Good morning!

1. "Here"

2. Go over homework

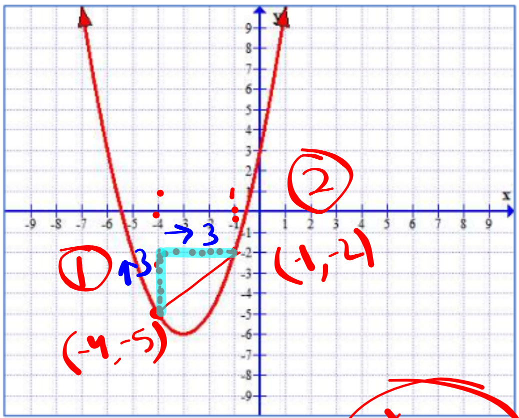
3. Notes on Writing Equations from Graphs and Graphing Standard Form

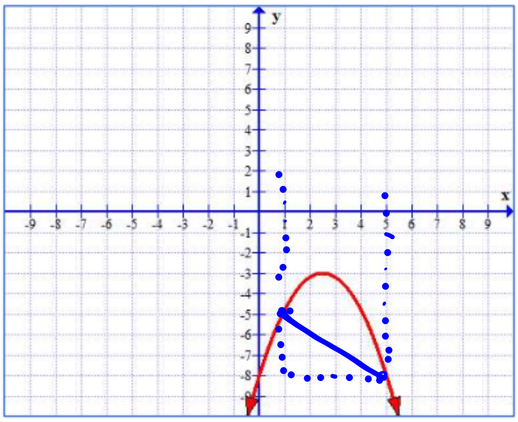
Average Rate of Change Notes

Average Rate of Change (AROC): The change in the value of a quantity divided by the elapsed time. For a function, this is the change in the y-value divided by the change in the x-value for two distinct points on the graph.

$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$ "Slope"

Finding AROC from a graph.
Using the problem, find the two points for which you are trying to find the average rate of change between. Then, use the formula to find the AROC.





Find the AROC of the interval $[-4, -1]$.

$$\frac{\text{change in y}}{\text{change in x}} = \frac{-2-(-5)}{-1-(-4)} = \frac{3}{3} = 1$$

Find the AROC between $x = 1$ and $x = 5$.

$$AROC = \frac{-3}{4}$$

Finding AROC from a graph.
Using the problem, plug in the two x-values (one at a time) to find the two points for which you are trying to find the average rate of change between. Then, use the formula to find the AROC.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad \frac{\text{change in y}}{\text{change in x}}$$

Given $y = (x-2)^2 + 6$, find the average rate of change between $x = -3$ and $x = 2$.

x	$y = (x-2)^2 + 6$
① -3	31
② 2	6

$+5$, -25

$$AROC = \frac{\Delta y}{\Delta x} = \frac{-25}{5} = -5$$

Given $y = -4x^2 + 6x + 11$, find the AROC of the interval $[0, 5]$. (x_1, x_2)

x	$y = -4x^2 + 6x + 11$
0	11
5	-59

$+5$, -70

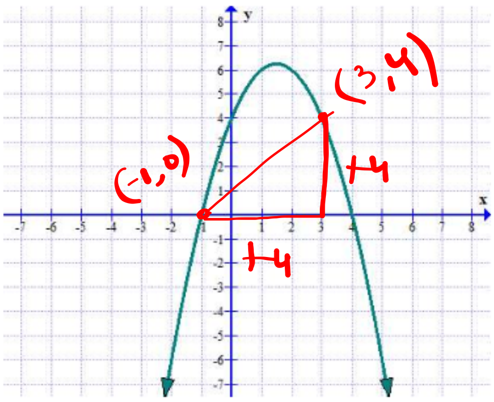
$$AROC = \frac{\Delta y}{\Delta x} = \frac{-70}{5} = -14$$

Average Rate of Change Practice

1) Find the average rate of change over the interval [-1, 3].

x_1, x_2

$AROC = \frac{4}{4} = 1$

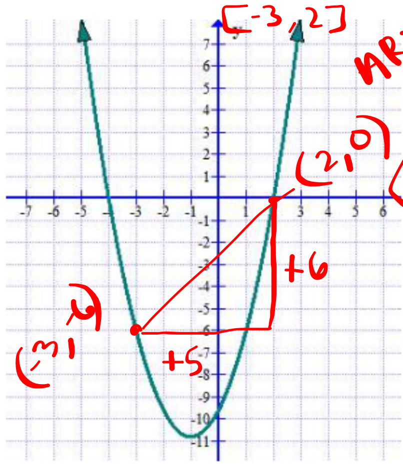


2) Find the average rate of change over the interval $-3 \leq x \leq 2$.

