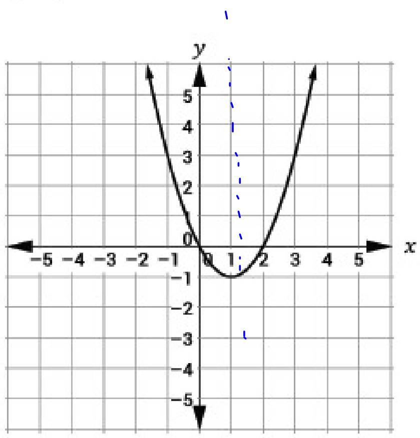
Section 5: Quadratic Equations and Functions – Part 2

Section 5 – Topic 1

Graphing Quadratic Functions in Standard Form

What information can we gather from the graph of the quadratic equation $y = x^2 - 2x$? Label all findings on the graph.



Opening Up or Down?	up
Axis of symmetry:	$x=1$
Vertex:	$(1,-1)$
x-intercept(s):	$x=0, 2$ $(0,0)(2,0)$
y-intercept:	$(0,0)$

The standard form of a quadratic function is: $y = ax^2 + bx + c$

Let's Practice!

1. Consider the following quadratic function.

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

$a = 3$
$b = 2$
$c = -1$

a. Complete the table below for $f(x)$.

Opening: If $a > 0$, quadratic opens upward. If $a < 0$, quadratic opens downward.	upward
$-\frac{b}{2a}$ **Axis of Symmetry:** $x = \frac{-b}{2a}$	$x = \frac{-2}{2(3)} = \frac{-2}{6} = \frac{-1}{3}$ $x = -\frac{1}{3}$
Vertex: x −coordinate of vertex is equal to $\frac{-b}{2a}$. Substitute x −coordinate of the vertex into equation to find y −coordinate of the vertex.	$\left(-\frac{1}{3}, -\frac{4}{3}\right)$
-Use quadratic **x-intercepts:** Substitute 0 *for* y and solve for x. formula	$\frac{-2+4}{6} = \frac{2}{6} = \frac{1}{3}$ $\frac{-2-4}{6} = \frac{-6}{6} = -1$
y-int = c **y-intercept:** Substitute 0 for x and solve for y.	$(0, -1)$

$3\left(-\frac{1}{3}\right)^2 + 2\left(-\frac{1}{3}\right) - 1$

$3\left(\frac{1}{9}\right) - \frac{2}{3} - 1$

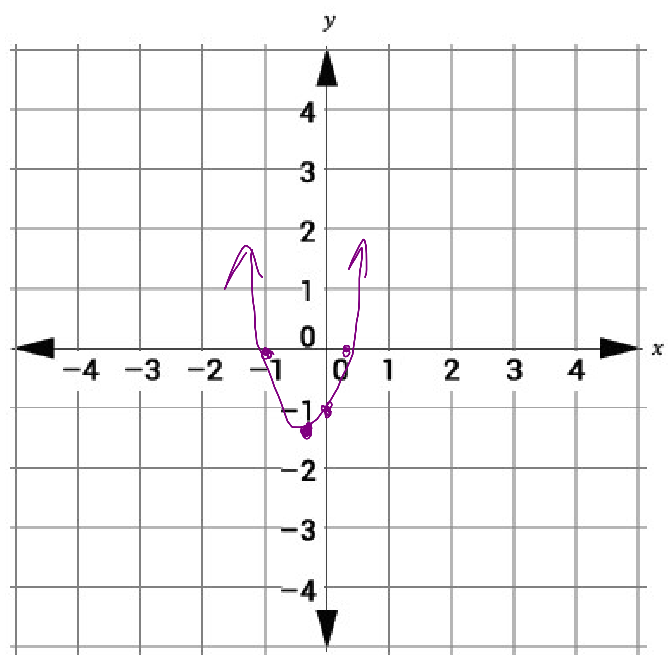
$\frac{1}{3} - \frac{2}{3} - \frac{3}{3}$

$\frac{-2 \pm \sqrt{(2)^2 - 4(3)(-1)}}{2(3)}$

$\frac{-2 \pm \sqrt{4 + 12}}{6}$

$\frac{-2 \pm \sqrt{16}}{6}$

b. Sketch the graph of $f(x)$.



c. What is the axis of symmetry? $x = -1/3$

d. Why do you think the c term is not used in the equation to find the axis of symmetry? c is the y-int

Try It!

2. Consider the following quadratic function.

$$g(x) = 2x^2 - 4x - 1$$

$a = 2$
$b = -4$
$c = -1$

a. Complete the table below for $g(x)$.

