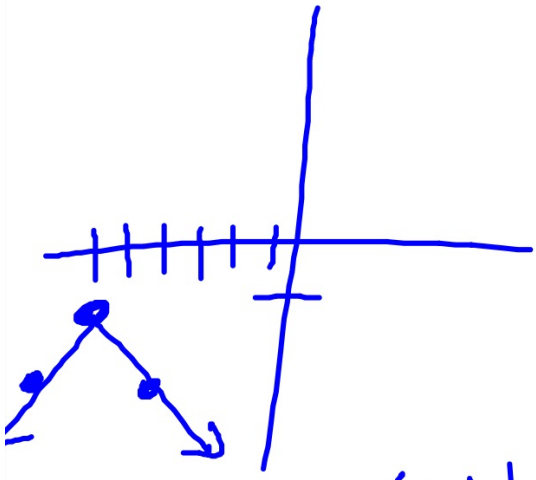
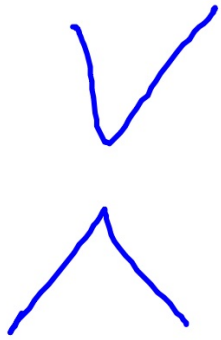
10.) $y = -|x+6| - 1$





Set: $R\{\cancel{x} \mid y \leq -1\}$

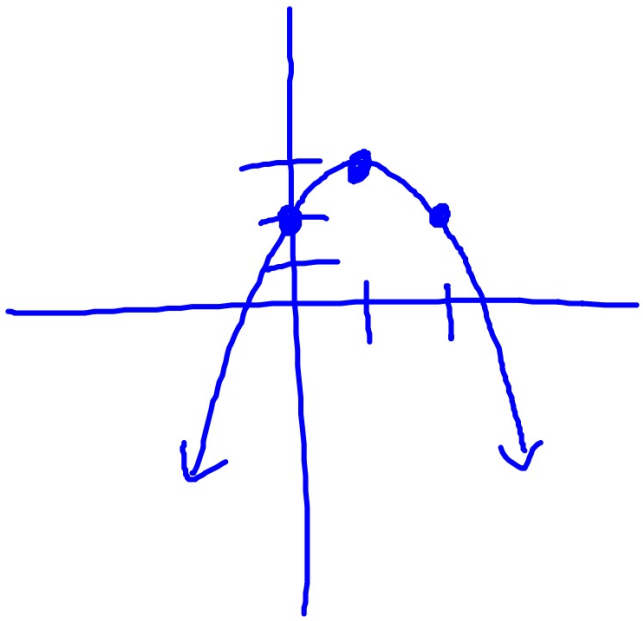
1.7 Completing The Square (Part 1)
1.2 Graph Quadratic Functions in Vertex and Intercept Forms

ex: Sketch: $y = -x^2 + 2x + 2$

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

$$x = +1$$

$$(+1, 3)$$

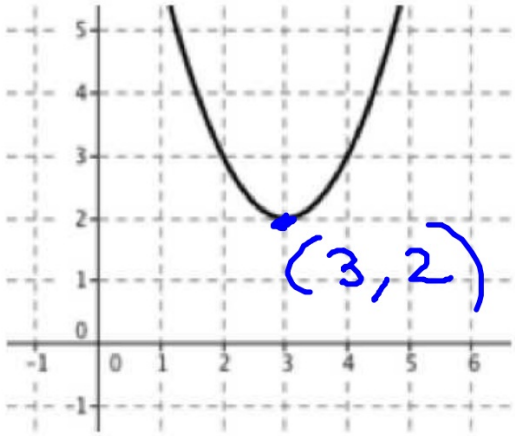


*Graphing in standard form is doable, but graphing in vertex form and intercept forms is easier and a lot less work!

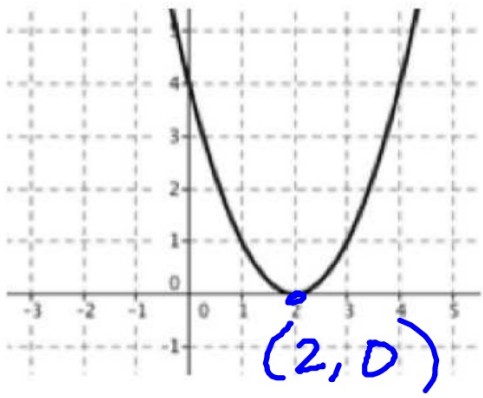
ex: Use the graph to determine the coordinates of the vertex.

vertex form

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



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



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

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

$(-9, 5)$

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

$(1, 10)$

ex: Factor.