[-3, 2]

$AROC = \frac{RISE}{RUN}$

$\boxed{AROC = \frac{6}{5}}$



3) Using the equation $y = -4(x+2)^2 - 6$, find the average rate of change from x = -2 to x = 1.

x	$y = -4(x+2)^2 - 6$
-2	-6
1	-42

+3, -36

$AROC = \frac{\Delta y}{\Delta x} = \frac{-36}{3} = -12$

4) Using the equation $y = -x^2 - 6x + 2$, find the average rate of change for the interval [-6, -2].

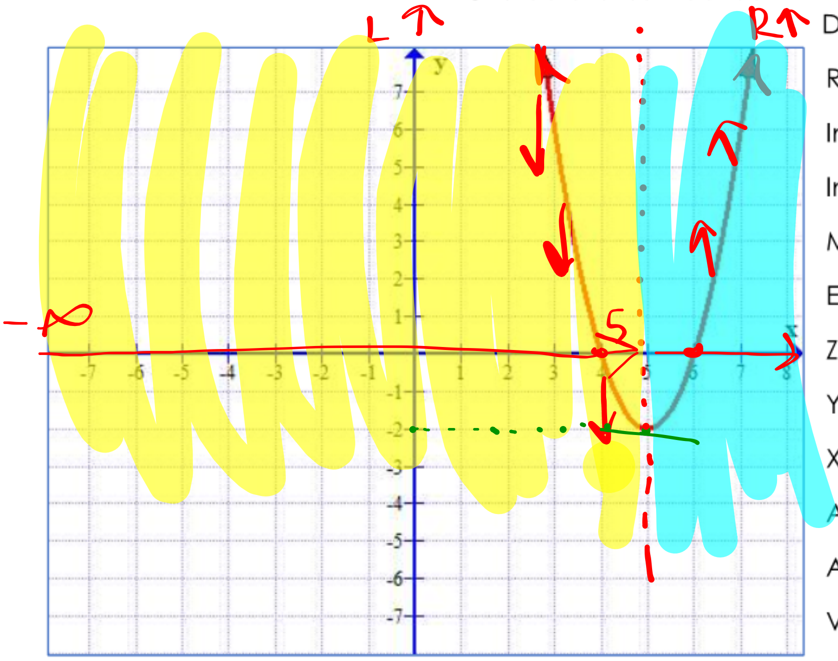
x_1, x_2

x	$y = -x^2 - 6x + 2$
-6	2
-2	$\cancel{22}$ 10

+4, $\cancel{+20}$ +8

$AROC = \frac{\Delta y}{\Delta x} = \frac{\cancel{4}\ 8}{\cancel{20}\ 4} = \cancel{\frac{1}{5}} = 2$

Characteristics Practice



Domain: $(-\infty, \infty)$

Range: $[-2, \infty)$

Int. of Increase: $(5, \infty)$

Int. of Decrease: $(-\infty, 5)$

Max/Min: min

Extrema Value: $y = -2$

Zeros: $x = 4, 6$

Y-Int: not pictured

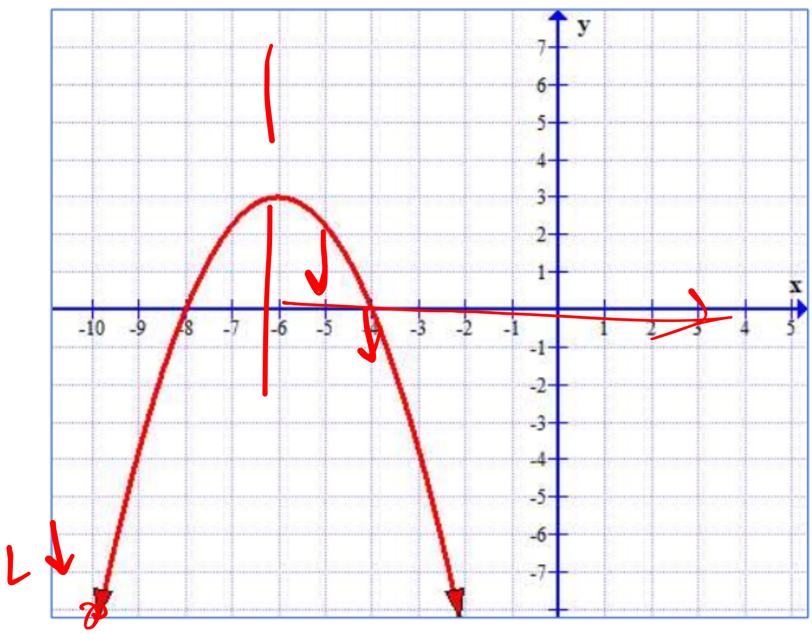
X-Int: $(4, 0), (6, 0)$

As $x \to \infty$ (R), $f(x) \to$ ∞ (UP)

