Summary of the three forms of Quadratic Function

	Standard Form	Factored Form	Vertex Form
	$y = ax^2 + bx + c$	$y = a(x-r)(x-s)$	$y = a(x-p)^2 + q$
Axis of Symm	$x = -\frac{b}{2a}$	$x = \frac{r+s}{2}$	$x = p$
vertex	$x = \frac{-b}{2a}$, $y = a\left(\frac{-b}{2a}\right)^2 + b\left(\frac{-b}{2a}\right) + c$	$x = \frac{r+s}{2} = p$ $y = a(p-r)(p-s)$	(p, q)
y-int	$(0, c)$	$y = a(0-r)(0-s)$	$y = a(0-p)^2 + q$
Domain	$\{x \mid x \in \mathbb{R}\}$	$\{x \mid x \in \mathbb{R}\}$	$\{x \mid x \in \mathbb{R}\}$
Range	If $a > 0$ $\{y \mid y \geq$ y-coord of vertex If $a < 0$ $\{y \mid y \leq$ y-coord of vertex	If $a > 0$ $\{y \mid y \geq$ y-coord of vertex If $a < 0$ $\{y \mid y \leq$ y-coord of vertex	If $a > 0$ $\{y \mid y \geq q, y \in \mathbb{R}\}$ If $a < 0$ $\{y \mid y \leq q, y \in \mathbb{R}\}$

x-int: $x = r$, $x = s$

Given the function $y = -\frac{1}{2}(x+4)^2 + 6$ determine the following information and sketch the graph. [7]

Axis of Symmetry equation: $x = -4$

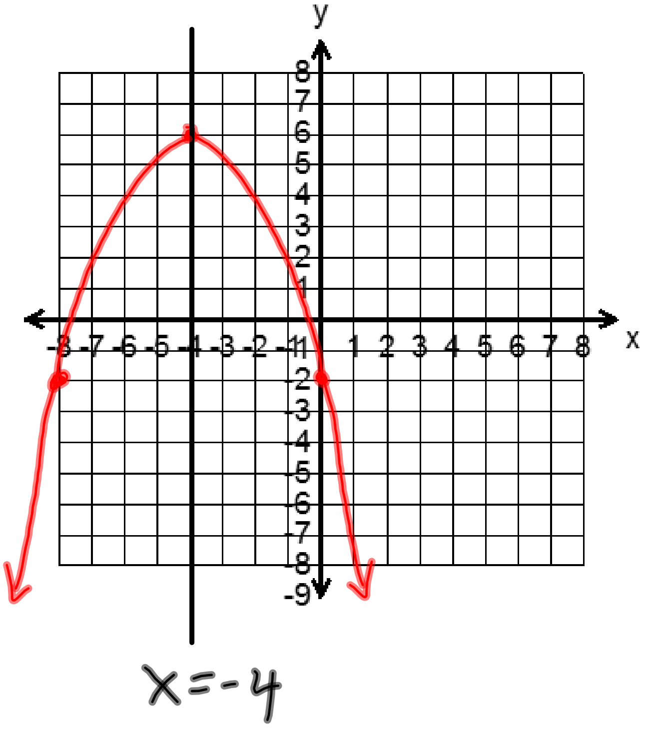
Vertex: $(-4, 6)$

Maximum or ~~Minimum~~ value is 6

Y–intercept: $(0, -2)$

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

Range: $\{y \mid y \leq 6, y \in \mathbb{R}\}$



$y = -\frac{1}{2}(0+4)^2 + 6$

$y = -\frac{1}{2}(4)^2 + 6$

$y = -\frac{1}{2}(16) + 6 = -8 + 6 = -2$

Given the function $\boxed{y = \frac{1}{2}x^2 + x + 1}$ determine the following information and sketch the graph. [7]

