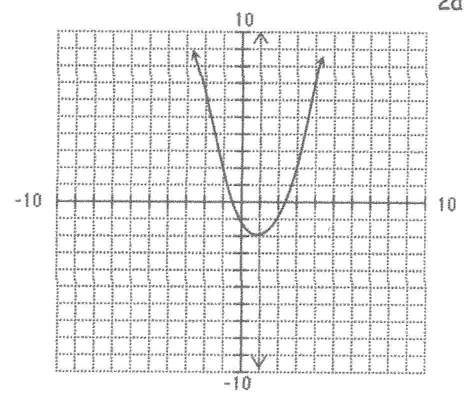
Master

5-1 Graphing Quadratic Functions

Quadratic Function: A square function, a function of degree 2, the shape of the graph is a parabola.

Vertex: the lowest (minimum) or highest (maximum) point on the graph. $V(h, k) = (-\frac{b}{2a}, k)$

Axis of Symmetry: the line about which each branch of the parabola is symmetric. $x = h$ or $x = -\frac{b}{2a}$



3 Different Ways to Write the Equation:

1. Standard form: $y = ax^2 + bx + c$
2. Vertex (Graphic) form: $y = a(x - h)^2 + k$
3. Intercept form: $y = a(x - p)(x - q)$

Rules about a:

If +a:	parabola will open up
If -a:	parabola will open down
If a > 1:	parabola will be skinnier
If 0 < a < 1:	parabola will be fatter

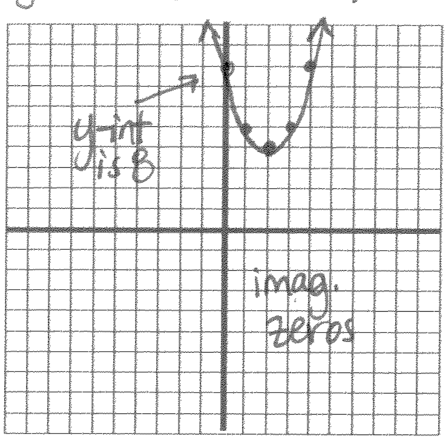
I. Graphing When in Standard Form: $y = ax^2 + bx + c$

1. Find the x coordinate of the vertex by using the formula $x = -\frac{b}{2a}$.
2. Substitute the x value into the equation and solve for y to find the vertex (h, k).
3. Plot the vertex and determine whether the parabola opens up or down according to a.
4. Use the 1a, 3a, 5a shortcut to plot five "happy" points and draw the parabola.