As $x \to -\infty$ (L), $f(x) \to$ ∞ (UP)

Vertex: $(5, -2)$

Axis of Symmetry: $x = 5$



Vertex: $(-6, 3)$

X-Int: $(-4, 0), (-8, 0)$

Int. of Decrease: $(-6, \infty)$

Zeros: $x = -4, -8$

Range: $(-\infty, 3]$

As $x \to -\infty, f(x) \to$ $-\infty$

Max/min: max

Axis of Sym: $x = -6$

Domain: $(-\infty, \infty)$

Y-Int: not pictured

As $x \to \infty, f(x) \to$ $-\infty$

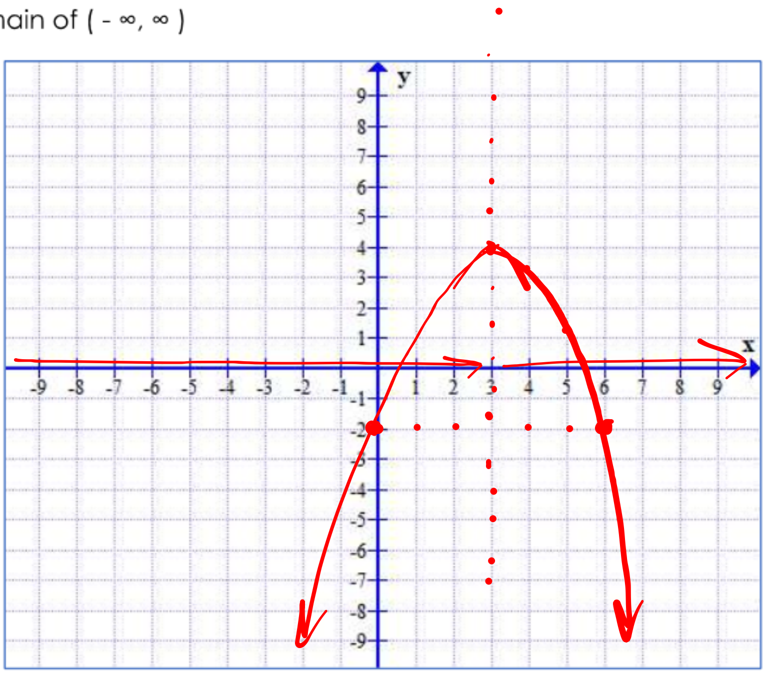
Int. of Increase: $(-\infty, -6)$

~~Int. of Constant:~~

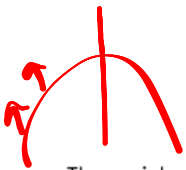
Draw a graph that has the following characteristics:

- Vertex at (3, 4)
- End behavior of as $x \to -\infty, f(x) \to -\infty$ $a < 0$ open down
- Two zeros
- A y-intercept of (0, -2)
- A domain of (- ∞, ∞)

L↓



R↓



Then, identify the following:

Axis of Symmetry: $x = 3$

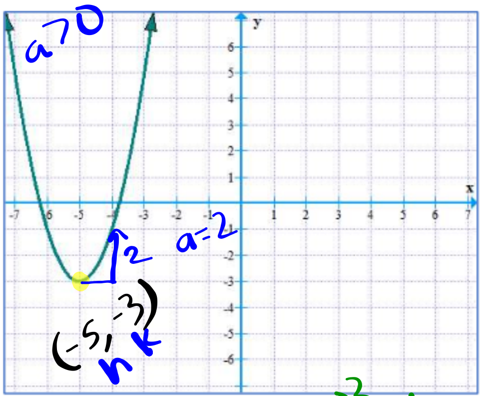
Range: $(-\infty, 4]$

Interval of Increase: $(-\infty, 3)$

Interval of Decrease: $(3, \infty)$

Writing Equations in Vertex Form When Given a Graph

Steps: ① Find the vertex ② Find stretch/shrink/reflection (AROC from vertex to one point to the right) ③ Plug values into equation



