* Only need the vertex and the a-value to graph a parabola

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

Memorize :)

Opposite

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	a is positive Concave Up	a is negative Concave Down

Max/min value

k

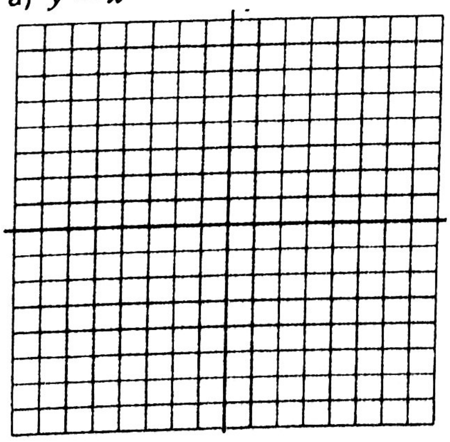
Concave - which way it opens

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

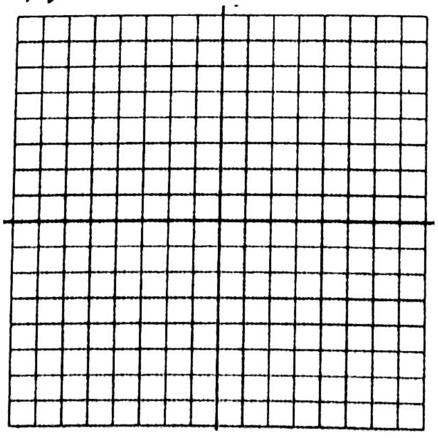
a) $y = (x-3)^2 + 2$ Vertex: $(3, 2)$ AoS: $x = 3$ Concave up	b) $y = 2(x+9)^2 - 3$ Vertex: $(-9, -3)$ AoS: $x = -9$ Concave Up
c) $y = -x^2 - 3 = -(x+0)^2 - 3$ Vertex: $(0, -3)$ AoS: $x = 0$ Concave down	d) $\frac{1}{2}(x+2)^2 + 0$ Vertex: $(-2, 0)$ AoS: $x = -2$ Concave up

Example 2: Identify the vertex then graph each parabola.

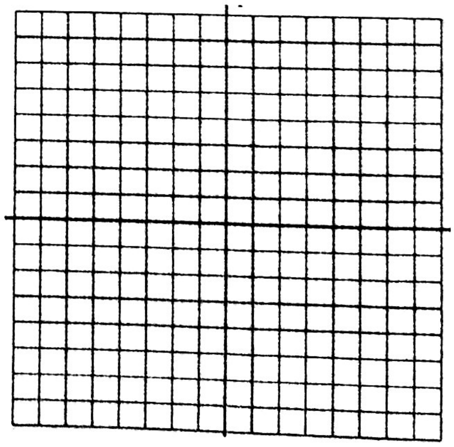
a) $y = x^2$



b) $y = x^2 + 4$



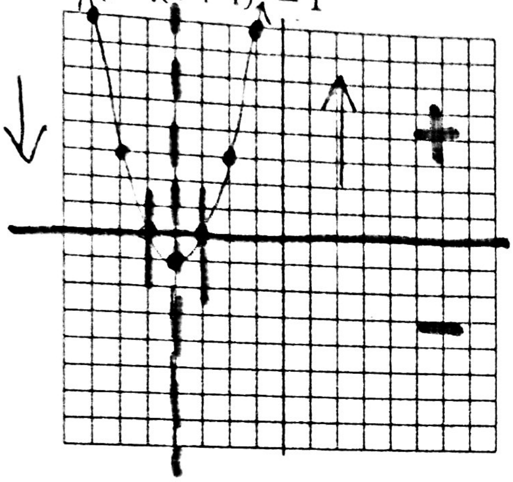
c) $y = (x-2)^2$



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

$a=1$

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



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

y-intercept: $(0, 15)$

Axis of Symmetry: $x = -4$

Vertex: $(-4,-1)$

Max/min value: -1

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

Range: $[-1, \infty)$

Increasing: $(-4, \infty)$

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

Positive: $(-\infty, -5) \cup (-3, \infty)$

Negative: $(-5, -3)$

End behavior:

As $x \to -\infty$, $y \to \infty$

As $x \to \infty$, $y \to \infty$

$a=1$ $1a = 1$ over 1, up 1

$3a = 3$ over 1, up 3

$5a = 5$ over 1, up 5

$x = 0$ $y = (0+4)^2 - 1$

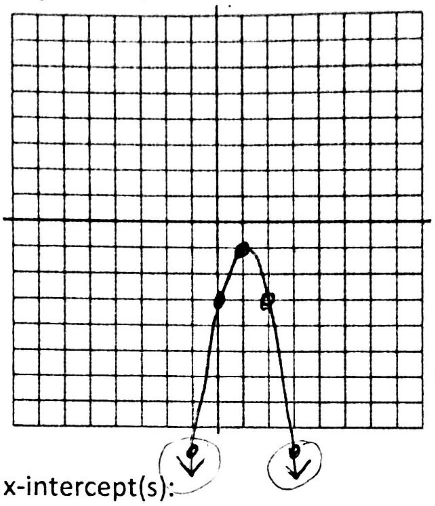
$= (4)^2 - 1$

$= 16 - 1$

$= 15$

$a=-2$

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



x-intercept(s):

y-intercept:

Axis of Symmetry:

Vertex: $(1,-1)$

Max/min value:

Domain:

Range:

Increasing:

Decreasing:

Positive: None

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

End behavior:

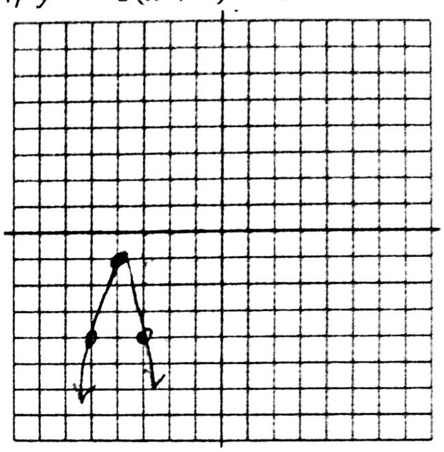
$1a = 1(-2) = -2$

$3a = 3(-2) = -6$

$5a = 5(-2) = -10$

$a=-3$

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



x-intercept(s):

y-intercept:

Axis of Symmetry:

Vertex: $(-4,-1)$

Max/min value:

Domain:

Range:

Increasing:

Decreasing:

Positive:

Negative:

End behavior:

$1a = 1(-3) = -3$

$3a = 3(-3) = -9$