Opening: If $a > 0$, quadratic opens upward. If $a < 0$, quadratic opens downward.	upward
Axis of Symmetry: $x = \frac{-b}{2a}$	$\frac{4}{2(2)} = \frac{4}{4} = 1$ $x = 1$
Vertex: x –coordinate of vertex is equal to $\frac{-b}{2a}$. Substitute x-coordinate of the vertex into equation to find y –coordinate of the vertex.	$(1, -3)$
x**-intercepts**: Substitute 0 for y and solve for x.	$\frac{4+4.9}{4} = 2.2$ $\frac{4-4.9}{4} = -.2$
y**-intercept**: Substitute 0 for x and solve for y.	$(0, -1)$

$2(1)^2 - 4(1) - 1$
$2 - 4 - 1 = -3$

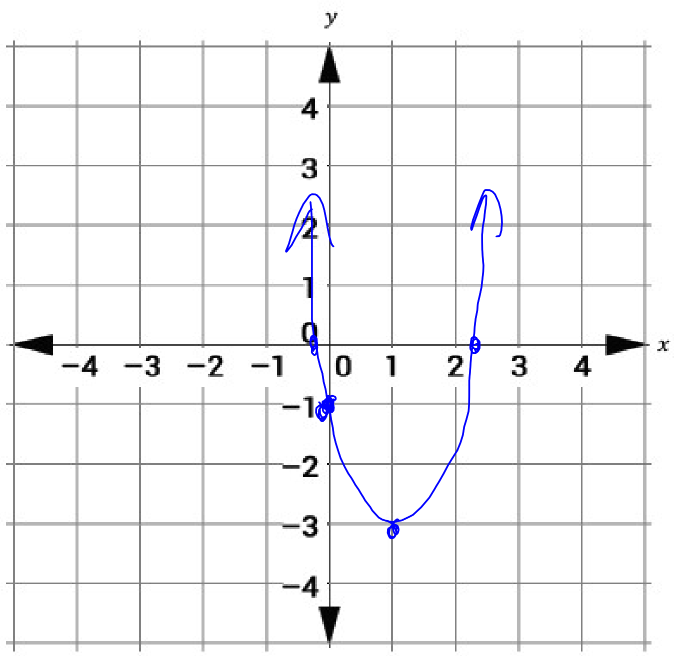
$\frac{4 \pm \sqrt{(4)^2 - 4(2)(-1)}}{2(2)}$

$\frac{4 \pm \sqrt{16+8}}{4}$

$\frac{4 \pm \sqrt{24}}{4}$

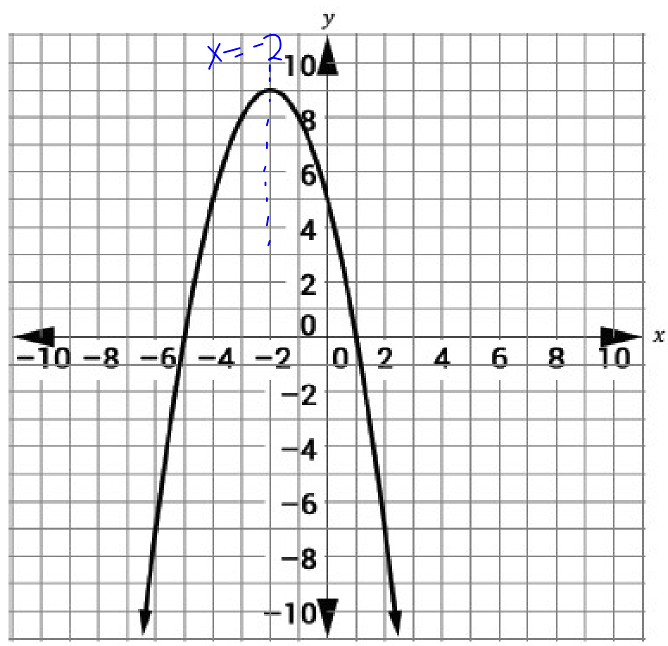
$\sqrt{24} = 4.9$

b. Sketch the graph of $g(x)$.



BEAT THE TEST!

1. Consider the following graph.



vertex $(-2, 9)$

$-2(-2)^2 - 8(-2) + 1$

$-2(4) + 16 + 1$

$-8 + 17 = 9$

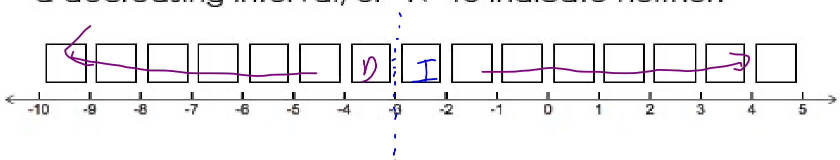
Which function has the same maximum as this graph?

$\frac{-b}{2a} = \frac{8}{2(-2)} = \frac{8}{-4} = -2$

- Ⓐ $f(x) = -2x^2 - 8x + 1$
- Ⓑ $g(x) = -x^2 + 9x + 18$
- Ⓒ ~~$h(x) = x^2 + 4x + 15$~~
- Ⓓ ~~$m(x) = 3x^2 + 12x + 22$~~

2. Consider the function $f(x) = 9x^2 + 54x - 66$.

Over which intervals is the graph increasing, decreasing, or neither? Above each interval on the horizontal axis, write "I" to indicate an increasing interval, "D" to indicate a decreasing interval, or "N" to indicate neither.



$$\frac{-54}{2(9)} = \frac{-54}{18} = -3$$

$(-3, \ )$