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

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

c) $9x^2 - 12x + 4$ $(3x-2)^2$

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

$y = (x^2 + 16x + 64) - 33 - 64$

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

1) Separate the x terms from the constant term

2) Calculate $(b/2)^2$

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

3) Add and subtract the value

4) Factor and combine the constants

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

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

$$\left(\frac{-6}{2}\right)^2 \qquad y = (x-3)^2 + 10$$

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

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

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

d) $y = x^2 + 5x - 10$

$$y = x^2 + 5x \underline{+ \frac{25}{4}} - 10 \underline{- \frac{25}{4}}$$

$$y = \left(x + \frac{5}{2}\right)^2 - \frac{65}{4}$$

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

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

$a \neq 1$ (factor out "a" from the variable terms)

f) $y = 4x^2 + 24x + 17$

$y = 4x^2 + 24x \_\_\_ + 17 \_\_\_$

$y = 4(x^2 + 6x \underline{+9}) + 17 \underline{-36}$

$y = 4(x+3)^2 - 19$

g) $y = 6x^2 - 24x + 2$

$y = 6x^2 - 24x + 2$

$y = 6(x^2 - 4x + \underline{4}) + 2 \underline{-24}$

$y = 6(x-2)^2 - 22$

h) $y = -x^2 + 8x - 4$

$y = -x^2 + 8x \_\_\_\_ - 4 \_\_\_\_$

$y = -(x^2 - 8x + \underline{16}) - 4 \underline{+16}$

$y = -(x-4)^2 + 12$

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

Sketching Quadratics In Vertex Form

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

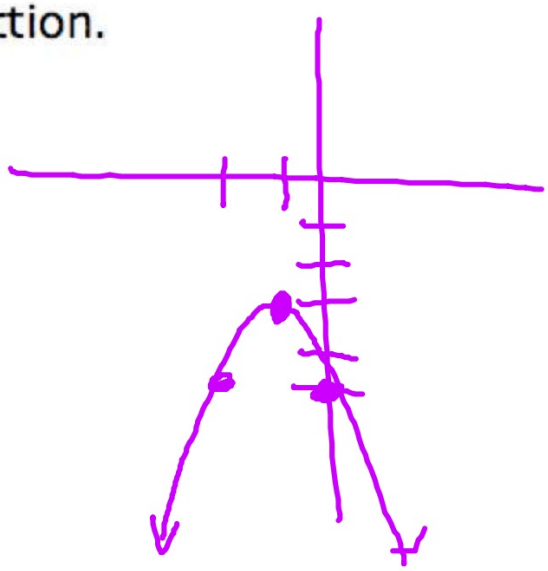
ex: Sketch the quadratic function.

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

Vertex $(-1, -3)$

$-2(1)^2 - 3$

$-2 - 3 = -5$



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

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?