$a>0$

$(-5,-3)$ — h, k

2 $a=2$

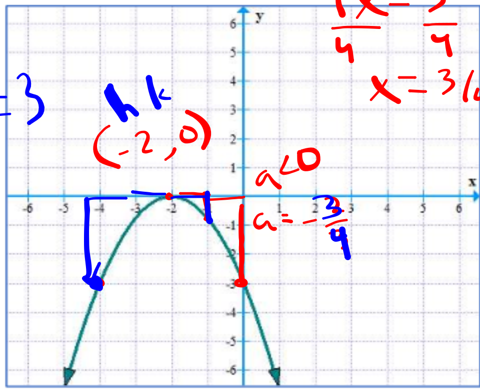
$y=a(x-h)^2+k$

$$\boxed{y=2(x+5)^2-3}$$

$x(2)^2=3$

$\frac{4x}{4}=\frac{3}{4}$

$x=\frac{3}{4}$



$\frac{4x}{4}=\frac{3}{4}$

$x=3/4$

h k $(-2,0)$

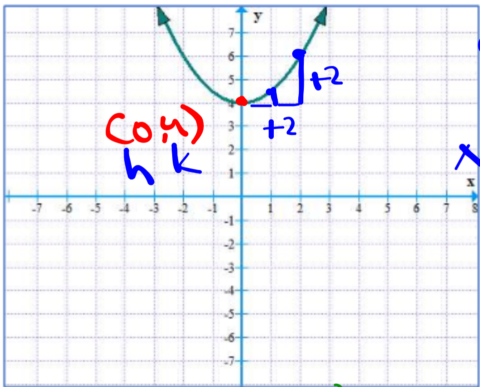
$a<0$

$a=-\frac{3}{4}$

$a=-3/4$

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

$$\boxed{y=-\frac{3}{4}(x+2)^2}$$



$(0,4)$ — h, k

$+2$ $+2$

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

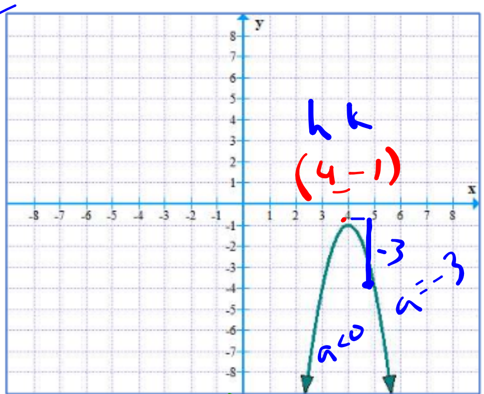
$$\boxed{y=\frac{1}{2}x^2+4}$$

$a=\frac{1}{2}$ ✓

$x(2)^2=2$

$\frac{4x}{4}=\frac{2}{4}$

$x=\frac{1}{2}$



h k $(4,-1)$

-3 $a=-3$

$a<0$

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

$f(x)=y=-3(x-4)^2-1$

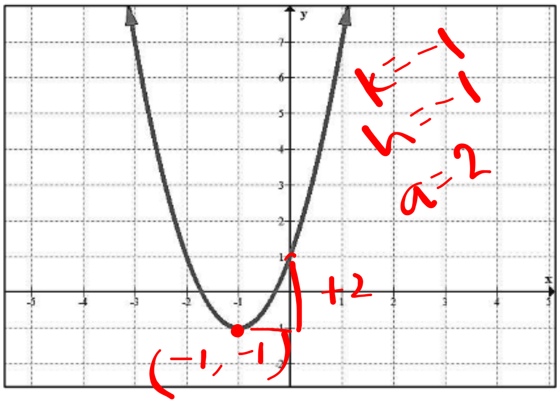
y int: $f(0)=-3(0-4)^2-1$

$-3(16)-1$

$-48-1$

-49

Graphing in Vertex Form – Practice



1) Determine the equation for the function graphed on the left.

