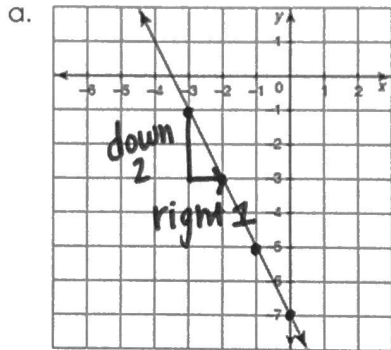


Average Rate of Change (Slope) of a Quadratic Function

Review: Find the slope (average rate of change) for the following problems:

Remember slope is: $\frac{\text{rise}}{\text{run}}$ or $\frac{y_2 - y_1}{x_2 - x_1}$



$$m = \frac{\text{rise}}{\text{run}} = \frac{-2}{+1} = \boxed{-2}$$

b.

x	y
3 x_1	27 y_1
5 x_2	45 y_2
7 x_1	63 y_1
9 x_2	81 y_2

$$\frac{45 - 27}{5 - 3} = \frac{18}{2} = \boxed{9} \quad \frac{81 - 63}{9 - 7} = \frac{18}{2} = \boxed{9}$$

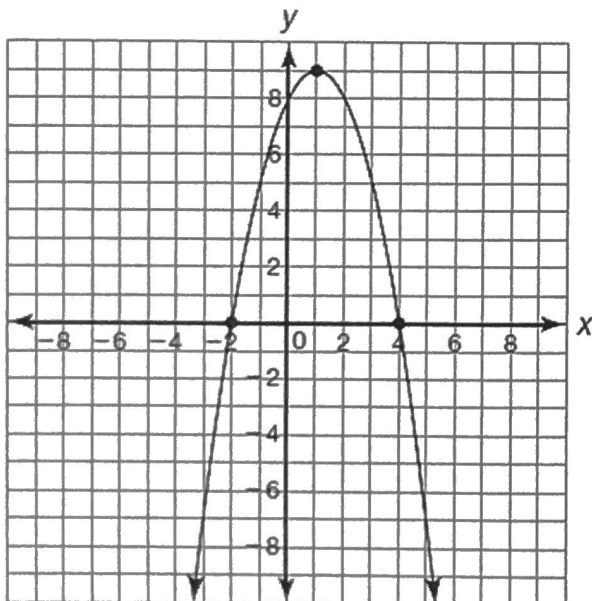
x_1, y_1, x_2, y_2
c. (-9, 5) & (-3, 1)

$$\frac{1 - 5}{-3 - (-9)} = \frac{-4}{6} = \boxed{-\frac{2}{3}}$$

When you calculate the slope of a linear function, its slope is ALWAYS the same.

Investigating the "Slope" of a Quadratic Function

The graph of $y = -x^2 + 2x + 8$ is given. Use the table of values on the right to determine the slope (average rate of change) from one point to the next point.



x	y
-3	-7
-2	0
-1	5
0	8
1	9
2	8
3	5
4	0
5	-7

a. Find the average rate of change from $x = -3$ and to $x = -2$.

$$\begin{matrix} (-3, -7) & (-2, 0) \\ x_1, y_1 & x_2, y_2 \\ \frac{0 - (-7)}{-2 - (-3)} = \frac{7}{1} = \boxed{7} \end{matrix}$$

b. Find the average rate of change from $x = -1$ and $x = 0$.

$$\begin{matrix} (-1, 5) & (0, 8) \\ x_1, y_1 & x_2, y_2 \\ \frac{8 - 5}{0 - (-1)} = \frac{3}{1} = \boxed{3} \end{matrix}$$

c. Find the average rate of change from $x = 2$ to $x = 3$.

$$\begin{matrix} (2, 8) & (3, 5) \\ x_1, y_1 & x_2, y_2 \end{matrix}$$

$$\frac{5 - 8}{3 - 2} = \frac{-3}{1} = \boxed{-3}$$

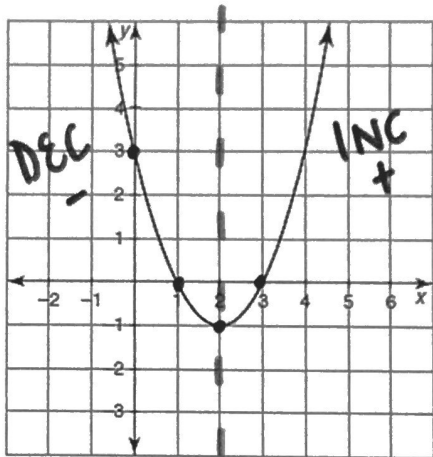
What do you notice about the rate of change as you go from one point to the next?

When you calculate the slope of a quadratic function, its slope is NOT the same
it CHANGES

Practice and Review: For the problems below, find the average rate of change for the given intervals, then list the characteristics of each graph.

Calculate average rate of change on interval $0 \leq x \leq 2$.

In other words, from when $x=0$ to when $x=2$.



$$\begin{array}{cc} (0, 3) & (2, -1) \\ x_1 & y_1 & x_2 & y_2 \end{array}$$

$$\frac{-1 - 3}{2 - 0} = \frac{-4}{2} = \boxed{-2}$$

Domain: all real #'s \mathbb{R}

Range: $y \geq -1$

Vertex: $(2, -1)$

Axis of Sym. $x = 2$

Y-Intercept: $(0, 3)$

Zeroes: $x = 1$ $x = 3$

Extrema: MIN

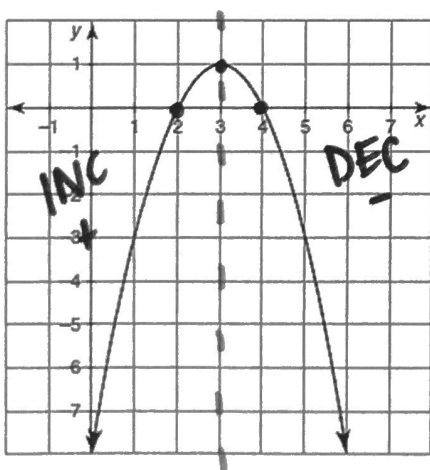
Max/Min Value: $y = -1$

End Behavior: As $x \rightarrow -\infty$, $f(x) \rightarrow \infty$. As $x \rightarrow \infty$, $f(x) \rightarrow \infty$

Int of Inc: $x > 2$ Int of Dec: $x < 2$

Calculate average rate of change on interval $0 \leq x \leq 3$.

In other words, from when $x=0$ to when $x=3$.



$$\begin{array}{cc} (0, -8) & (3, 1) \\ x_1 & y_1 & x_2 & y_2 \end{array}$$

$$\frac{1 - (-8)}{3 - 0} = \frac{9}{3} = \boxed{3}$$

Domain: all real #'s \mathbb{R}

Range: $y \leq 1$

Vertex: $(3, 1)$

Axis of Sym. $x = 3$

Y-Intercept: $(0, -8)$

Zeroes: $x = 2$ $x = 4$

Extrema: MAX

Max/Min Value: $y = 1$

End Behavior: As $x \rightarrow -\infty$, $f(x) \rightarrow -\infty$. As $x \rightarrow \infty$, $f(x) \rightarrow -\infty$

Int of Inc: $x < 3$ Int of Dec: $x > 3$