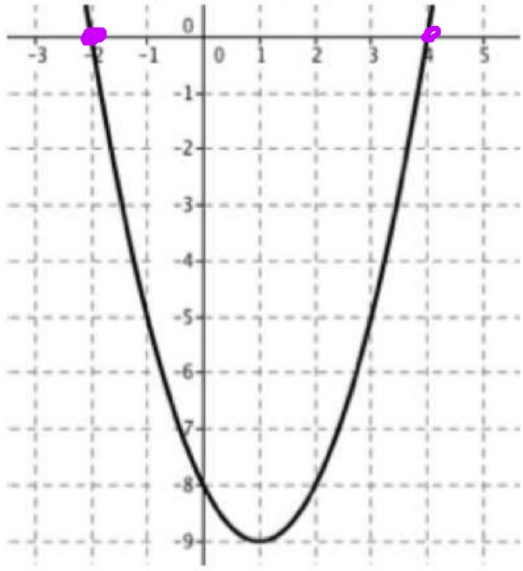
$x = h$

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

Exploring Intercept Form

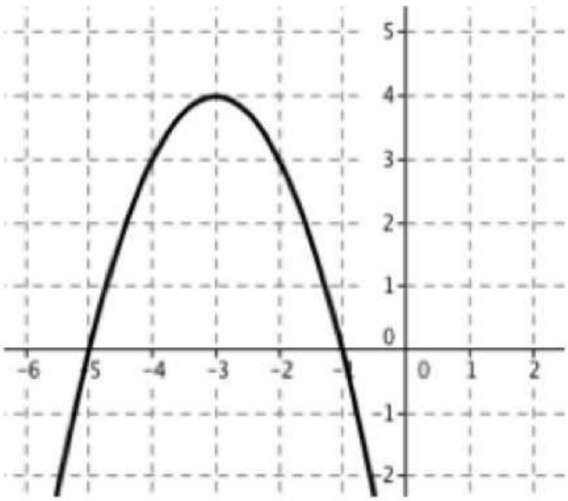
ex: Use the graph to determine the coordinates of the vertex and state the x-intercepts.

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



(-2, 0) (4, 0)

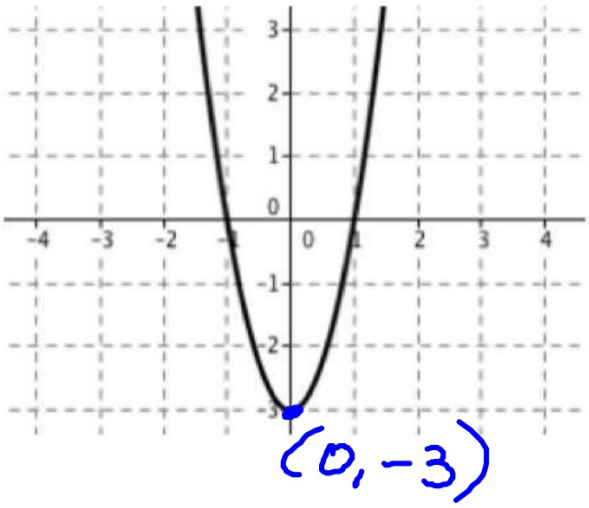
b) $y = -(x+1)(x+5)$



$(-5, 0)$

$(-1, 0)$

c) $y = 3(x+1)(x-1)$



$(-1, 0)$

$(1, 0)$

ex: State the x-intercepts and the x-value of the vertex.

a) $y=(x+5)(x-1)$

$(-5,0)\ (1,0)$

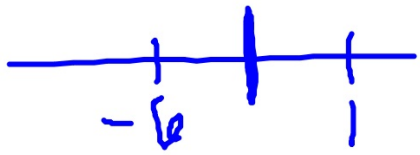
$\frac{-5+1}{2}=-2$

$x: -2$

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

x-intercepts: $(1,0), (-6,0)$

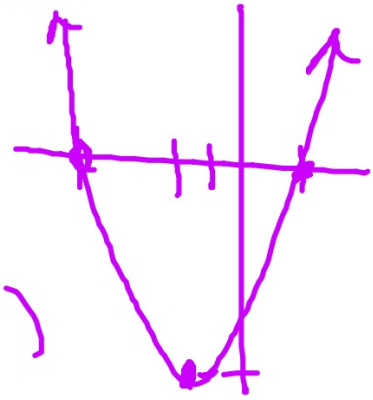
vertex: $-2\frac{1}{2}$



Sketching Quadratics In Intercept Form

*To sketch in vertex form find the vertex and the x-intercepts.

ex: Sketch the quadratic function.



a) $y = 2(x-1)(x+5)$

x-int. $(1, 0)$ $(-5, 0)$

vertex $(-2, -18)$

$y = 2(-2-1)(-2+5) = 2(-3)(3) = -18$

b) $y = -(x+2)(x+6)$

In general...

Intercept Form: $y = a(x-p)(x-q)$

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?

$x = \frac{p+q}{2}$

d) How do you find the y-value of the vertex?

plug in x-value for AOS

ex: Rewrite in standard form.

a) $y = 2(x+3)(x-5)$

$y = 2(x^2 - 5x + 3x - 15)$

$y = 2(x^2 - 2x - 15)$

$y = 2x^2 - 4x - 30$

b) $y = -2(x+5)^2 + 10$

$y = -2(x^2 + 10x + 25) + 10$

$y = -2x^2 - 20x - 50 + 10$

$y = -2x^2 - 20x - 40$

Review:

ex: What number sets does $1.\overline{718}$ belong to?

$\mathbb{R}$, $\mathbb{Q}$ 3.14.....

ex: Express in set & interval notation: Any number, except 3.

Set: $\{x \mid x \neq 3\}$

Interval: $(-\infty, 3) \cup (3, \infty)$