Good morning!

1. "Here"
2. Notes on Graphing Characteristics
3. Upload practice p. 19-20 to CTLS

Warm-up

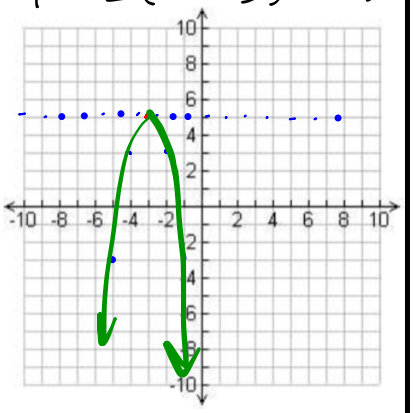
$y = -2(x + 3)^2 + 5$

h k

open down $a < 0$

$|a| > 1$

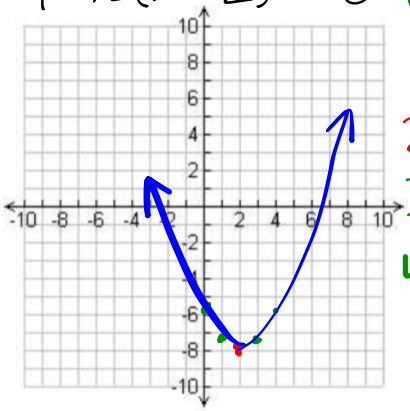
x	y
-5	-3
-4	3
-3	5
-2	3
-1	-3



$y = \frac{1}{2}(x - 2)^2 - 8$

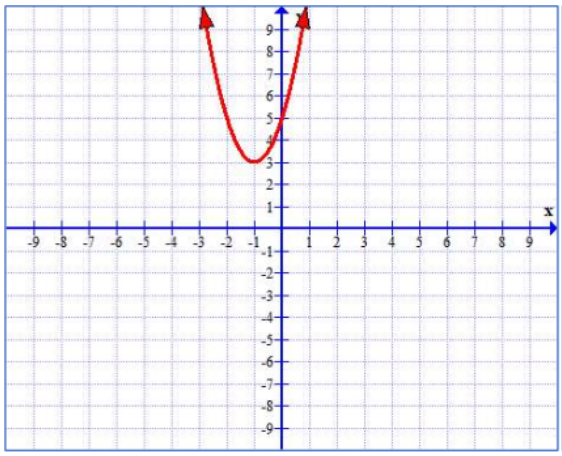
h k

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



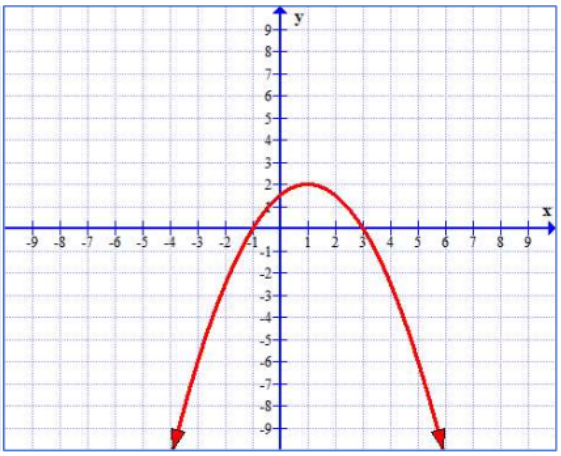
Characteristics
– Domain and Range –

Domain		
Define: All possible values of x	**Think:** How far left to right does the graph go?	**Write:** [#, #]
Range		
Define: All possible values of y	**Think:** How far down to how far up does the graph go?	**Write:** [#, #]



Domain:

Range:



Domain:

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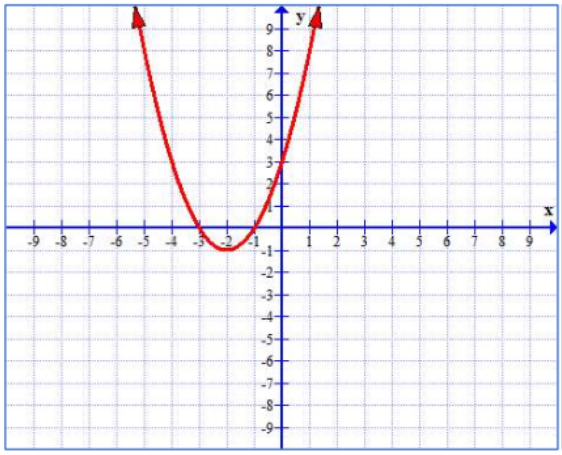
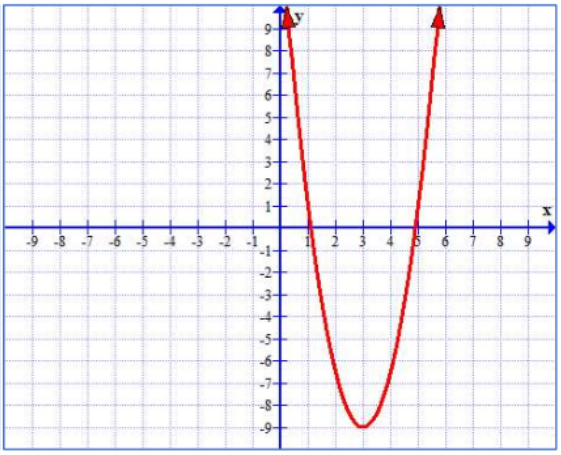


Domain:

Range:

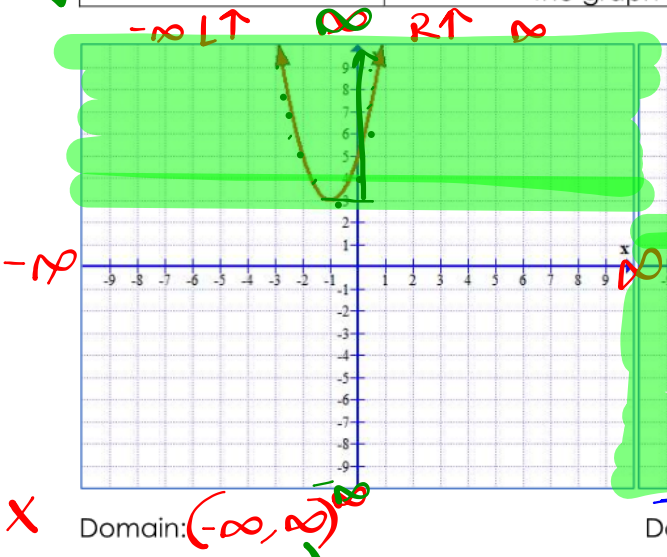


Domain:

Range:

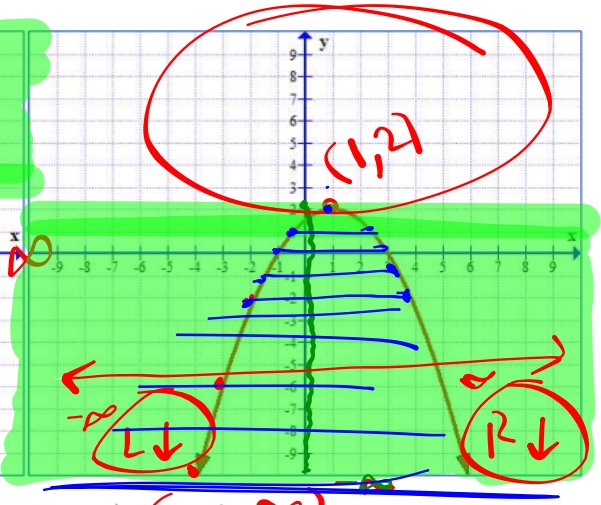
Characteristics
– Domain and Range –

Domain		
Define: All possible values of x	**Think:** How far left to right does the graph go?	**Write:** [#, #]
Range		
Define: All possible values of y	**Think:** How far down to how far up does the graph go?	**Write:** [#, #]



