5.5: 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: $y = a(x-h)^2 + k$ — h & k are x & y coordinates of the vertex

Although this form is most beneficial in identifying the vertex of the graph, you can also easily determine the axis of symmetry, if the graph opens up or down, and if there is a vertical stretch or compression.

Vertex	(h, k)
Axis of Symmetry	x=h
Direction of Opening	+/- a value
Vertical stretch/compression	a>1 or a<1 Stretch Compress

a=1 Neither

Example1: Given the following quadratic equation, state the vertex, axis of symmetry, and if it opens up or down. Also state if there is a vertical stretch/compression and if there is a reflection.

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

Vertex: (3, 2)
AoS: x=3
Opens up
Neither stretch/compress

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

Vertex: (-9, -3)
AoS: x=-9
Opens up
Stretch (a=2)

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

Vertex: (0, -3)
AoS: x=0
Opens down
Neither stretch/compress

When nothing is in parentheses with x^2, the number that represents nothing is 0.

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

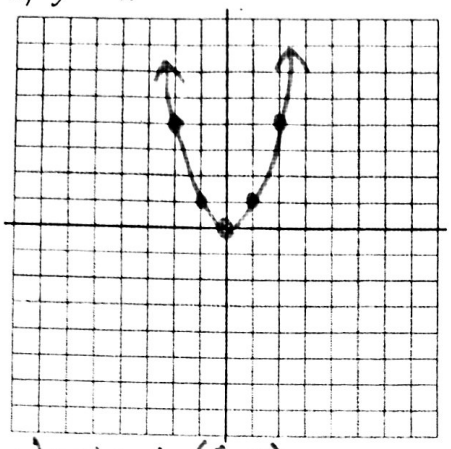
Vertex: (-2, 0)
AoS: x=-2
Opens up
Compression ($a=\frac{1}{2}$)

Nothing outside number that represents nothing is 0

All we need to graph is the vertex and the a-value.

Example 2: Identify the vertex then graph each parabola.

a) $y = x^2$



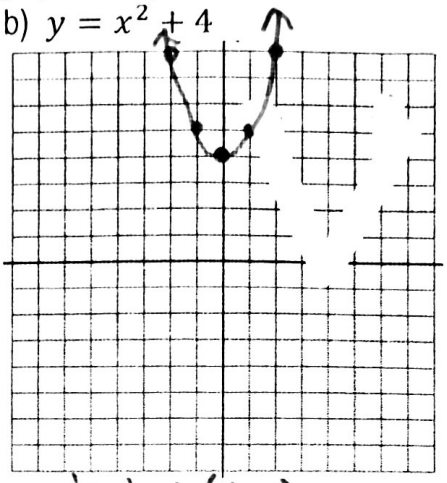
Vertex: (0,0)

$a = 1$

$1a = 1(1) = 1$

$3a = 3(1) = 3$

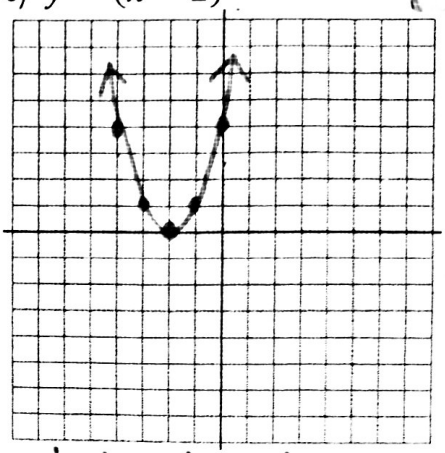
b) $y = x^2 + 4$



Vertex: (0,4)

