(6.) $f(x) = -6x^2 - 4x - 5$

vertex $\left(\frac{-1}{3}, \frac{-13}{3}\right)$

$$x = \frac{-b}{2a} = \frac{-(-4)}{2(-6)}$$

$$x = \frac{4}{-12} = \frac{-1}{3}$$

$$f\left(\frac{-1}{3}\right) = -6\left(\frac{-1}{3}\right)^2 - 4\left(\frac{-1}{3}\right) - 5$$

$$= \frac{-6}{9} + \frac{4}{3} - 5 = -\frac{2}{3} + \frac{4}{3} - 5 = \frac{2}{3} - 5$$

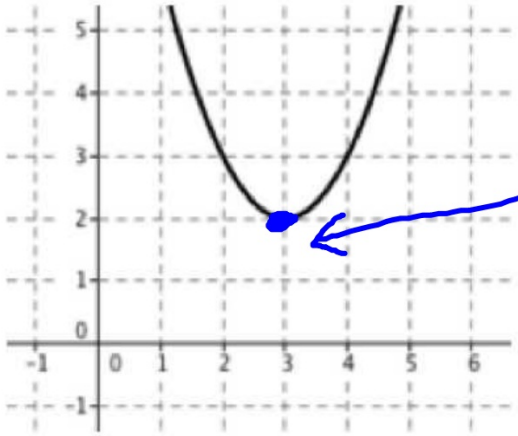
$$= \frac{2}{3} - \frac{15}{3}$$

$-13/3$

*Graphing in standard form is doable, but graphing in vertex form and intercept forms is easier and a lot less work!

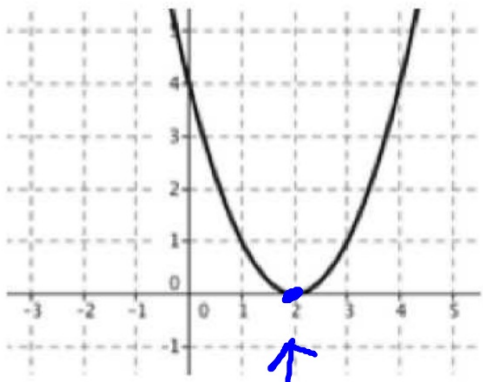
ex: Use the graph to determine the coordinates of the vertex.

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



(3, 2)

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



$(2, 0)$

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

$(3, -4)$

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

$(-1, -3)$

ex: Determine the coordinates of the vertex <u>without</u> the use the graph.

a) $y=(x+9)^2+5$

$(-9,5)$

b) $y=-2(x-1)^2+10$

$(1,10)$

c) $y=-(x+3)^2+7$

$(-3,7)$

ex: Factor. *perfect square trinomials*

a) $x^2 - 10x + 25$ $(x-5)^2 = (x-5)(x-5)$

b) $x^2 + 12x + 36$ $(x+6)^2$

c) $x^2 - 2x + 1$ $(x-1)^2$

Rewriting From Standard To Vertex Form

*To rewrite a quadratic from standard form to vertex form you must complete the square.

ex: Write the quadratic function in vertex form.

a) $y = x^2 + 16x - 33$

1) rewrite with placeholders

2) $(b/2)^2$

3) Factor and simplify

$$y = \underbrace{x^2 + 16x + 64}\ \underline{-64} - 33$$

$$\left(\frac{16}{2}\right)^2 = 64$$

$$y = (x+8)^2 - 97$$

b) $y = x^2 - 6x + 19$

$y = \underbrace{x^2 - 6x + 9} - 9 + 19$

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

$\left(\frac{-6}{2}\right)^2 = 9$

c) $y = x^2 + 24x + 100$

$y = \underbrace{x^2 + 24x + 144} - 144 + 100$

$y = (x+12)^2 - 44$

$\left(\frac{24}{2}\right)^2 = 144$

d) $y = x^2 + 14x + 27$

$y = x^2 + 14x \underline{+49} \underline{-49} + 27$

$y = (x+7)^2 - 22$

e) $y = x^2 - 12x + 36$

$y = (x-6)^2$

f) $y = x^2 + 20x$

$$y = \underbrace{x^2 + 20x + 100} \underline{-100}$$

$$y = (x+10)^2 - 100$$

g) $y = x^2 + 7x + 2$

$$y = \underbrace{x^2 + 7x + \underline{\tfrac{49}{4}}} \underline{-\tfrac{49}{4}} + 2$$

$$\left(\frac{7}{2}\right)^2 = \frac{49}{4}$$

$$y = \left(x + \frac{7}{2}\right)^2 - \frac{49}{4} + \frac{8}{4}$$

$$y = \left(x + \frac{7}{2}\right)^2 - \frac{41}{4}$$

Sketching Quadratics In Vertex Form

*To sketch in vertex form find the vertex and two other points, one on each side of the vertex.