A. $y = x^2 - 4x + 8$

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

$y = (2)^2 - 4(2) + 8 = 4$



Vertex: $(2,4)$

Domain: $(-\infty,\infty)$

Range: $[4,\infty)$

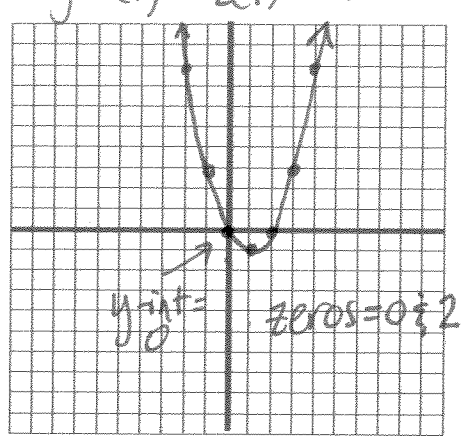
Axis of Symmetry: $x=2$

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

B. $y = x^2 - 2x$

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

$y = (1)^2 - 2(1) = -1$



Vertex: $(1,-1)$

Domain: $(-\infty,\infty)$

Range: $[-1,\infty)$

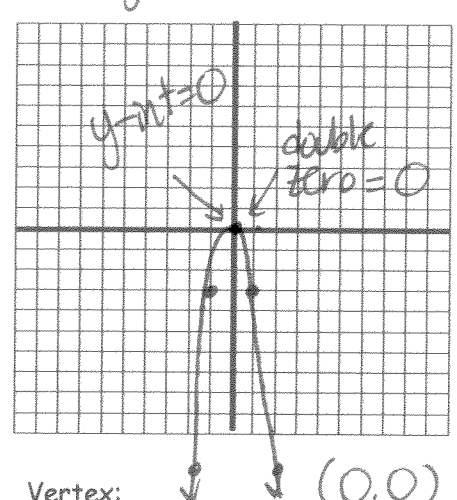
Axis of Symmetry: $x=1$

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

C. $y = -3x^2$

$x = \frac{-0}{2(-3)} = 0$

$y = -3(0)^2 = 0$



Vertex: $(0,0)$

Domain: $(-\infty,\infty)$

Range: $(-\infty,0]$

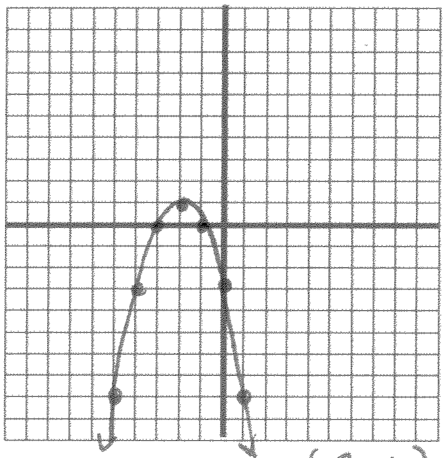
Axis of Symmetry: $x=0$

$y = -3x^2$

II. Graphing When in Vertex (Graphic) Form: $y = a(x - h)^2 + k$ (The easiest☺)

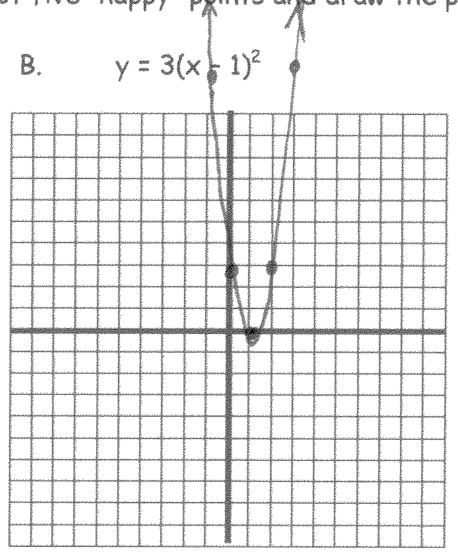
1. Find the vertex using (h, k).
2. Plot the vertex and determine whether the parabola opens up or down according to a.
3. Use the 1a, 3a, 5a shortcut to plot five "happy" points and draw the parabola.

A. $y = -(x + 2)^2 + 1$



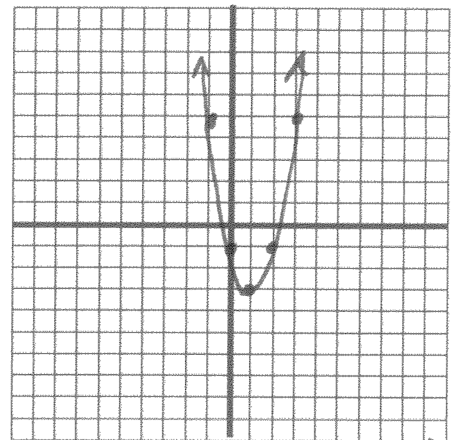
Vertex: $(-2, 1)$
Domain: $(-\infty, \infty)$
Range: $(-\infty, 1]$
Axis of Symmetry: $x = -2$

B. $y = 3(x - 1)^2$



Vertex: $(1, 0)$
Domain: $(-\infty, \infty)$
Range: $[0, \infty)$
Axis of Symmetry: $x = 1$