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

a) Domain:

b) Range:

c) Extrema:

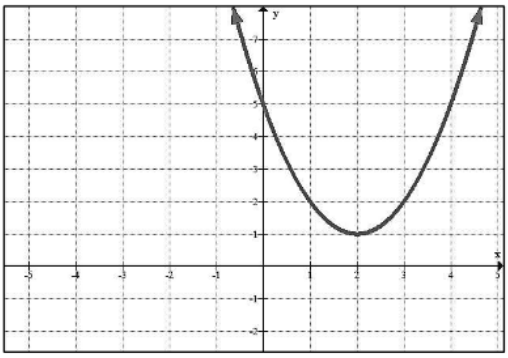
d) Axis of Symmetry:

e) Increasing:

f) Decreasing:

g) As $x \to -\infty, f(x) \to$ ____

h) AROC $-3 \leq x \leq -1.$



1) Determine the equation for the function graphed on the left.

a) Domain:

b) Range:

c) Extrema:

d) Axis of Symmetry:

e) Increasing:

f) Decreasing:

g) As $x \to -\infty, f(x) \to$ ____

h) As $x \to \infty, f(x) \to$ ____

i) AROC between $x = 1$ and $x = 4.$

Graphing and Characteristics of Quadratic Functions

[standard form]

To graph a quadratic function that is in standard form, follow these steps:

① Create an x-y table with 5 rows

② Find the vertex – this goes in the middle row

To find the x-value of the vertex: $x = \frac{-b}{2a}$ h

Then plug the x-value into the equation to get the y-value

③ Fill out the two x-values before and after the vertex

④ Use your calculator to find the y-values and graph

**Note: the y-intercept of a quadratic function in standard form is c **

For the following problems, find the vertex and graph the function.

1) $y = 1x^2 - 2x - 1$

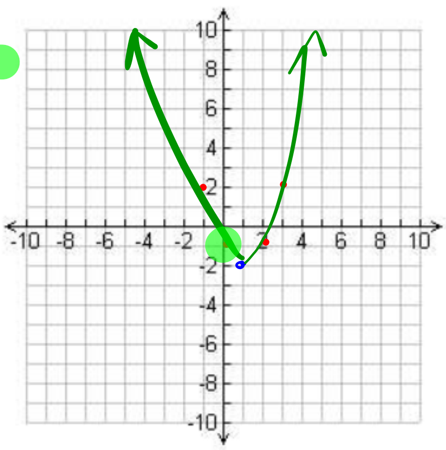
a = 1 b = -2 c = -1

$h = \frac{-b}{2a} = \frac{-(-2)}{2(1)} = 1$

$k = (1)^2 - 2(1) - 1$

$k = -2$

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



2) $y = 3x^2 - 6x + 0$

a = 3 b = -6 c = 0

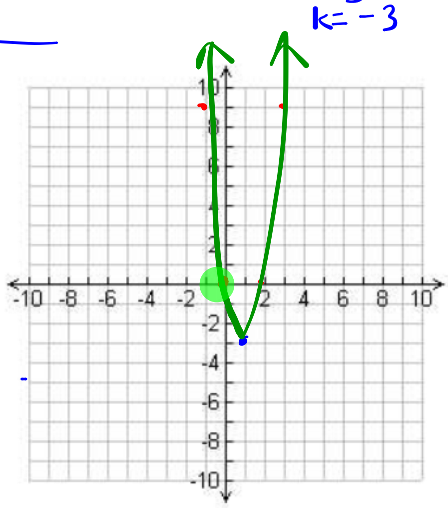
$h = \frac{-b}{2a} = \frac{-(-6)}{2(3)} = 1$

