

December 4, 2018 Tuesday

Tech: what is the difference between discrete and continuous graphs? Describe in words and make a pic of each graph!

Dec 4-8:13 AM

December 4, 2018 Tuesday

Foundations of Algebra Unit 4 - Characteristics of Linear Equations

Day 10 - Characteristics of Linear Equations

Domain and Range

- Discrete Graphs: you just **plot the point** the domain and range.
- Continuous Graphs: you use **continuous curve or line**

Holes
 ○ are used when there is an open dot or the number is NOT included on the graph.
 ● are used when there is a closed dot or when the number is included on the graph.

Practice:

1. Domain: \mathbb{R} **ALL REAL NUMBERS**
 Range: \mathbb{R}
 Outputs, y values
2. Domain: \mathbb{R}
 Range: $y \geq -6$
 Above -6
3. Domain: $[-4, 4]$ or $-4 \leq x \leq 4$
 Range: $[-5, 4]$ or $-5 \leq y \leq 4$

Dec 4-9:02 AM

December 4, 2018 Tuesday

Foundations of Algebra Unit 4 - Characteristics of Linear Equations

Intercepts

- x-intercept: the point at which the line intersects the **x-axis** at $(x, 0)$.
- y-intercept: the point at which the line intersects the **y-axis** at $(0, y)$.
- zeros** are the same thing as the x-intercepts.

Practice:

1. Domain: $[-2, 4]$
 Range: $[-4, 7]$
 x-int: $(0, 0), (2, 0)$
 y-int: $(0, 0)$
2. Domain: $(-\infty, 4]$
 Range: $(-\infty, 0]$
 x-int: $(4, 0)$
 y-int: $(0, 2), (0, -3)$
3. Domain: $[-3, 0]$
 Range: $(0, 11]$
 x-int: $(-3, 0)$
 y-int: $(0, 11)$

Dec 4-9:02 AM

December 5, 2018 Wednesday

10. Air temperatures over a 5-hour period are shown in the graph at the right.

a) What is the **domain** of this set of data?
 Choose:
 $0 \leq x \leq 5$ $56 \leq x \leq 70$
 $0 \leq y \leq 80$ $56 \leq y \leq 70$

b) What is the **range** of this set of data?
 Choose:
 $0 \leq x \leq 5$ $56 \leq x \leq 70$
 $0 \leq y \leq 80$ $56 \leq y \leq 70$

4. What is the domain of the function shown at the right?

Domain $[-2, \infty)$

Dec 4-10:08 AM

December 4, 2018 Tuesday

Foundations of Algebra Unit 4 - Characteristics of Linear Equations

Day 10 - Characteristics of Linear Equations

For each graph, find the characteristics.

1. a. domain: $\mathbb{R}, (-\infty, \infty)$
 b. range: $[-3, \infty)$
 c. x-intercept: $(2.5, 0), (6, 0)$
 d. y-intercept: $(0, 5)$
 e. increasing or decreasing? **Both**
2. a. domain: $(-\infty, \infty), \mathbb{R}$
 b. range: $(-\infty, 0], \mathbb{R}$
 c. x-intercept: $(1.5, 0)$
 d. y-intercept: $(0, -4)$
 e. increasing or decreasing? **Decreasing**
3. a. domain: $[-6, 2]$
 b. range: $(-7, 5)$
 c. x-intercept: $(-6, 0)$
 d. y-intercept: $(0, 4), (0, -6)$
 e. increasing or decreasing? **BOTH**
4. a. domain: $(-\infty, \infty)$
 b. range: $(-\infty, \infty)$
 c. x-intercept: $(-1.2, 0)$
 d. y-intercept: $(0, 5)$
 e. increasing or decreasing? **Increasing**

Dec 4-9:21 AM

December 4, 2018 Tuesday

Foundations of Algebra Unit 4 - Characteristics of Linear Equations

5. A gear on a machine turns at a rate of 3 revolutions per second. Write the equation, and determine the key features of the function.

Equation: _____ Discrete or Continuous: _____
 Domain: _____ Range: _____
 Intercept: _____ Increasing or Decreasing: _____

4. Create your own linear function: draw the graph, write the equation, and fill in the characteristics.

a. equation: _____
 b. domain: _____
 c. range: _____
 d. x-intercept: _____
 e. y-intercept: _____
 f. increasing or decreasing? _____

Dec 4-9:21 AM

December 6, 2018, Thursday

What is the slope equation (from middle school)? Draw a line with positive slope. Draw a line with negative slope.

$m = \text{Slope} = \text{rate of change} = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$

Dec 4-11:14 AM

Foundations of Algebra Unit 4 - Characteristics of Linear Equations Notes
Date: _____
Name: _____

Day 12 - Rate of Change

Rate of Change = slope

- The rate of change is a ratio describing how one quantity changes as another quantity changes.
- positive rate of change (ROC)** increases over time.
- Negative ROC** decreases over time.

Linear functions have a **constant** rate of change (also called **slope**). meaning values increase or decrease at the **same factor** over a given interval.

- Horizontal** have a rate of change.
- Vertical** have undefined rate of change.

