5.3 Graphing from Vertex Form

When a problem is written as a perfect square, we call this vertex form. Vertex form allows you to quickly identify the VERTEX! Since the first step to graphing a quadratic is to find the vertex – you won't have to do much altering to this form.

VERTEX FORM:

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

Although this form is most beneficial in identifying the vertex of the graph, you can also easily determine the axis of symmetry and the direction of opening.

Vertex	(h, k)	
Axis of Symmetry	$x = h$	
Direction of Opening	Up: a is positive	Down: a is negative

Example1: Given the following quadratic equation, state the vertex, axis of symmetry, and if it opens up or down.

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

Vertex: $(3, 2)$
AoS: $x = 3$
Opens up

b) $y = 2(x+9)^2 - 3$

Vertex: $(-9, -3)$
AoS: $x = -9$
Opens up

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

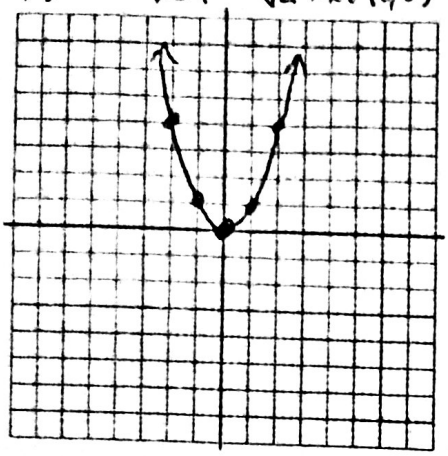
$y = -(x+0)^2 - 3$
Vertex: $(0, -3)$
AoS: $x = 0$
Opens Down

d) $\frac{1}{2}(x+2)^2 + 0$

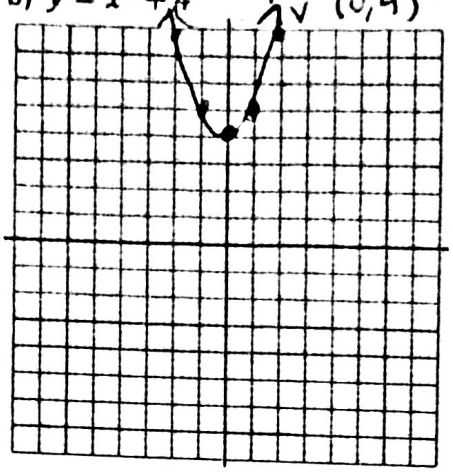
Vertex: $(-2, 0)$
AoS: $x = -2$
Opens up

Example 2: Identify the vertex then graph each parabola.

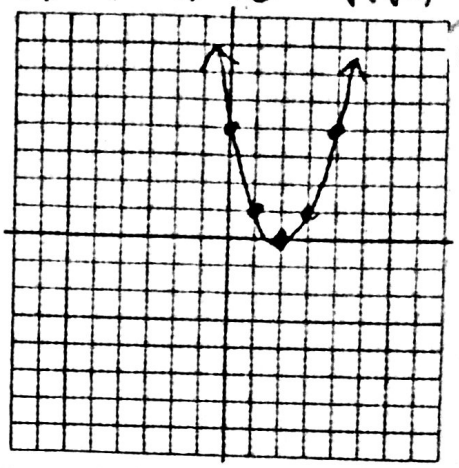
a) $y = x^2$ $a=1$ Vertex: (0,0)



b) $y = x^2 + 4$ $y = (x+0)^2 + 4$ V (0,4)

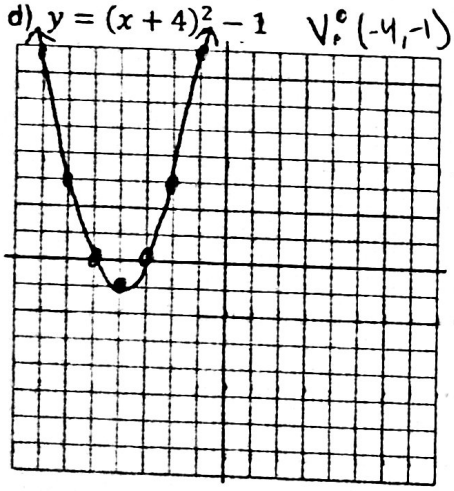


c) $y = (x-2)^2 + 0$ V: (2,0)



Tip: If you are missing part of the equation, use 0 as a placeholder ex: $y = x^2 + 4$
$= (x+0)^2 + 4$

d) $y = (x+4)^2 - 1$ V: (-4,-1)



x-intercept(s): (-5,0), (-3,0)

y-intercept: ~~off~~ graph

Axis of Symmetry: $x = -4$

Vertex: (-4,-1)

Max/min value: -1

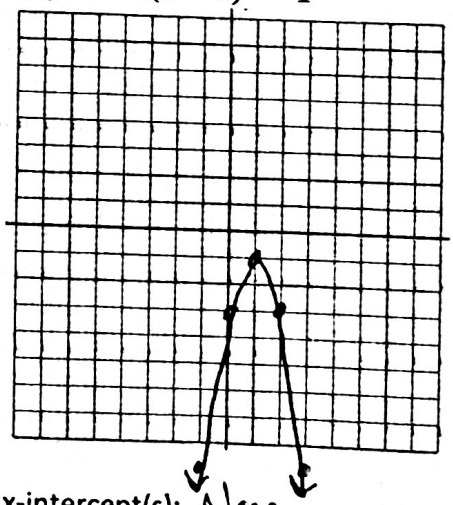
Domain: $(-\infty, \infty)$

Range: $[-1, \infty)$

Increasing: $(-4, \infty)$

Decreasing: $(-\infty, -4)$

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



x-intercept(s): None

y-intercept: (0,-3)

Axis of Symmetry: $x = 1$

Vertex: (1,-1)

Max/min value: -1

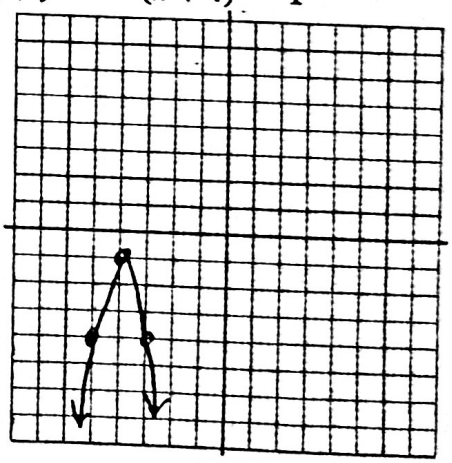
Domain: $(-\infty, \infty)$

Range: $(-\infty, -1]$

Increasing: $(-\infty, 1)$

Decreasing: $(1, \infty)$

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



x-intercept(s): None

y-intercept: ~~off~~ graph

Axis of Symmetry:

Vertex: (-4,-1)

Max/min value: -1

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

Range: $(-\infty, -1]$

Increasing: $(-\infty, -4)$

Decreasing: $(-4, \infty)$