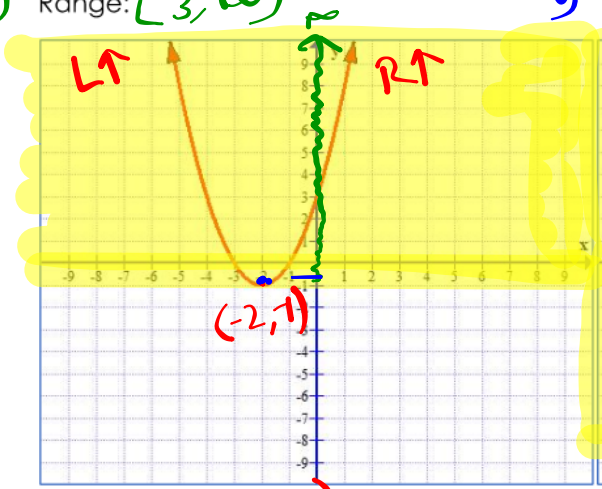
Domain: $(-\infty, \infty)$

Range: $[3, \infty)$



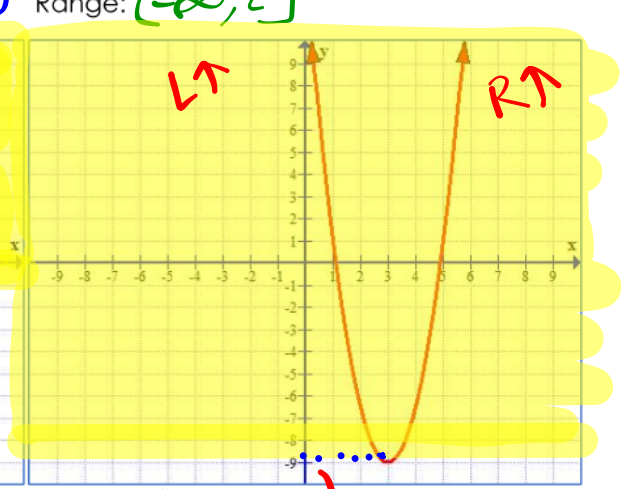
Domain: $(-\infty, \infty)$

Range: $(-\infty, 2]$



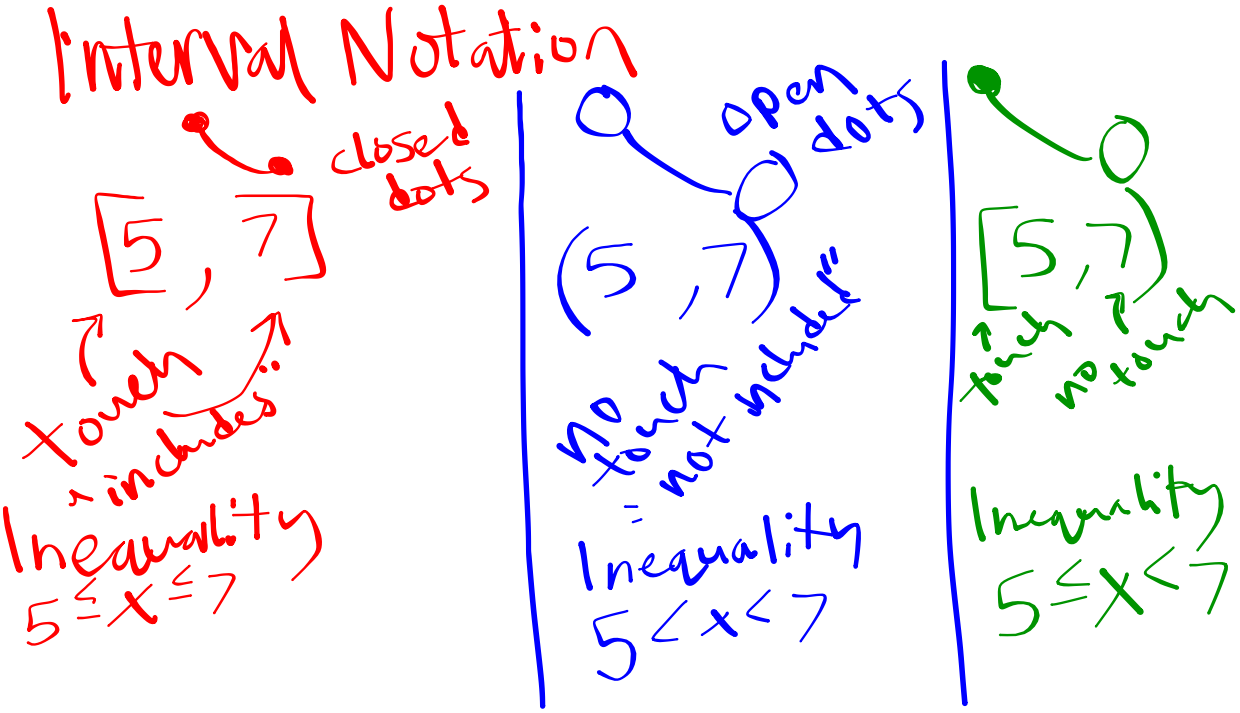
Domain: $(-\infty, \infty)$

Range: $[-1, \infty)$



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

Range: $[-9, \infty)$


Interval Notation
closed dots
[5, 7]
touch
includes
Inequality
5 ≤ x ≤ 7
open dots
(5, 7)
no touch
not include
Inequality
5 < x < 7
[5, 7)
touch
no touch
Inequality
5 ≤ x < 7

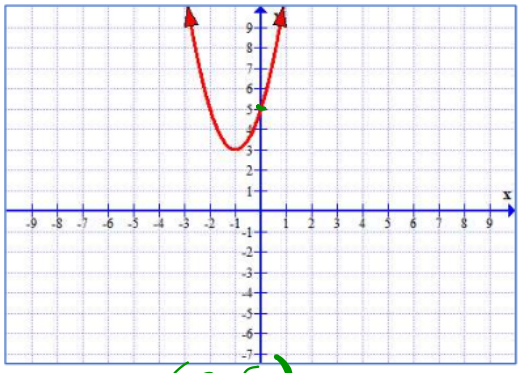
Not Interval! Points!

– zeros and intercepts –

Y-Intercept		
Define: Point where the graph crosses the y-axis	**Think:** At what coordinate point does the graph cross the y-axis?	**Write:** (0, b)
X-Intercept		
Define: Point where the graph crosses the x-axis	**Think:** At what coordinate point does the graph cross the x-axis?	**Write:** (a, 0)
Zero		
Define: Where the function (y-value) equals 0	**Think:** At what x-value does the graph cross the x-axis?	**Write:** x = ____

x is zero

y is zero

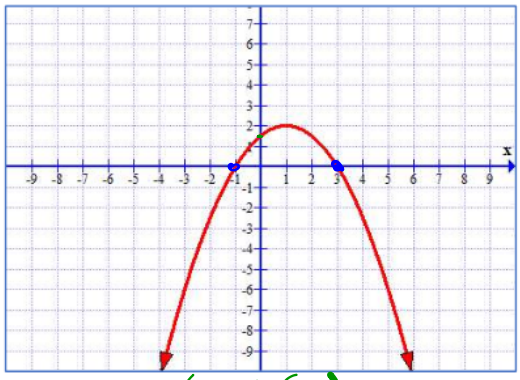


Points

Y-Intercept: (0, 5)

X-Intercept(s): nah bruh

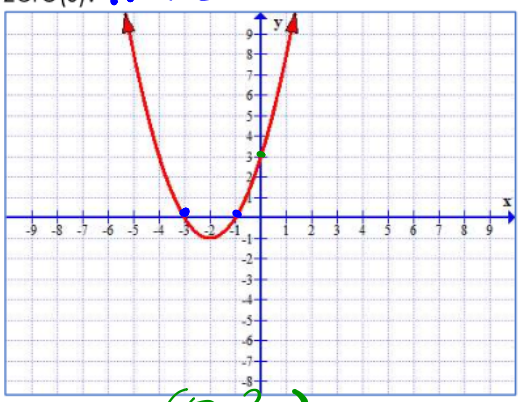
Zero(s): none



Y-Intercept: (0, 1.5)

X-Intercept(s): (-1, 0), (3, 0)

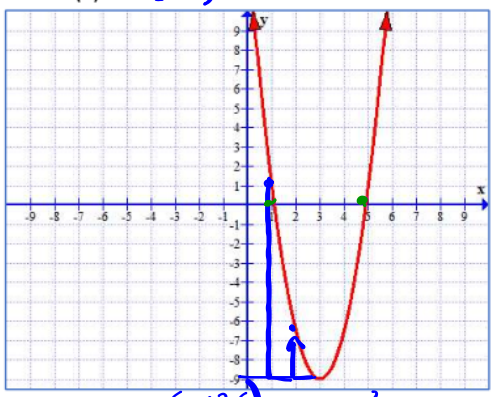
Zero(s): x = -1, 3



Y-Intercept: (0, 3)

X-Intercept(s): (-3, 0), (-1, 0)

Zero(s): x = -3, -1



Y-Intercept: (0, 13.5)

X-Intercept(s): (1, 0) (5, 0)