Constant Rate of Change

The slope of a non-vertical line is the ratio of the vertical (change in y) to the horizontal (change in x) between any two points on the line.

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

- Example: Find the slope between $(2, 4)$ and $(4, 8)$.
 $\frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - 4}{4 - 2} = \frac{4}{2} = 2$
- Example: The table shows the amount of water evaporating from a swimming pool on a hot day. Find the rate of change between 2 hours and 4 hours.

Time (hours)	x_1	x_2	y_1	y_2
2	2	4	13.5	17
4	4	6	16	27

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{13.5 - 16}{2 - 4} = \frac{-2.5}{-2} = 1.25 \text{ gal/hr}$$

Dec 4-11:18 AM

Foundations of Algebra Unit 4 - Characteristics of Linear Equations Notes

- Example: Looking at a graph

Rate of change is considered to be the **Slope** of a line. When determining the greatest rate of change we want to look for the steepest **positive** slope.

a. Where is the greatest rate of change on the graph?
 $x=5$ from 3 to 6

b. What is the value?
 $\frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 7}{5 - 6} = \frac{-3}{-1} = 3$

The **average rate of change** between any two points $(x_1, f(x_1))$ and $(x_2, f(x_2))$ is the slope of the line through the 2 points.

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

- Find the average rate of change for $f(x) = 4x + 10$ from $[1, 3]$.
 $\frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{f(3) - f(1)}{3 - 1} = \frac{(-4(2) + 10) - (-4(-1) + 10)}{3 - 1} = \frac{-8 - 14}{2} = \frac{-22}{2} = -11$
- Find the average rate of change for $f(x) = 2x^2 - 3$ from $[2, 4]$.
 $\frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{f(4) - f(2)}{4 - 2} = \frac{(2(4)^2 - 3) - (2(2)^2 - 3)}{4 - 2} = \frac{(2(16) - 3) - (2(4) - 3)}{2} = \frac{29 - 5}{2} = \frac{24}{2} = 12$
- Find the average rate of change for the following graph over the given interval. $[0, 1]$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - 1}{0 - 1} = \frac{-3}{-1} = 3$$

Dec 4-11:19 AM

Foundations of Algebra Unit 4 - Characteristics of Linear Equations Notes

You try: Find the average rate of change for $f(x) = x^2 + 2$ from $[3, 5]$.

Person 1: $\frac{2(5) - 2(-3)}{5 - 3} = \frac{(6)^2 + 2 - (-3)^2 + 2}{5 - 3} = \frac{27 - 11}{2} = \frac{16}{2} = 8$

Rate of Change with Tables

1. Find the rate of change using the table.

a. Find the rate of change from day 1 to 2.

Day	Amount of Bacteria
$x_1 = 1$	$f(x_1) = 19$
$x_2 = 2$	$f(x_2) = 38$
$x_3 = 3$	$f(x_3) = 57$
$x_4 = 4$	$f(x_4) = 76$
$x_5 = 5$	$f(x_5) = 95$
$x_6 = 6$	$f(x_6) = 114$

Person 2: $\frac{19 - 38}{2 - 1} = -19$. The bacteria is decreasing each day.

b. Find the rate of change from day 4 to 5.

Person 3: $\frac{58 - 66}{2011 - 2008} = \frac{-8}{3} = -2.67$. The landline is decreasing.

Year (x)	Households in Millions (y)
2008 x_1	41 $f(x_1)$
2009 x_2	41 $f(x_2)$
2010 x_3	54 $f(x_3)$
2011 x_4	51 $f(x_4)$

Dec 4-11:19 AM

December 7, 2018, Friday

Is the rate of change of the follow two points +, -, und, or 0?
 $(-3, -3)$ & $(0, 2)$

How do you know?

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

Dec 4-11:19 AM

Foundations of Algebra Unit 4 - Characteristics of Linear Equations Homework
Name: _____ Date: _____

ROC Day 12 - Rate of Change

1. Find the **average rate of change** for each of the following graphs over the given interval.

a) $[-1, 1]$ b) $[0, 3]$ c) $[1, 2]$

d) $[0, 3]$ e) $[-3, -1]$ f) $[0, 1]$

2. Use the table to find the rate of change between x_1 and x_2 .

Time (years)	1	2	3	4	5	6
Temperature	27	35	37	42	45	47

a. 3 to 5 years b. 2 to 6 years

3. For $f(x) = 3x + 1$, find the rate of change on the interval $[1, 5]$.

4. For $f(x) = x^2 - 2$, find the rate of change on the interval $[2, 3]$.

Dec 4-11:20 AM

Foundations of Algebra Unit 4 - Characteristics of Linear Equations Practice

Name: _____ Date: _____

Day 13 - Rate of Change

Rate of Change with Points:

1. Find the rate of change, given the following points (x_1, y_1) and (x_2, y_2) .

A. $(3, 1)$ and $(-1, 3)$ $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 1}{-1 - 3} = \frac{2}{-4} = -\frac{1}{2}$