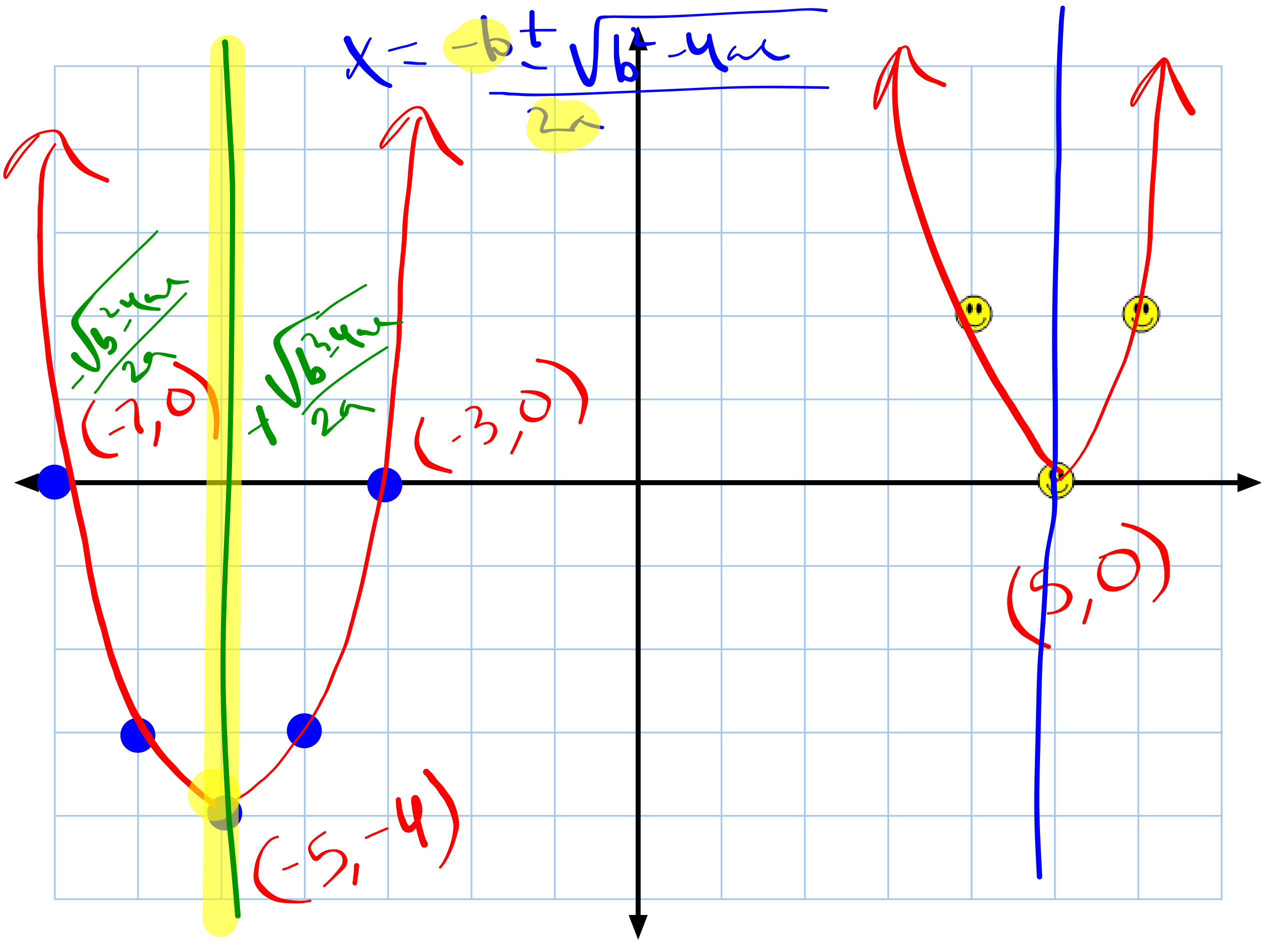
$k = 3(1)^2 - 6(1)$

3 -6

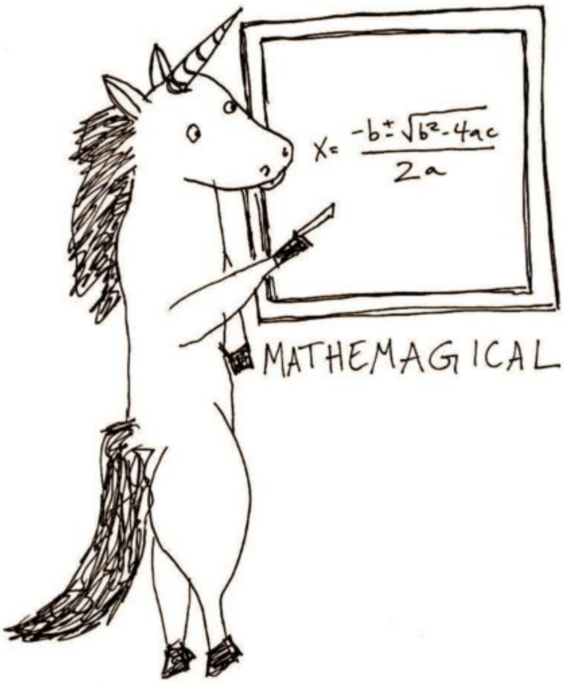
$k = -3$

x	y
-1	9
0	0
1	-3
2	0
3	9





$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
$\frac{-\sqrt{b^2-4ac}}{2a}$
$+\frac{\sqrt{b^2-4ac}}{2a}$
(-7,0)
(-3,0)
(-5,-4)
(5,0)


