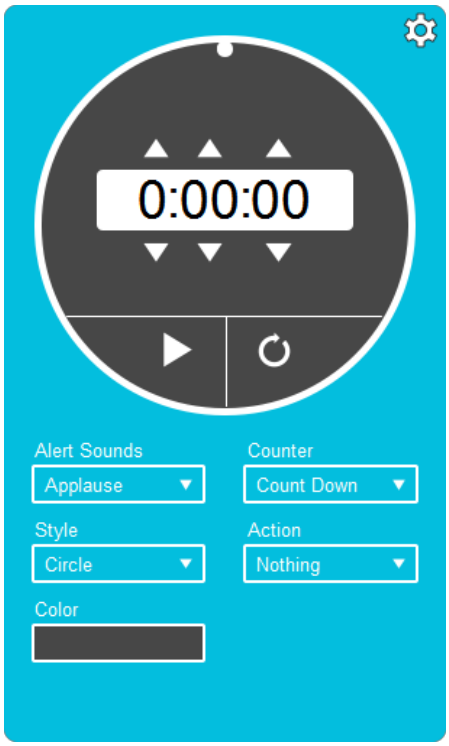
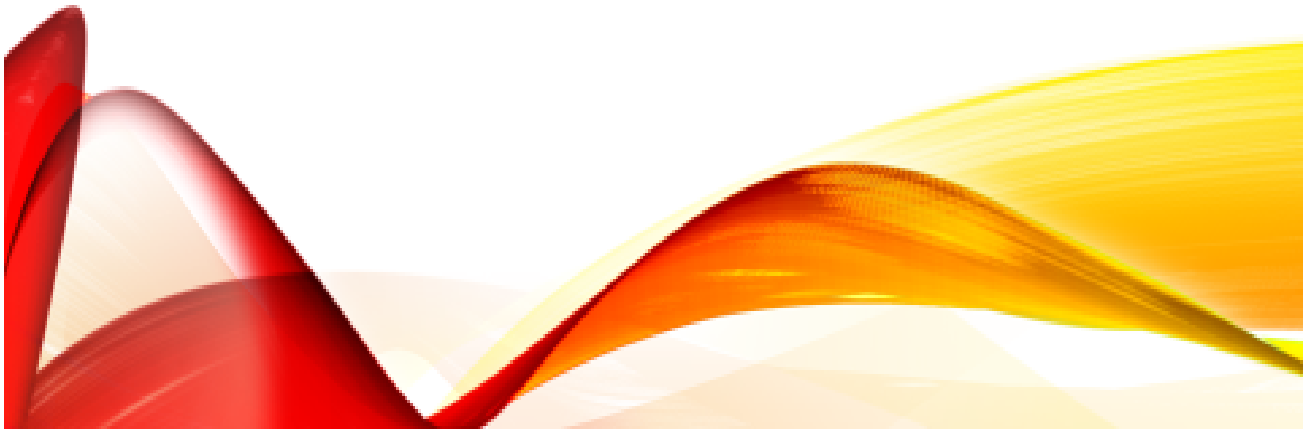
Unit 3B Quiz - Graphing Quadratic Functions 3/7/18

- Complete your quiz in 10 minutes
- Do your very best; you can do this!!!



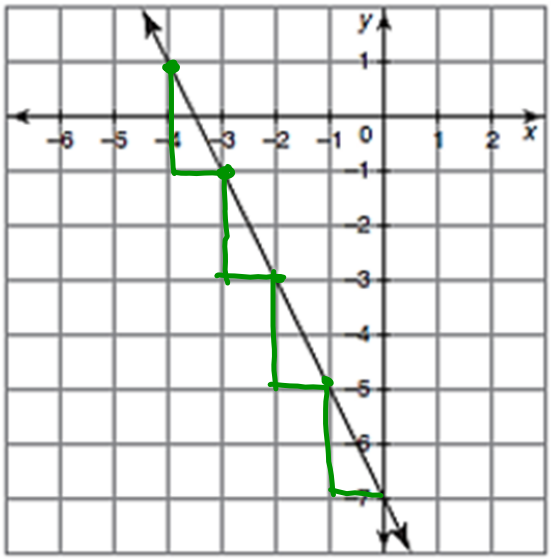
DAY 9: AVERAGE RATE OF CHANGE

Unit 3B: Quadratic Functions



Review: Slope

a. ROC = -2



$\frac{45-27}{5-3} = \frac{18}{2} = 9$

b.