Zero(s): x = 1, 5

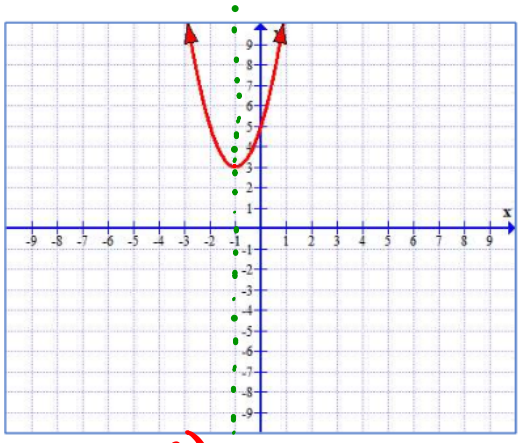
$2.5(1)^2$

$2.5(2)^2 = 2.5(4) = 10$

$2.5(3)^2 = 2.5(9) = 22.5$

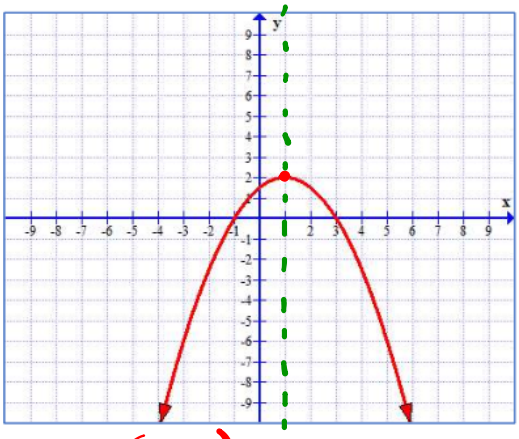
– vertex and axis of symmetry –

Vertex (turning point)		
Define: Highest or lowest point or peak of a parabola	**Think:** What is my highest or lowest point on my graph?	**Write:** Name the point (h, k)
Axis of Symmetry		
Define: The vertical line that divides the parabola into mirror images and runs through the vertex (x coordinate of the vertex)	**Think:** What imaginary, vertical line would make the parabola symmetrical?	**Write:** x = h (x value of the vertex)



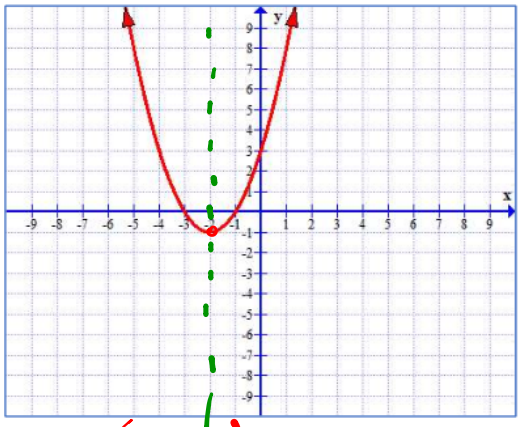
Vertex: (-1, 3)

Axis of Symmetry: x = -1



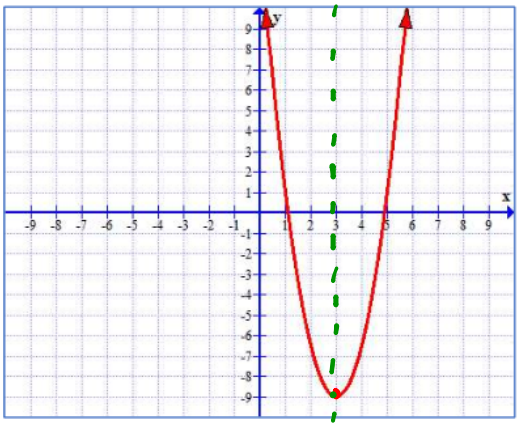
Vertex: (1, 2)

Axis of Symmetry: x = 1



Vertex: (-2, -1)

Axis of Symmetry: x = -2

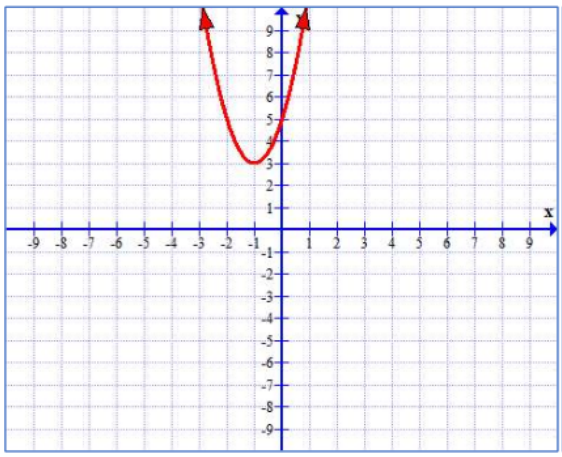


Vertex: (3, -9)