$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
MATHEMAGICAL

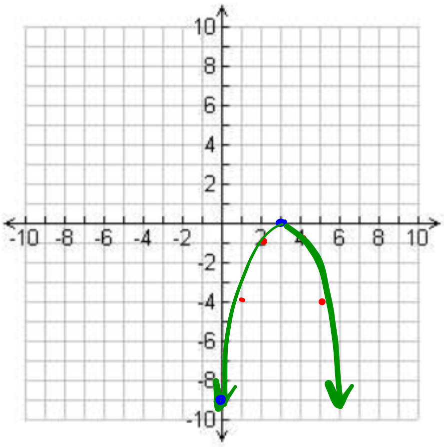
$a = -1$ $b = 6$ $c = -9$

3) $f(x) = -x^2 + 6x - 9$

$h = \frac{-6}{2(-1)} = 3$

$k = 0$

x	y
1	-4
2	-1
3	0
4	-1
5	-4



$a = \frac{1}{2}$ $b = 2$ $c = -6$

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

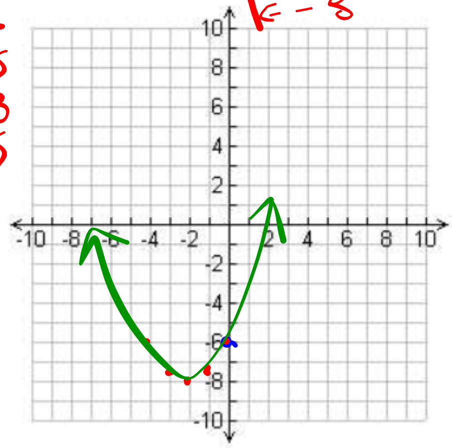
$h = \frac{-b}{2a} = \frac{-2}{2(\frac{1}{2})} = -2$

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

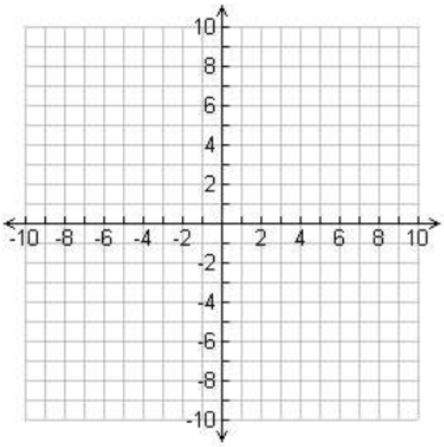
$2 - 4 - 6$

$k = -8$

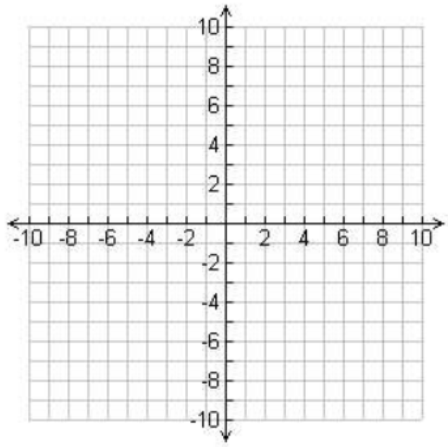
x	y
-4	-6
-3	-7.5
-2	-8
-1	-7.5
0	-6



5) $f(x) = -1.2x^2 + 8$



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



3) $f(x) = -x^2 + 6x - 9$

$0 = -1x^2 + 6x - 9$

$+9 \qquad\qquad +9$

$-1x^2 + 6x + \square = 9$

$-1(x^2 - 6x + \boxed{9}) = 9 - 1\boxed{9}$

$-1(x-3)^2 = 0$

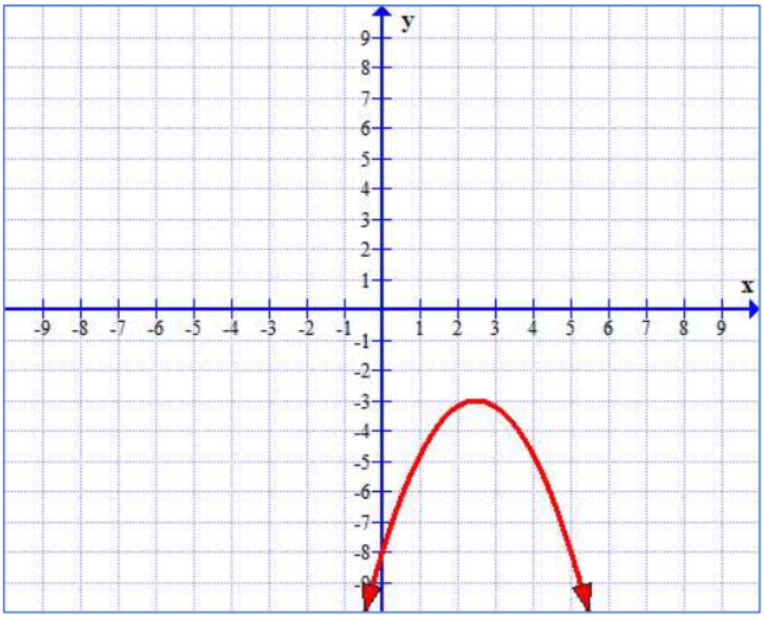
$-1(x-3)^2 = y$

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

$h = 3 \quad k = 0$

25

For the graphs below, find the characteristics listed.