State the vertex, AOS, domain, range, and max/min value.

ex: Sketch the quadratic function.

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

Vertex (-1, -3)

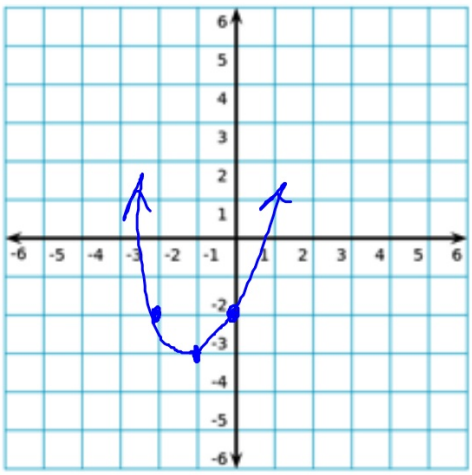
AOS X = -1

Domain (-∞, ∞)

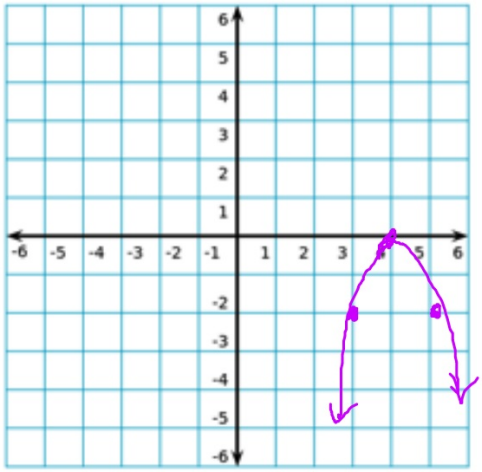
Range [-3, ∞)

Max/min value -3

x	y
0	-2
-1	-3
-2	-2



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



Vertex $(4, 0)$

AOS $x = 4$

Domain $(-\infty, \infty)$

Range $(-\infty, 0]$

max/min value 0

x	y
3	-2
4	0
5	-2

c) $y = x^2 + 2x - 5$

$y = x^2 + 2x \underline{+1} \underline{-1} - 5$

$y = (x+1)^2 - 6$

Vertex $(-1, -6)$

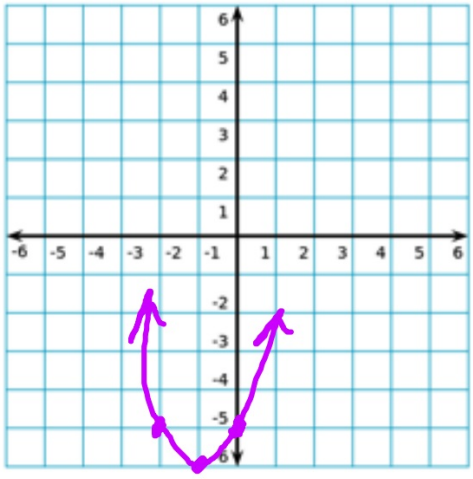
AOS $x = -1$

Domain $\{x \mid x \in R\}$

Range $\{y \mid y \geq -6\}$

max/min value -6

x	y
0	-5
-1	-6
-2	-5



d) $y = x^2 - 4x$

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

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

Vertex $(2, -4)$

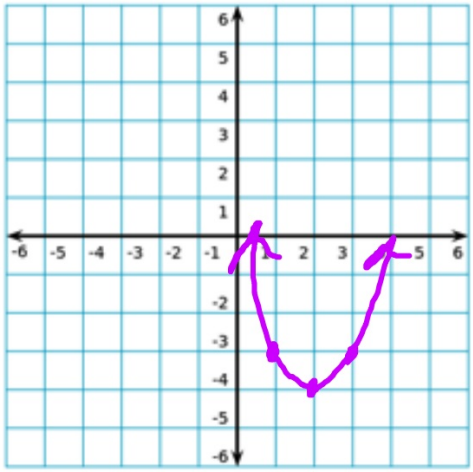
AOS $x = 2$

Domain $\{x \mid x \in R\}$

Range $\{y \mid y \geq -4\}$

max/min value -4

x	y
1	-3
2	-4
3	-3



In general...

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

a) When will the graph open up?

$a > 0$

b) When will the graph open down?

$a < 0$

c) What is the axis of symmetry?

$x = h$

d) What is the vertex? (h, k)