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

$\frac{63-45}{7-5} = \frac{18}{2} = 9$

Review: Slope

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

- c. (-9, 5) & (-3, 1)

  x_1 y_1 x_2 y_2

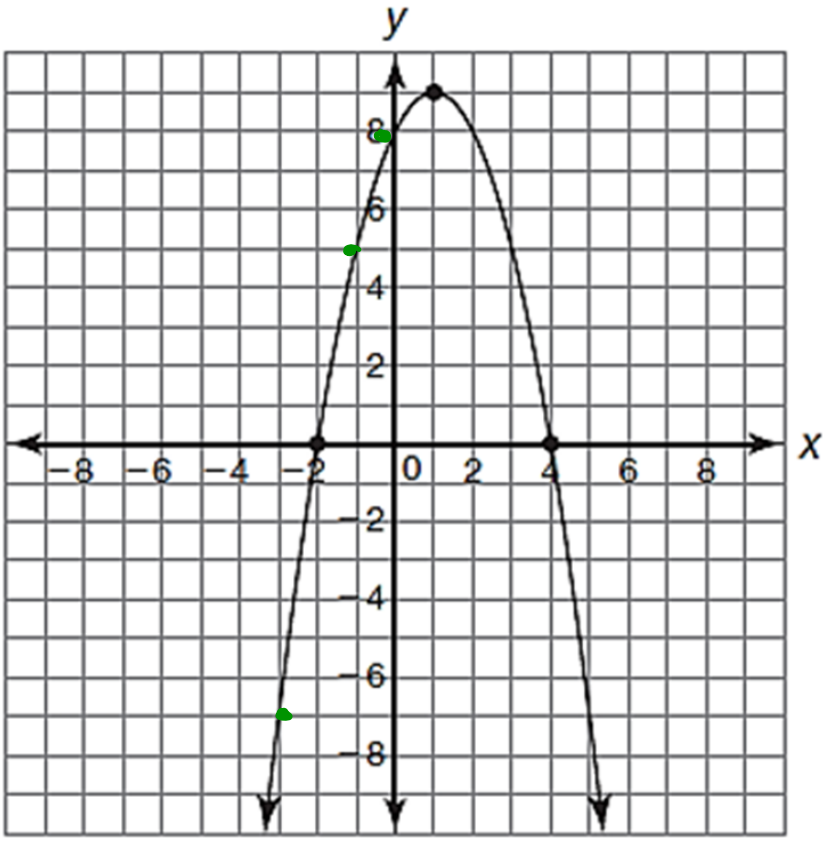
$$= \frac{1-5}{-3-(-9)} = \frac{-4}{6}$$

$$= -2/3$$

- When you calculate the slope of linear function, its slope is ALWAYS constant.

Investigating the Slope of a Quadratic Function

- Graph: $y = -x^2 + 2x + 8$

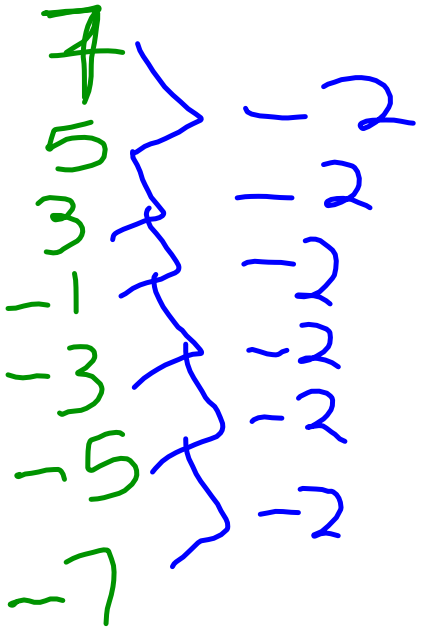


X	Y
-3	−7
-2	0
-1	5
0	8
1	9
2	8
3	5
4	0
5	−7

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

Not the Same

- What do you notice if you find the difference of all the slopes?