$a = 1$

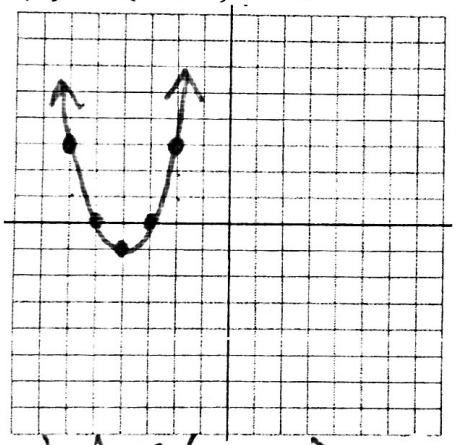
c) $y = (x - 2)^2$



Vertex: (-2,0)

$a = 1$

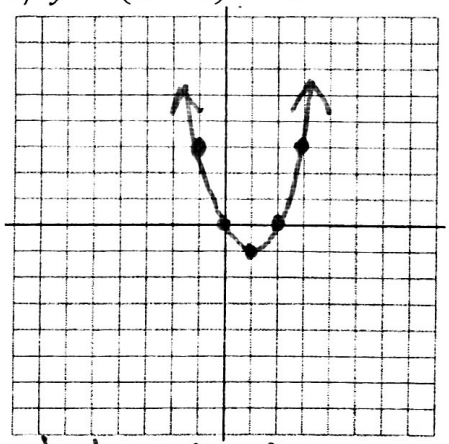
d) $y = (x + 4)^2 - 1$



Vertex: (-4,-1)

$a = 1$

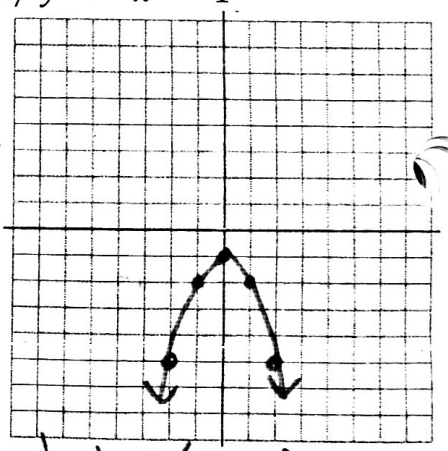
e) $y = (x - 1)^2 - 1$



Vertex: (1,-1)

$a = 1$

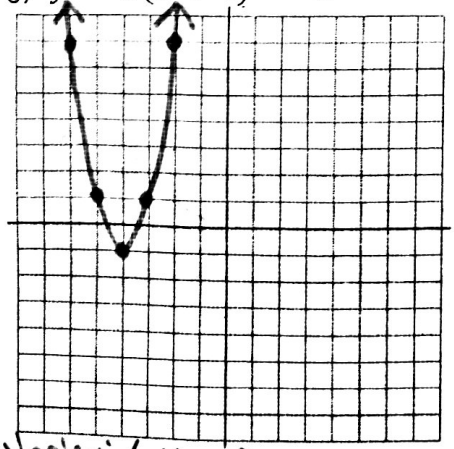
f) $y = -x^2 - 1$



Vertex: (0,-1)

$a = -1$

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



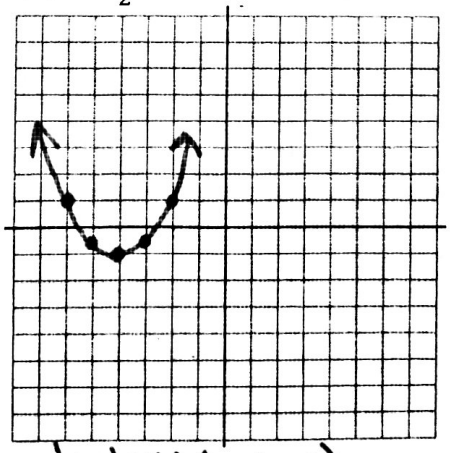
Vertex: (-4,-1)

$a = 2$

$1a = 1(2) = 2$

$3a = 3(2) = 6$

h) $y = \frac{1}{2}(x + 4)^2 - 1$



Vertex: (-4,-1)

$a = \frac{1}{2}$

$1a = 1(\frac{1}{2}) = \frac{1}{2}$

$3a = 3(\frac{1}{2}) = 1.5$

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