Domain:

Range:

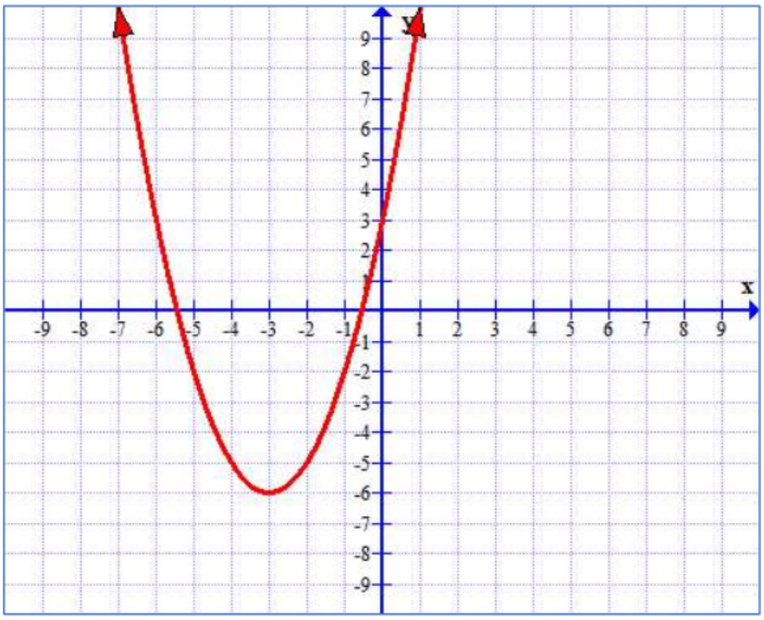
Zeros:

Y-Intercepts:

Interval of Increase:

As x → ∞, f(x) → _____

Extrema:



Range:

X-Intercepts:

Max or Min:

As x → ∞, f(x) → _____

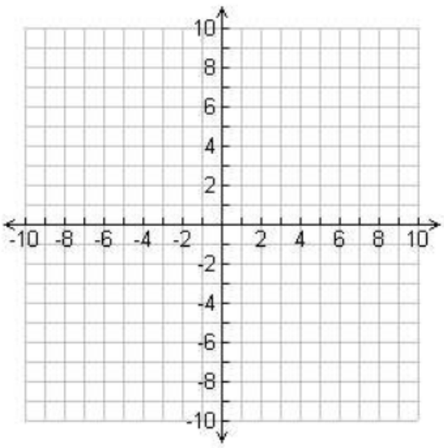
Interval of Increase:

Interval of Decrease

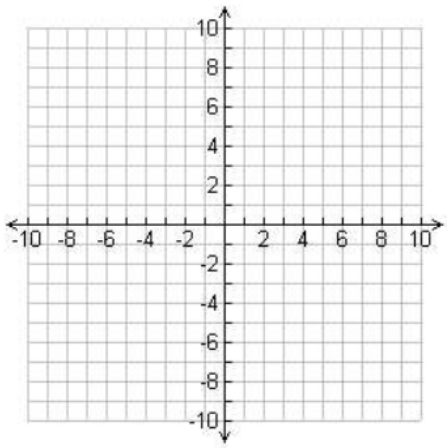
Graphing in Standard Form – Practice

Graph the following.

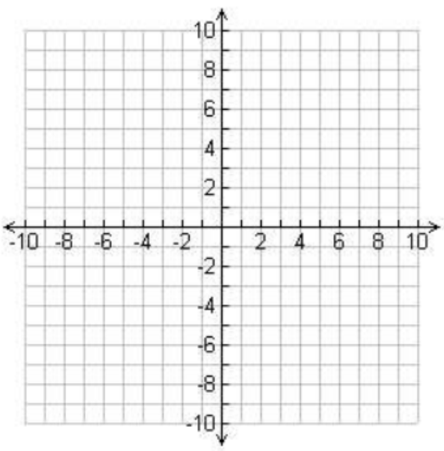
1) $y = 2x^2 + 6x + 3$



2) $y = x^2 - 2x - 1$



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



4) $y = 2x^2 - 8x + 6$