Constant

1st and 2nd Differences

- Quadratic Functions have **constant second differences.** Second differences can be calculated by finding the rate of change with the first differences.

- Linear functions have **constant first differences.** Since quadratic functions do not have constant first differences, they do not have a slope that remains constant for the entire graph of a parabola.

- Let's look what first and second differences mean on the next slide.

Comparing 1st and 2nd Differences

a. $y = 2x$ linear

x	y	First Differences	Second Differences
−3	−6	2	0
−2	−4	2	0
−1	−2	2	0
0	0	2	0
1	2	2	0
2	4	2	0
3	6		

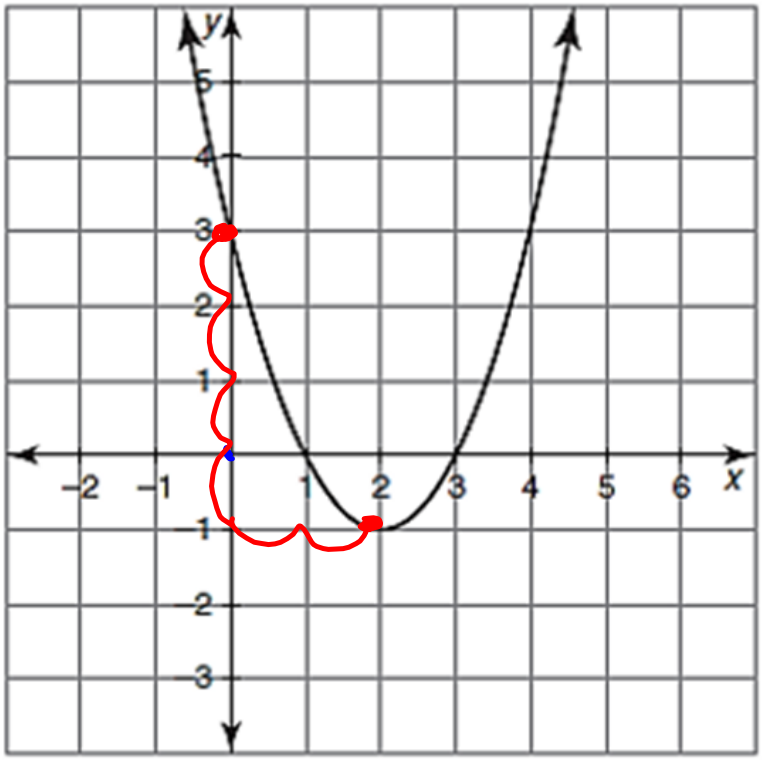
b. $y = 2x^2$ Quadratic

x	y	First Differences	Second Differences
−3	18	−10	4
−2	8	−6	4
−1	2	−2	4
0	0	2	4
1	2	6	4
2	8	10	
3	18		

