plug in the vertex (h and k)
- plug in the coordinates of the other point
- solve for a
- write the equation

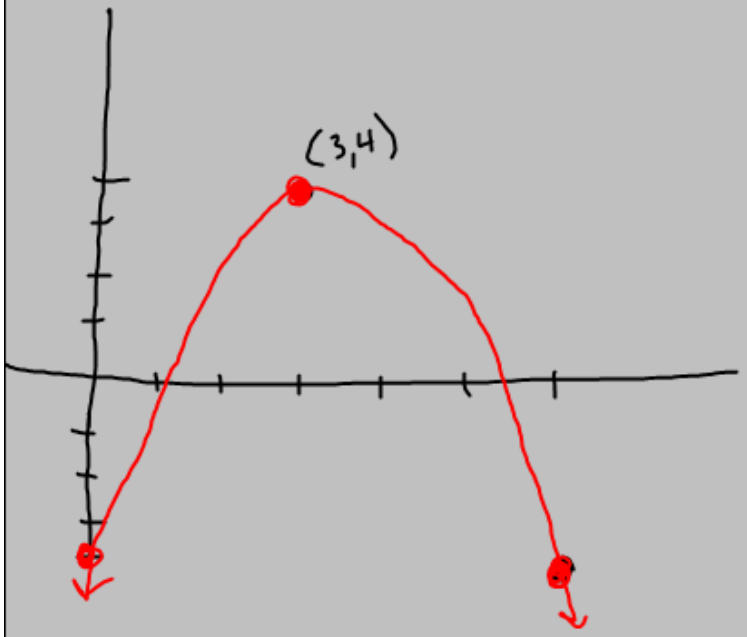
# Example:

**Vertex Form**

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

Write the equation of the quadratic that has a vertex at (3,4) and passes through the point (6,-4)

$y = -\frac{8}{9}(x-3)^2 + 4$




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

$-4 = a(6-3)^2 + 4$

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

$-4 = 9a + 4$

$-4 \quad\quad -4$

$\frac{-8}{9} = \frac{9a}{9}$ $\quad a = -\frac{8}{9}$

# Write the equation of the quadratic function that this table represents:

| x | y |
|---|---|
| -3 | 22 |
| -2 | 13 |
| -1 | 10 |
| 0 | 13 |
| 1 | 22 |

-1 vertex

Vertex Form

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

$y = a(x+1)^2 + 10$

$13 = a(-2+1)^2 + 10$

$13 = a(-1)^2 + 10$

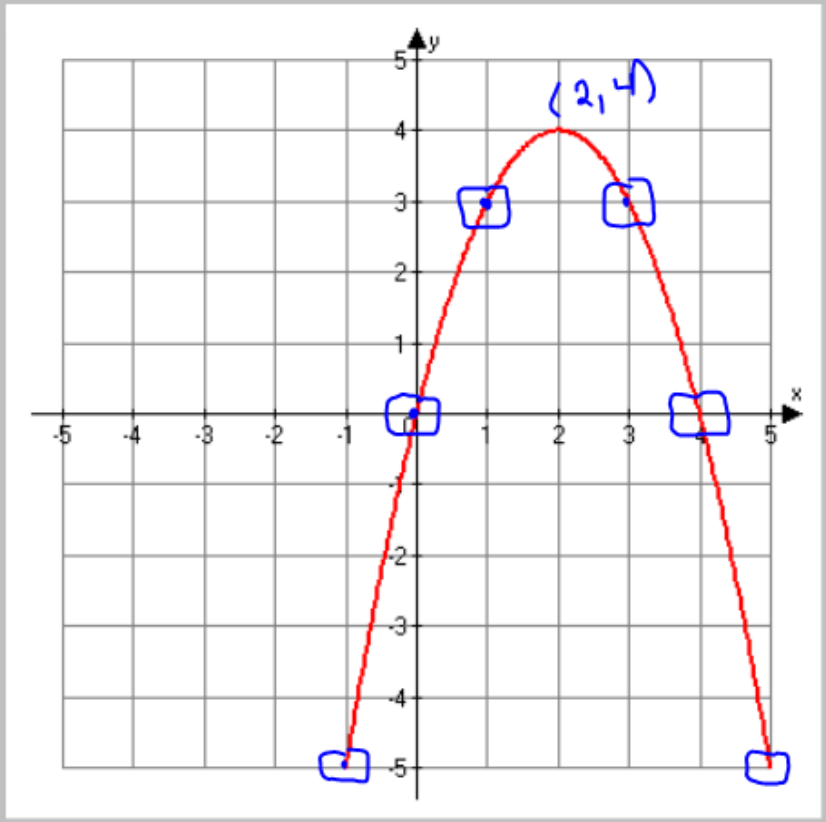
$13 = 1a + 10$

$-10 \quad -10$

$a = 3$

$y = 3(x+1)^2 + 10$

# Write the equation of the quadratic function shown in the graph:




## Vertex Form

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

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

$0 = a(0-2)^2 + 4$

$0 = a(-2)^2 + 4$

$0 = 4a + 4$

$-4 = 4a$

$a = -1$

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

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

# Write the equation of the quadratic function in standard form:

In order to convert from vertex form to standard form we must:

1. square our binomial
2. distribute our leading coefficient
3. combine our like terms

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

$(x-2)^2$

$(x-2)(x-2)$

O I L

$x^2 - 2x - 2x + 4$

$x^2 - 4x + 4$

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

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

$y = 2x^2 - 8x + 11$

# Write the equation of the quadratic function in standard form:

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

$y = -3x^2 + 12x - 14$

$y = -3x^2 - 12x - 24$

$y = -3x^2 - 12x + 10$

$y = -6x^2 - 12x$

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

$-3x^2 + 12x - 12 - 2$

# Convert the equation from standard form to vertex form

We've already learned how to do this!!

Anyone remember what process we need to do?

complete the square or $\frac{-b}{2a}$ = x-coor. of vertex

**Vertex Form**

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

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

$$y = 3x^2 + 24x + 44$$

x-coor: $\frac{-24}{2(3)} = \frac{-24}{6} = -4$

$y = 3(-4)^2 + 24(-4) + 44$

$y = -4$

# You try: Convert to vertex form

$$y = -2x^2 + 12x + 7$$

$\frac{-12}{2(-2)} = \frac{-12}{-4} = 3 = h$

$y: -2(3)^2 + 12(3) + 7$

$y = 25 = k$

$y = -2(x-3)^2 + 25$

# HW #11

# Writing equations