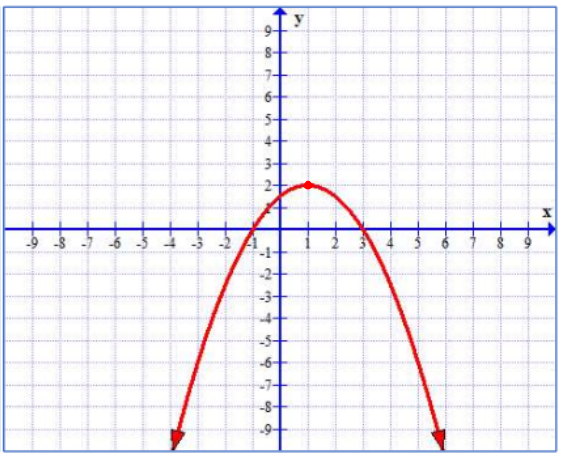
Axis of Symmetry: x = 3

– extrema –

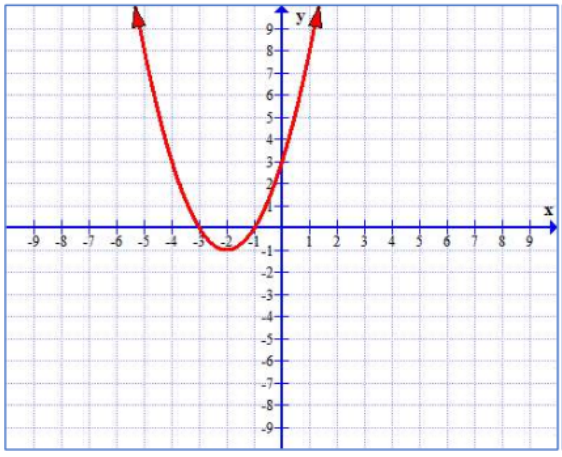
Maximum		
Define: Highest point or peak of a function.	**Think:** What is my highest point on my graph?	**Write:** y = k (y-value of the vertex)
Minimum		
Define: Lowest point or valley of a function.	**Think:** What is the lowest point on my graph?	**Write:** y = k (y-value of the vertex)



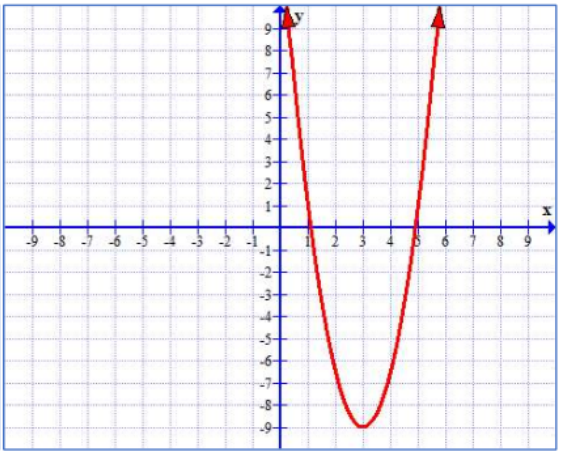
Extrema: min $y = -3$



Extrema: max $y = 2$



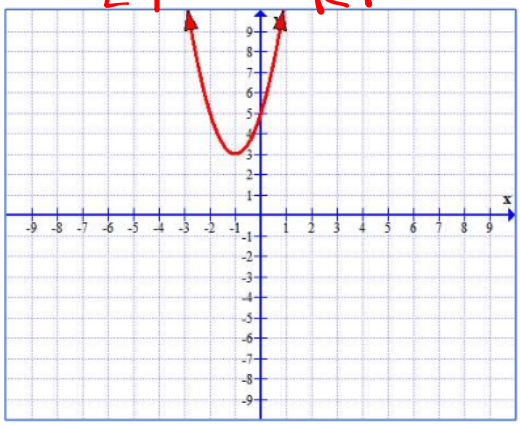
Extrema: min $y = -1$



Extrema: min $y = -9$

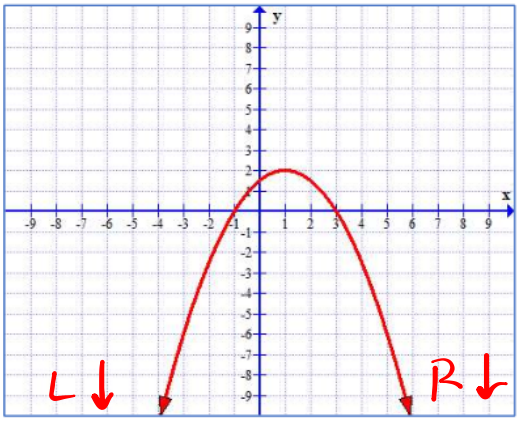
– end behavior –

Define: Behavior of the ends of the function (what happens to the y-values or f(x)) as x approaches positive or negative infinity. The arrows indicate the function goes on forever so we want to know where those ends go.	
Think: As x goes to the left (negative infinity), what direction does the left arrow go?	**Write:** As x → -∞, f(x) → ____
Think: As x goes to the right (positive infinity), what direction does the right arrow go?	**Write:** As x → ∞, f(x) → ____