C. $y = 2(x - 1)^2 - 3$



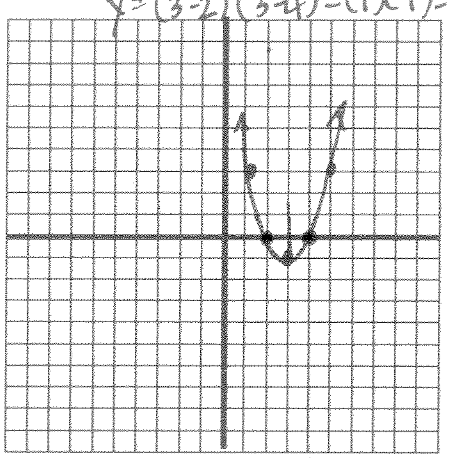
Vertex: $(1, -3)$
Domain: $(-\infty, \infty)$
Range: $[-3, \infty)$
Axis of Symmetry: $x = 1$

III. Graphing When In Intercept Form: $y = a(x - p)(x - q)$

1. Identify p and q from the equation. These are the x intercepts of the parabola.
2. Plot the 2 intercepts (p, 0), and (q, 0) on the x - axis.
3. Since the axis of symmetry would bisect the segment joining p and q, the x coordinate of the vertex will be the midpoint of that segment $\left(\frac{p+q}{2}\right)$.
4. Find the y-coordinate of the vertex by substituting x into the equation and solving for y.
5. Plot the vertex (h, k). Use the 1a, 3a, 5a shortcut to plot five "happy" points and draw the parabola..

A. $y = (x - 2)(x - 4)$

$y = (3-2)(3-4) = (1)(-1) = -1$

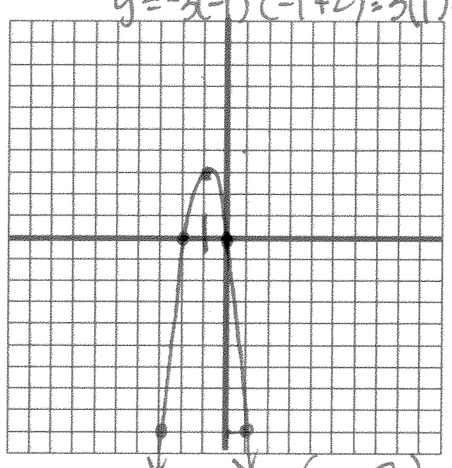


Vertex: $(3, -1)$
Domain: $(-\infty, \infty)$
Range: $[-1, \infty)$
Axis of Symmetry: $x = 3$

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

B. $y = -3x(x + 2)$

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

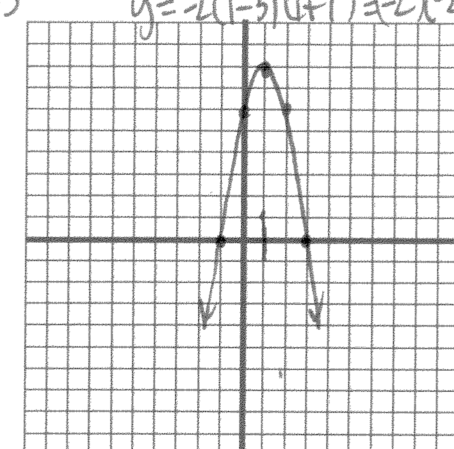


Vertex: $(-1, 3)$
Domain: $(-\infty, \infty)$
Range: $(-\infty, 3]$
Axis of Symmetry: $x = -1$

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

C. $y = -2(x - 3)(x + 1)$

$y = -2(1-3)(1+1) = (-2)(-2)(2) = 8$



Vertex: $(1, 8)$
Domain: $(-\infty, \infty)$
Range: $(-\infty, 8]$
Axis of Symmetry: $x = 1$

$y = -2(x-1)^2 + 8$