B. $(2, 5)$ and $(10, 2)$ $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 5}{10 - 2} = \frac{-3}{8} = -\frac{3}{8}$

Rate of Change with Functions:

2. Find the average rate of change for $f(x) = 2x - 4$ from $(0, 2)$ to $(2, 0)$.

$m = \frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{f(2) - f(0)}{2 - 0} = \frac{(2(2) - 4) - (2(0) - 4)}{2 - 0} = \frac{(4 - 4) - (-4)}{2} = \frac{0 + 4}{2} = \frac{4}{2} = 2$

3. Find the average rate of change for $f(x) = 2x^2 - 3$ from $(2, 1)$ to $(3, 2)$.

$m = \frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{f(3) - f(2)}{3 - 2} = \frac{(2(3)^2 - 3) - (2(2)^2 - 3)}{3 - 2} = \frac{(18 - 3) - (8 - 3)}{1} = \frac{15 - 5}{1} = 10$

4. Find the average rate of change for $f(x) = 2x^2 + 3x - 4$ from $(-1, 1)$ to $(2, 1)$.

$m = \frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{f(2) - f(-1)}{2 - (-1)} = \frac{(2(2)^2 + 3(2) - 4) - (2(-1)^2 + 3(-1) - 4)}{2 + 1} = \frac{(8 + 6 - 4) - (2 - 3 - 4)}{3} = \frac{10 - (-5)}{3} = \frac{15}{3} = 5$

Rate of Change with Tables

5. Find the rate of change using the table.

A. Find the rate of change from 0 to 2.

x	f(x)
0	4
1	7
2	10
3	13
4	16
5	19

$m = \frac{f(2) - f(0)}{2 - 0} = \frac{10 - 4}{2} = \frac{6}{2} = 3$

B. Find the rate of change from -1 to 3.

x	f(x)
-1	3
0	4
1	5
2	6
3	7

$m = \frac{f(3) - f(-1)}{3 - (-1)} = \frac{7 - 3}{4} = \frac{4}{4} = 1$

Dec 4-11:20 AM

Foundations of Algebra Unit 4 - Characteristics of Linear Equations Practice

Name: _____ Date: _____

Day 13 - Rate of Change

1. The graph below shows the United States population from 1900 to 2010, as recorded by the U.S. Census Bureau.

A. What was the rate of change in the population from 1900 to 1999?

$m = \frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{250 - 75}{1999 - 1900} = \frac{175}{999} \approx \frac{175}{1000} = \frac{35}{200} = \frac{7}{40}$

B. Which 10-year time period has the highest rate of change? How did you know?

a. 1910 - 1920 b. 1930 - 1940 c. 1950 - 1960

2. Kyle decided that it was time for him to lose weight. Before he started his diet and workout plan, Kyle weighed 400 lbs. On average, each month Kyle lost 5 lbs. Create a graph, and then determine the characteristics of the function.

Equation: _____

Discrete or Continuous: _____

Domain: _____ Range: _____

X-int: _____ Y-int: _____

Increasing or Decreasing: _____

Rate of Change from $(6, 1)$: _____

Dec 4-11:22 AM

Foundations of Algebra Unit 4 - Characteristics of Linear Equations Practice

3. Your parents have given you \$50 for you to purchase a new iPad. Their only condition is that you pay them back as you can. You've decided that each paycheck you get, you will put \$30 towards paying them back.

a) Write the equation that represents how much money you still owe: _____

b) Complete the table on the left.

x	f(x)
0	
1	
2	
3	
4	
5	

c) Calculate the average rate of change between paychecks 1 and 3.

d) Calculate the average growth rate for the first five paychecks (0, 5).

e) Which average growth rate is higher? Does this make sense?

4. Sarah has 7 pairs of shoes in her closet. Every time she goes to the mall, she purchases two new pairs of shoes. Create a graph and determine the characteristics of the function.

Equation: _____

Discrete or Continuous: _____

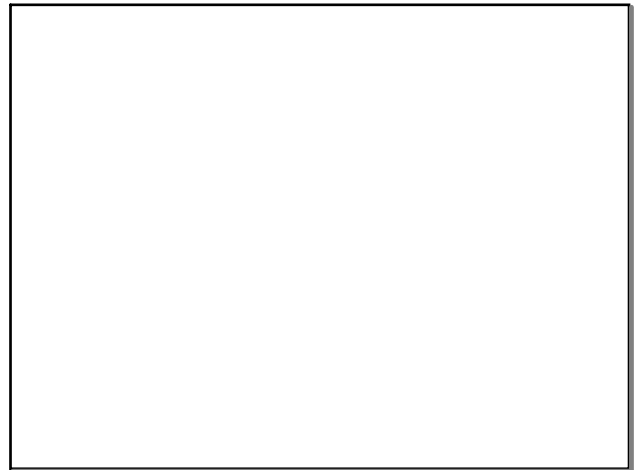
Domain: _____ Range: _____

X-int: _____ Y-int: _____

Increasing or Decreasing: _____

Rate of Change from $(8, 10)$: _____

Dec 4-11:22 AM



Dec 7-7:48 AM