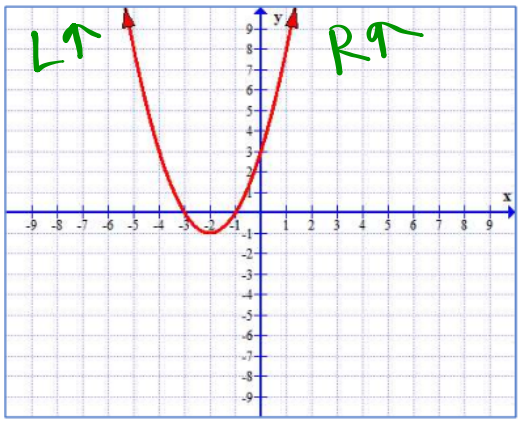
As x → -∞, f(x) → ____

As x → ∞, f(x) → ____



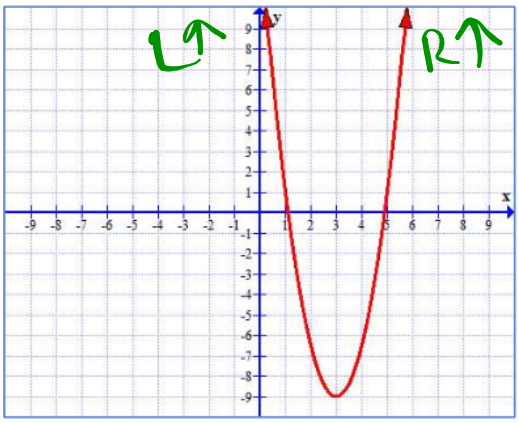
As x → ∞, f(x) → ____

As x → -∞, f(x) → ____



As x → -∞, f(x) → ____

As x → ∞, f(x) → ____

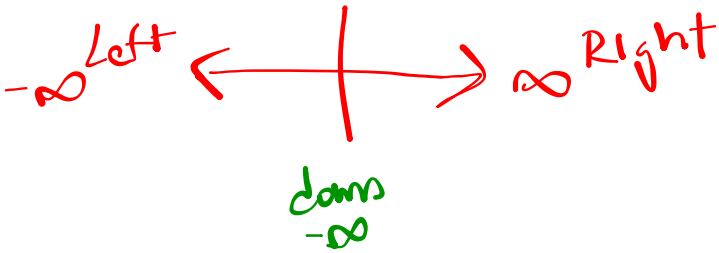


As x → -∞, f(x) → ____

As x → ∞, f(x) → ____

infinity ∞

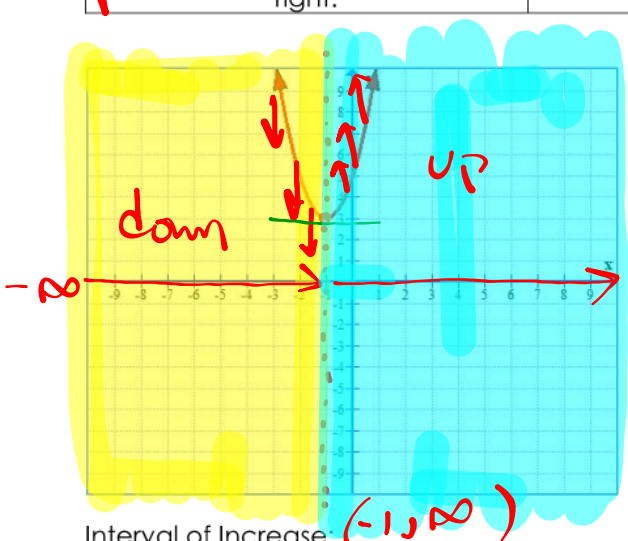
8 number eight



x values!!

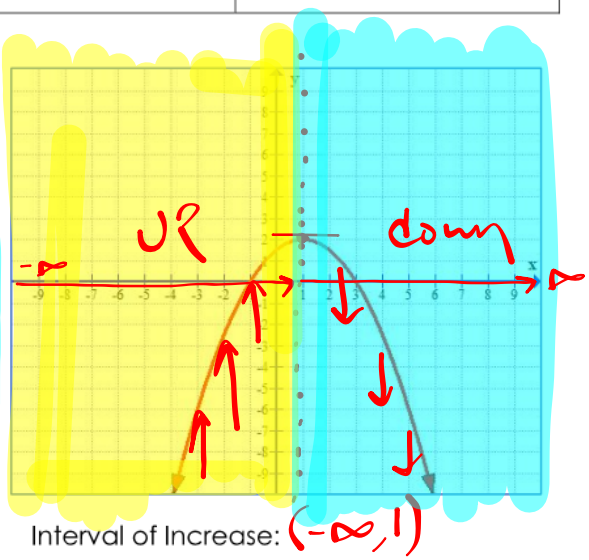
– interval of increase and decrease –

Interval of Increase		
Define: The part of the graph that is rising as you read left to right.	**Think:** From left to right, is my graph going up?	**Write:** [left, right] of portion going up
Interval of Decrease		
Define: The part of the graph that is falling as you read from left to right.	**Think:** From left to right, is my graph going down?	**Write:** [left, right] of portion going down



