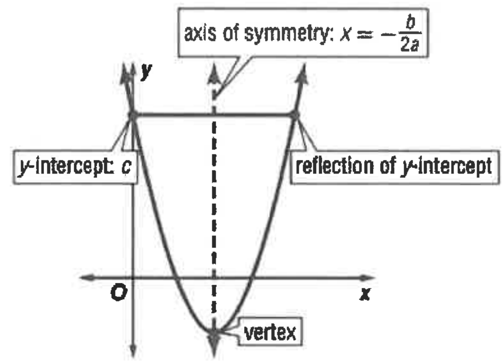
Quadratic Function

$$\underbrace{f(x) = ax^2}_{\text{quadratic term}} + \underbrace{bx}_{\text{linear term}} + \underbrace{c}_{\text{constant term}}, \text{ where } a \neq 0$$

Axis of Symmetry:

$\boxed{x = \frac{-b}{2a}}$

a line through the graph of a parabola that divides the graph into 2 congruent halves



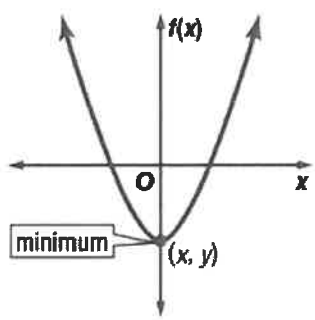
Vertex:

point where axis of symmetry intersects the parabola

$\left(-b/2a,\ f(-b/2a)\right)$

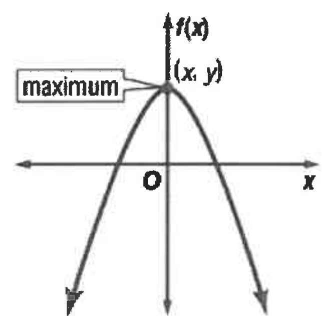
$f(x) = ax^2 + bx + c$

a is positive.



The *y*-coordinate is the minimum value.

a is negative.



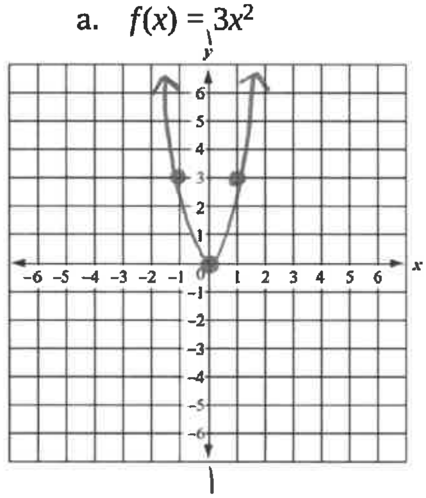
The *y*-coordinate is the maximum value.

4.1 Graphing Quadratic Functions
Honors Algebra 2

1. Sketch the following functions. To do this find the axis of symmetry, vertex, and y-intercepts. Make a table of values if needed.

a. $f(x) = 3x^2$

$a = 3$
$b = 0$
$c = 0$



AoS: $x = \frac{-0}{2(3)} = 0$

vertex: $f(0) = 3(0)^2 = 0$

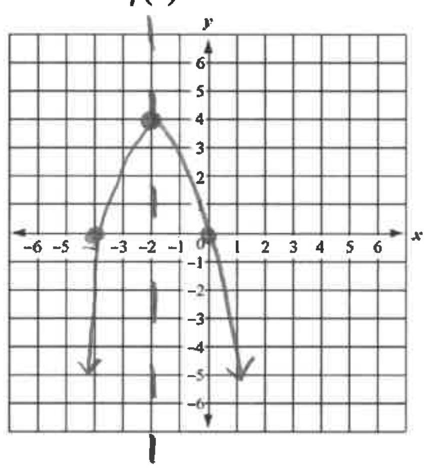
$(0, 0)$

y-int: $(0, 0)$

x	y
1	3
	↖ reflect over AoS
-1	3

b. $f(x) = -x^2 - 4x$

$a = -1$
$b = -4$
$c = 0$



AoS: $x = \frac{-(-4)}{2(-1)}$

$= 4/-2$

$= -2$

vertex: $f(-2) = -(-2)^2 - 4(-2)$

$= -4 + 8$

$= 4$

$(-2, 4)$

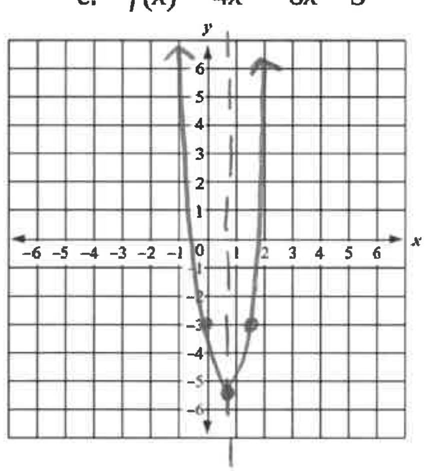
y-int: $f(x) = -0^2 - 4(0)$

$= 0$

$(0, 0)$ ↖ reflect over AoS

c. $f(x) = 4x^2 - 6x - 3$

$a = 4$
$b = -6$
$c = -3$



AoS: $x = \frac{-(-6)}{2(4)} = \frac{6}{8} = \frac{3}{4}$

vertex: $f(3/4) = 4(3/4)^2 - 6(3/4) - 3$

$= -5.25$

$(3/4, -5.25)$

y-int: $f(x) = 4(0)^2 - 6(0) - 3$

$= -3$

$(0, -3)$

↖ reflect

2. Consider $f(x) = -4x^2 + 12x + 18$.
   a. Determine whether the function has a maximum or minimum.

max b/c $a = -4$

   b. Find the max/min value.

$x = \frac{-12}{2(-4)} = \frac{-12}{-8} = \frac{3}{2}$

$f(3/2) = -4(3/2)^2 + 12(3/2) + 18$
$= 27$

$(3/2, 27)$

max value $= 27$

3. Consider $f(x) = 3x^2 + 8x + 5$.
   a. Determine whether the function has a maximum or minimum.

min b/c $a = 3$

   b. Find the max/min value.

$x = \frac{-8}{2(3)} = -\frac{8}{9}$

$f(-8/9) = 3(-8/9)^2 + 8(-8/9) + 5$

$= 7/27$

$(-8/9, 7/27)$

min value $= 7/27 \approx 0.259$