$-2-(-6)$ $2-(-2)$

Average Rate of Change from a Graph

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



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

$(0, 3)$
$x_1 \quad y_1$

$(2, -1)$
$x_2 \quad y_2$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

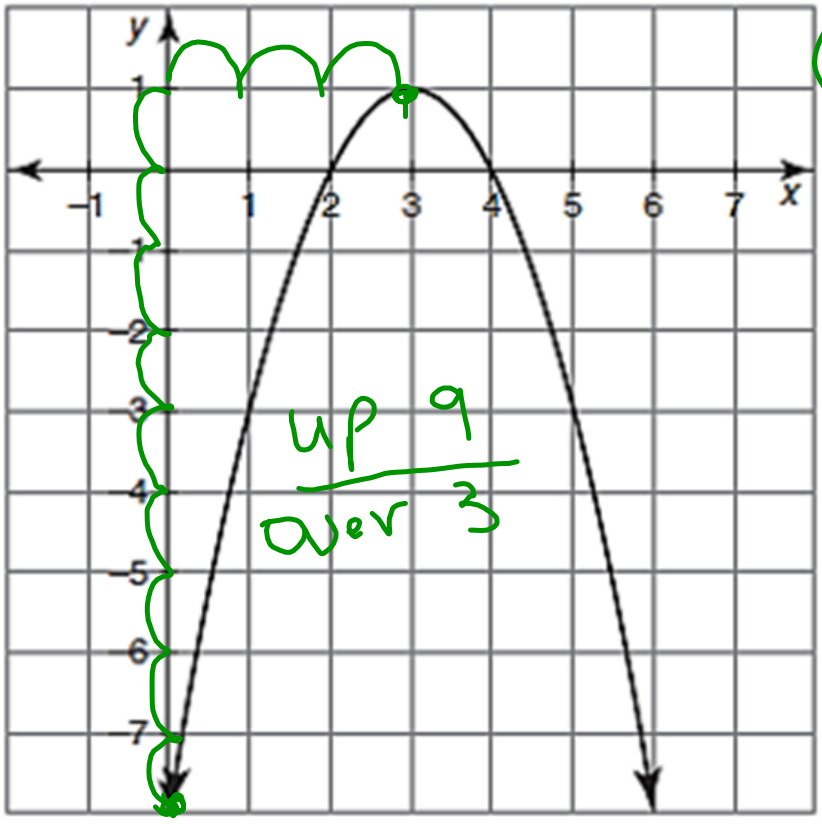
$$= \frac{-1 - 3}{2 - 0} = \frac{-4}{2}$$

$$= -2$$

Average Rate of Change from a Graph

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

AROC $= \frac{9}{3} = 3$



(0, −8)
x_1 y_1

(3, 1)
x_2 y_2

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

$= \frac{9}{3} = 3$

Average Rate of Change from an Equation

- If you are asked to calculate the average rate of change on an interval without a graph, you will have to come up with two points to calculate the slope.

- You will get your two points by taking the bounds of your interval and substitute those x-values into your equation to find the y-values. Then use the slope formula to calculate the slope.

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

Guided Practice

Practice: Calculate the average rate of change of the function $y = (x-4)^2$ on the given intervals:

$1 \le x \le 3$

$f(1) = (1-4)^2 = 9$

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

$(1, 9)\ (3, 1)$

$x_1\ y_1\ \ x_2\ y_2$

$AROC = \frac{1-9}{3-1}$

$= \frac{-8}{2} = -4$

$-2 \le x \le 2$

$(-2, 36), (2, 4)$

$x_1\ y_1\ \ x_2\ y_2$

$AROC = \frac{4-36}{2-(-2)} = \frac{-32}{4}$

$= -8$

Guided Practice

Practice: Calculate the average rate of change of the function $y = x^2 + 4x - 12$ on the given intervals:

$-2 \le x \le 4$

$f(-2) = (-2)^2 + 4(-2) - 12$

$f(-2) = 4 - 8 - 12 = -16$

$(-2, -16)$

$f(4) = (4)^2 + 4(4) - 12$

$f(4) = 16 + 16 - 12$

$f(4) = 20$

$(4, 20)$

$$AROC = \frac{20 - (-16)}{4 - (-2)}$$

$$= \frac{20 + 16}{4 + 2}$$

$$= \frac{36}{6} = 6$$

$-3 \le x \le -6$

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

$f(-3) = 9 - 12 - 12$

$f(-3) = -15$ $(-3, -15)$

$f(-6) = (-6)^2 + 4(-6) - 12$

$f(-6) = 36 - 24 - 12$

$f(-6) = 0$ $(-6, 0)$

$$AROC = \frac{0 - (-15)}{-6 - (-3)}$$

$$= \frac{15}{-6 + 3} = \frac{15}{-3}$$

$$= -5$$

Home Work:

1. Day 9: Average Rate of Change Writing Equations of Parabolas # 1 - 10 is due on Friday 3/9/18