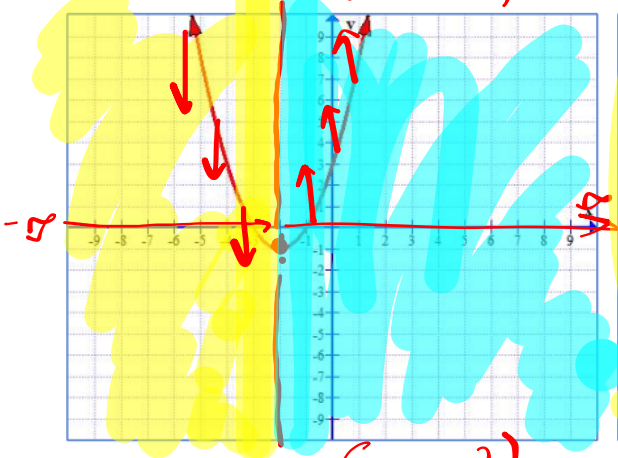
Interval of Increase: $(-1, \infty)$

Interval of Decrease: $(-\infty, -1)$



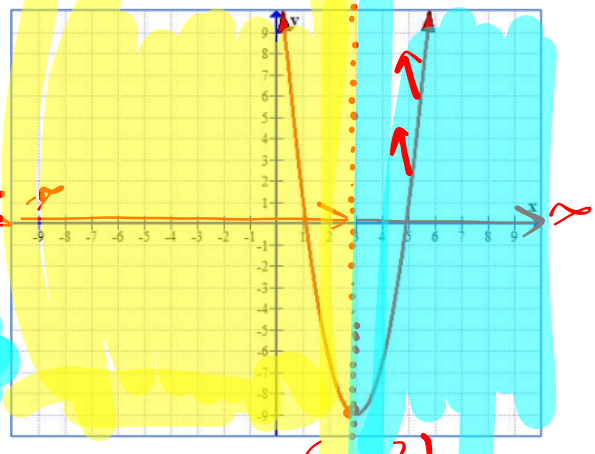
Interval of Increase: $(-\infty, 1)$

Interval of Decrease: $(1, \infty)$



Interval of Decrease: $(-\infty, -2)$

Interval of Increase: $(-2, \infty)$

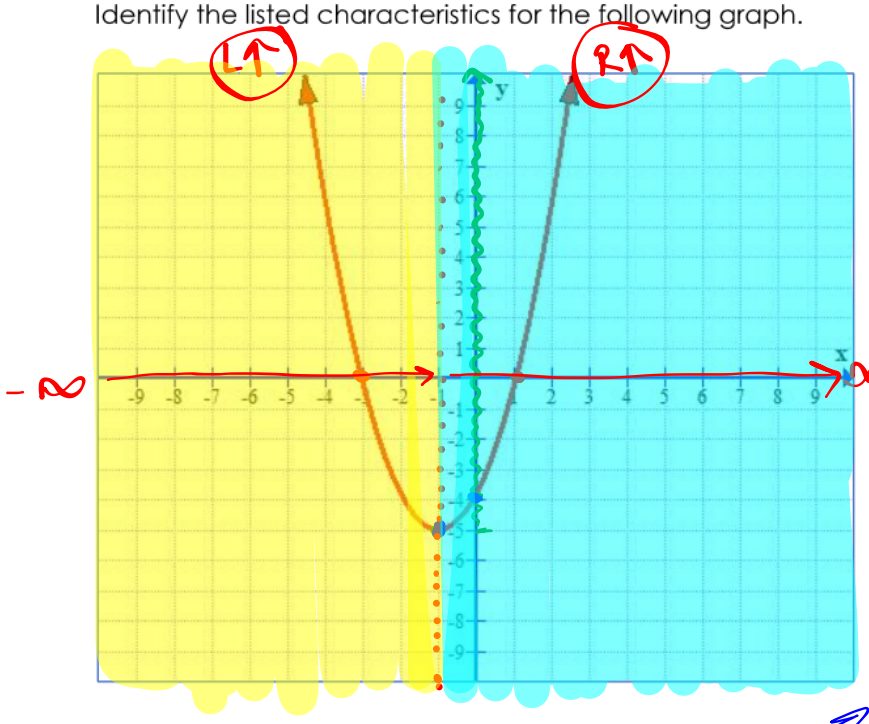


Interval of Decrease: $(-\infty, 3)$

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

16

Identify the listed characteristics for the following graph.



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

Range: $[-5, \infty)$

Vertex: point $(-1, -5)$

Max or Min: min U

Extrema Value: $y = -5$

Axis of Symmetry: $x = -1$

Zero(s): $x = -3, 1$

Y-Intercept: $(0, -4)$

X-Intercept(s): $(-3, 0), (1, 0)$

Interval of Increase: $(-1, \infty)$

As x → ∞, f(x) → ∞

Interval of Decrease: $(-\infty, -1)$

As x → −∞, f(x) → ∞

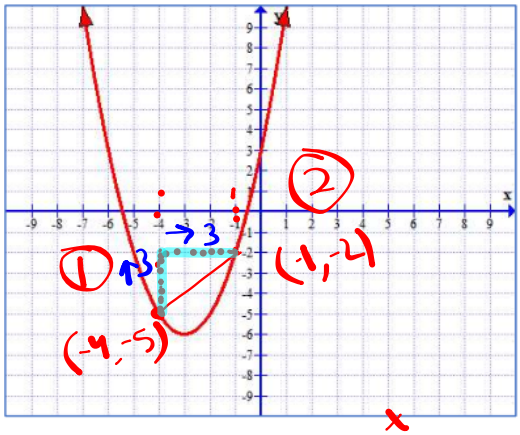
Average Rate of Change Notes

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.

"Slope"

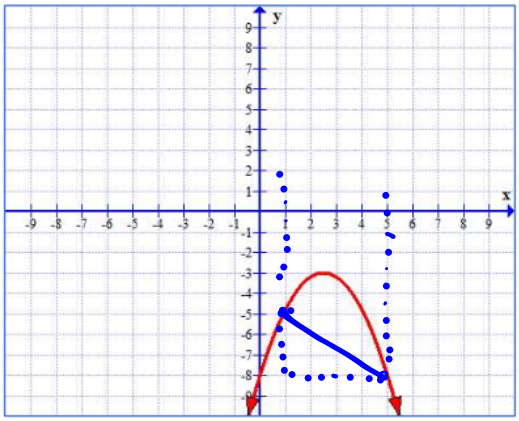
$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

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 $[-4,-1]$.

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



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

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

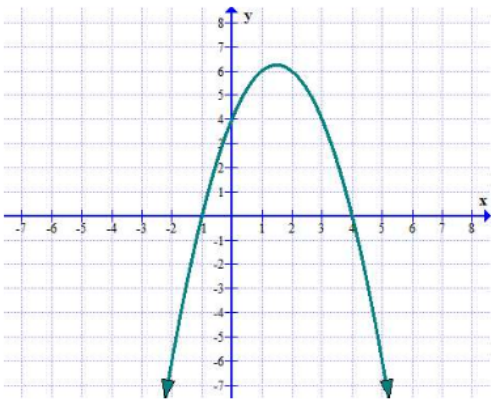
Finding AROC from a graph.
Using the problem, plug in the two x-values (one at a time) to find the two points for which you are trying to find the average rate of change between. Then, use the formula to find the AROC.

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

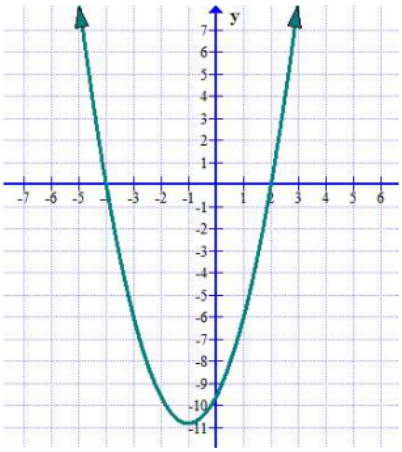
Given $y = -4x^2 + 6x + 11$, find the AROC of the interval $[0,5]$.