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

Axis of Symmetry equation: $x = -1$

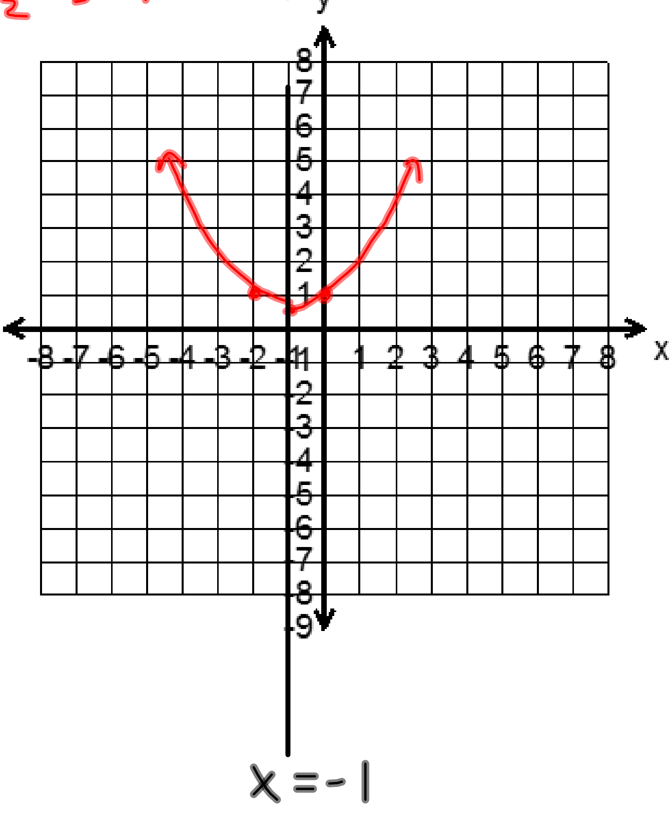
Vertex: $(-1, \frac{1}{2})$

~~Maximum~~ or Minimum value is $\frac{1}{2}$

Y–intercept: $(0, 1)$

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

Range: $\{y \mid y \geq \frac{1}{2}, y \in \mathbb{R}\}$



Ex: The vertex of a parabola is $(4,-12)$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\;\; p \;\; q$

write an equation to represent <u>all</u> parabolas with this vertex.

Solution using vertex form : $y = a(x-p)^2 + q$

and vertex$(\underset{p}{4}, \underset{q}{-12})$: $y = a(x-4)^2 - 12$

(b) If a specific parabola passes through $(\overset{x}{13}, \overset{y}{15})$ with this vertex $(4,-12)$, what is its equation?

Solution: Parabola with vertex $(4,-12)$ is

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

using $(13,15)$ to temporarily replace x and y, we can solve for "a"

$$15 = a(13-4)^2 - 12$$

$$15+12 = a(9)^2$$

$$\frac{27}{81} = \frac{\cancel{81}a}{\cancel{81}}$$

$$a = \frac{27}{81}$$

$$a = \frac{1}{3}$$

So, the specific parabola with vertex $(4,-12)$ and passing through $(13,15)$ is

$$y = \frac{1}{3}(x-4)^2 - 12$$

Ex: A parabola has x-intercepts at $x = -6$ and $x = -2$. The parabola has a maximum height of 15 m. Determine the quadratic function that fits this parabola.

$(-6,0)$ $(-2,0)$

vertex is $(-4,15)$

vertex form is: $y = a(x+4)^2 + 15$

using $(-2,0)$ we get $0 = a(-2+4)^2 + 15$

$$-15 = a(2)^2$$

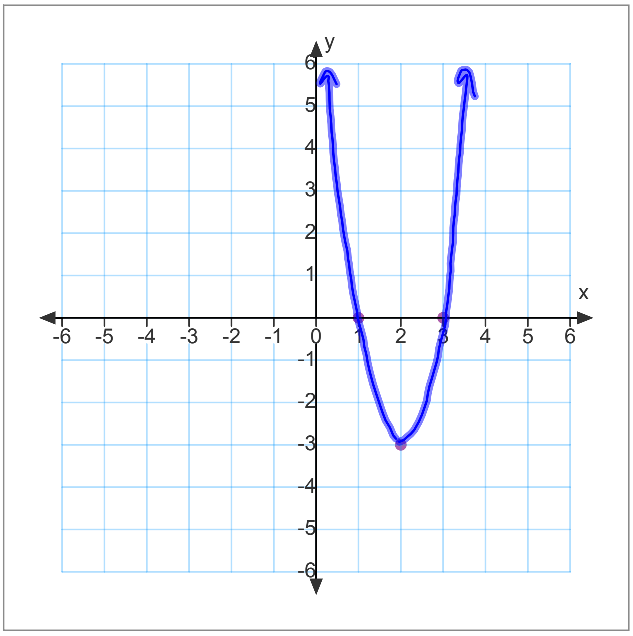
$$\frac{-15}{4} = \frac{4a}{4}$$

$$\frac{-15}{4} = a$$

So, the function is

$$y = -\frac{15}{4}(x+4)^2 + 15$$

Ex: Determine the function represented by this graph



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

Practice questions:

p. 386 #s 1, 3, 4, 7, 9–14