Average Rate of Change Practice

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



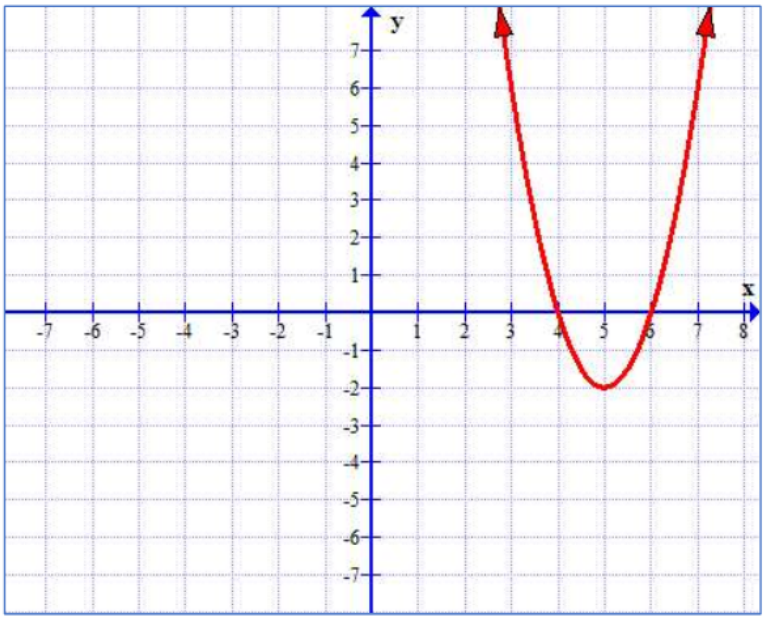
2) Find the average rate of change over the interval $-3 \leq x \leq 2$.



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

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

Characteristics Practice



Domain:

Range:

Int. of Increase:

Int. of Decrease:

Max/Min:

Extrema Value:

Zeros:

Y-Int:

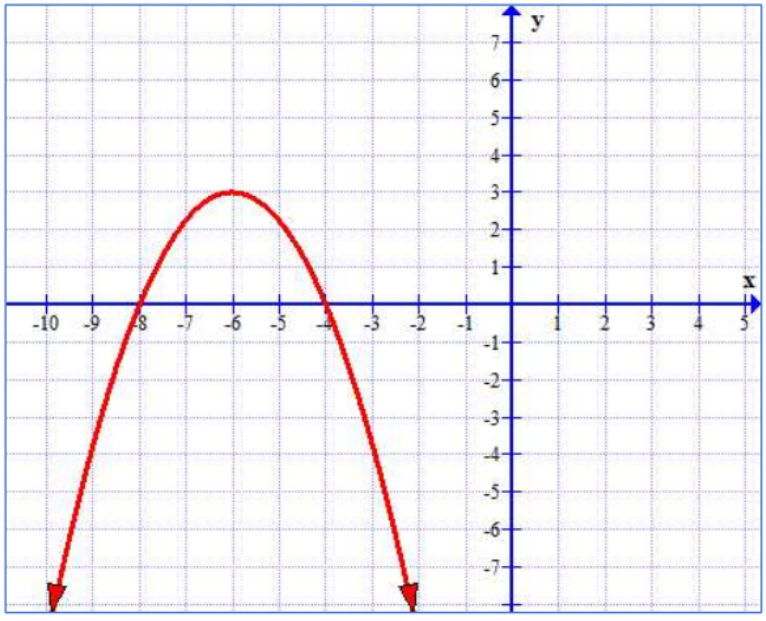
X-Int:

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

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

Vertex:

Axis of Symmetry:



Vertex:

X-Int:

Int. of Decrease:

Zeros:

Range:

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

Max/min:

Axis of Sym:

Domain:

Y-Int:

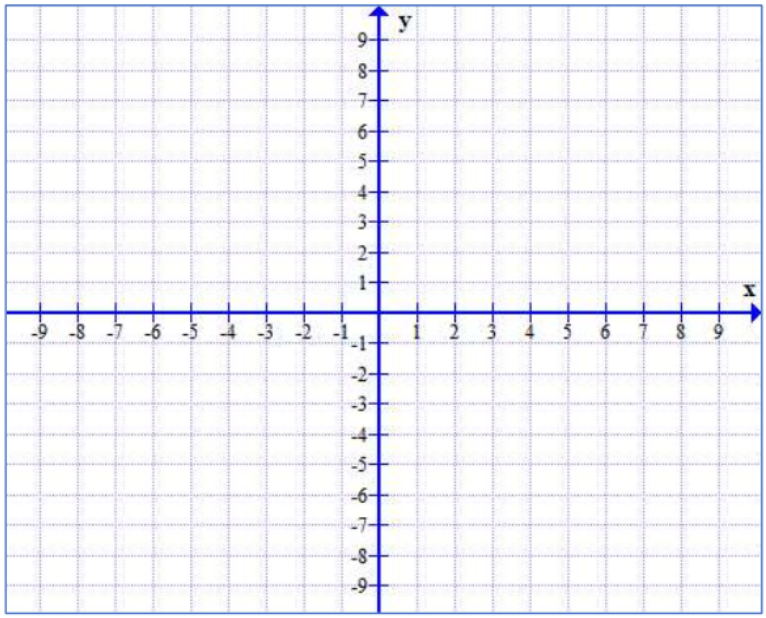
As $x \to \infty, f(x) \to$ ____

Int. of Increase:

Int. of Constant:

Draw a graph that has the following characteristics:

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



Then, identify the following:

Axis of Symmetry:

Range:

Interval of Increase:

Interval of Decrease: