

Name: \_\_\_\_\_

**UNIT 2 RECOVERY**

This packet is due, in its entirety, by **MONDAY DECEMBER 2ND**. Following the completion of this packet you will be required to take a unit assessment, similar to that given at the beginning of the year.

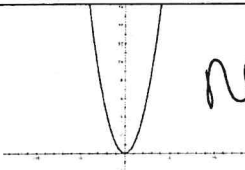
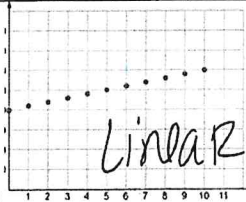
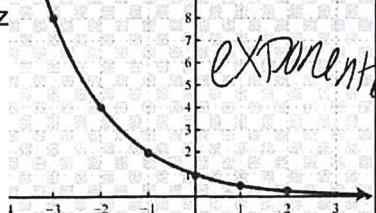
**Concept 1: Continuous vs. Discrete data, Linear vs. Exponential**

- **Continuous** data is data that has an infinite number of options, such as temperature, height, weight etc. It includes decimals and parts of things.
- **Discrete** data is data that has a finite number of options, such as books, number of siblings, students in a class, etc.
- A **linear** function/equation/scenario is a problem that has a constant rate of change (slope). From point to point we are adding or subtracting the same number again and again. The graph is a straight line, with no curves.
- An **exponential** function/equation/scenario is a problem that has a rate of change that multiplies each time. From each point you multiply by the constant ratio (base). The numbers either grow really fast or decay really fast. These graphs have the asymptote that they flatten out at, which is the imaginary line the graph approaches but never touches.

For the following, tell if they are continuous or discrete, linear or exponential.

- 1) Water flows over Shoshone Falls (a waterfall in Idaho) at a rate of  $300 \text{ ft}^3$  per second.  
*Continuous, Linear*
- 2) Brick layers are increasing their rate at 5% more per day.  
*Exponential, discrete*
- 3) Each day in your Algebra 1 class, you do 5 more problems than the day before.  
*Linear, discrete*
- 4) A bank account starts with \$30,000. Each month, the amount of money in the account halves.  
*Exponential, continuous*
- 5) Every hour, 13 E-books are downloaded onto a computer.  
*continuous, Linear*

For the graphs, tables and scenarios, tell if it is linear, exponential or neither.

<p>6) </p> <p style="text-align: center;"><i>neither</i></p>	<p>7) <math>y = 10\left(\frac{1}{2}\right)^x</math></p> <p style="text-align: center;"><i>exponential</i></p>	<p>8) <math>y - 2 = \frac{1}{4}(x + 3)</math></p> <p style="text-align: center;"><i>Linear</i></p>																								
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr><th>x</th><th>y</th></tr> </thead> <tbody> <tr><td>-1</td><td>13</td></tr> <tr><td>-3</td><td>16</td></tr> <tr><td>-5</td><td>19</td></tr> <tr><td>-7</td><td>22</td></tr> <tr><td>-9</td><td>25</td></tr> </tbody> </table> <p style="text-align: center;"><i>Linear</i></p>	x	y	-1	13	-3	16	-5	19	-7	22	-9	25	<p>10) <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr><th>x</th><th>y</th></tr> </thead> <tbody> <tr><td>0</td><td>4</td></tr> <tr><td>1</td><td>2</td></tr> <tr><td>2</td><td>1</td></tr> <tr><td>3</td><td><math>\frac{1}{2}</math></td></tr> <tr><td>4</td><td><math>\frac{1}{4}</math></td></tr> </tbody> </table> <p style="text-align: center;"><i>exponential</i></p> </p>	x	y	0	4	1	2	2	1	3	$\frac{1}{2}$	4	$\frac{1}{4}$	<p>11) <math>y = x^2</math></p> <p style="text-align: center;"><i>neither</i></p>
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x	y																									
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-3	9																									
-1	8																									
1	7																									

**Concept 2: Creating equations from scenarios, tables and graphs**

- **Linear** – you need a slope and a point, or two points to find the slope. We are adding or subtracting the same thing over and over again.

- o Point slope -  $y - y_1 = m(x - x_1)$
- o Slope intercept:  $y = mx + b$
- o Standard form:  $ax + by = c$

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad b = y\text{-intercept}$$

- Given the point (-3, 4) and (1, -4) create the point slope equation then convert it to slope intercept.

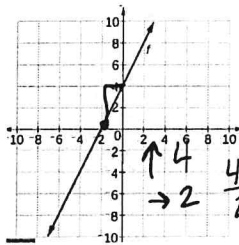
$$m = \frac{-4 - 4}{1 - (-3)} = \frac{-8}{4} = -2 = m \quad \begin{matrix} (-3, 4) \\ x_1, y_1 \end{matrix}$$

$$y - 4 = -2(x - (-3))$$

$$\boxed{y - 4 = -2(x + 3)} \rightarrow \text{point slope}$$

$$\begin{array}{r} y - 4 = -2x - 6 \\ +4 \quad \quad +4 \end{array}$$

$$\boxed{y = -2x - 2} \rightarrow \text{slope intercept}$$



$$b = 4$$

$$m = 2$$

$$\boxed{y = 2x + 4}$$

x	y
-1	13
-3	16
-5	19
-7	22
-9	25

$$m = \frac{3}{-2}$$

$$(-1, 13) \quad y - 13 = -\frac{3}{2}(x - (-1))$$

$$x_1, y_1 \quad y - 13 = -\frac{3}{2}(x + 1)$$

$$y - 13 = -\frac{3}{2}x - \frac{3}{2}$$

$$\boxed{y = -\frac{3}{2}x + \frac{23}{2}}$$

- **Exponential** – you multiply from point to point. The base (ratio) could be a whole number or a fraction. We can use the zero term, the first term or whatever term we want as long as you change the exponent to match.

x	y
0	4
1	2
2	1
3	$\frac{1}{2}$
4	$\frac{1}{4}$

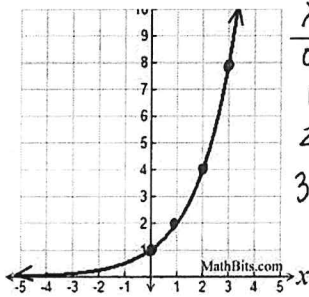
$$r = \frac{1}{2}$$

$$0 \text{ term } m = 4$$

$$y = 4\left(\frac{1}{2}\right)^x$$

$$\text{OR}$$

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



x	y
0	1
1	2
2	4
3	8

x	y
0	40
1	120
2	360
3	1080

$$y = 40(3)^x$$

$$y = 120(3)^{x-1}$$

**Creating Equations practice problems. Create the appropriate equation.**

- 1) Using a new app that I just downloaded I want to cut back on my calorie intake so that I can lose weight. I currently weigh 90 kilograms; my plan is to lose 1.2 kilograms a week until I reach my goal. How can I make an equation to model my weight loss for the next several weeks

$$y = 90 - 1.2x$$

- 2) Create the equation given a slope of 9 and going through the point (-3, 2).

$$y - 2 = 9(x - (-3))$$

$$y - 2 = 9(x + 3)$$

$$y - 2 = 9x + 27$$

$$+2 \qquad +2$$

$$y = 9x + 29$$

- 3) Bacteria is halving every hour. You start with 9000 bacteria.

$$y = 9000 \left(\frac{1}{2}\right)^x$$

x	y
-5	-6
-3	-2
-1	2
1	6

+2  
+2

+4  
+4

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

$$y - 6 = 2(x - 1)$$

$$y = 2x + 4$$

- 4)

x	0	1	2	3	4	5	6	7
y	3	6	12	24	48	96	192	384

$$x \cdot 2 \quad x \cdot 2 \quad 3(2)^x$$

- 6) Julie gets a prepaid cell phone. Initially she has a \$40 balance on the phone. Each minute of talking costs her \$0.15.

a. Is the function linear or exponential?

b. Create the equation here in function notation:  $f(x) = 40 - 0.15x$

c. Find the value of  $f(0)$  and tell what that means in context (write a sentence).

$$f(0) = 40 - 0.15(0) = 40 \quad \text{At 0 mins, Julie has \$40.}$$

d. Find the value of  $f(100)$  and tell what that means in context (write a sentence).

$$f(100) = 40 - 0.15(100) = 25 \quad \text{At 100 mins, Julie has \$25 left.}$$

- 7) A science experiment is periodically measuring the amount of mold in your backpack. At the start of the experiment, you have 24 cells of mold in your backpack. Each time you check again, periodically, you realize that the mold is tripling in amount.

a. Fill in the chart below with the missing amount of bacteria cells.

x = observation number	0	1	2	3	4	5	6
y = amount of bacteria cells	24	72	216	648	1944	5832	17496

b. Create the equation that goes along with this scenario.

$$y = 24(3)^x$$

c. What would be the mold cell count in your backpack on the 32<sup>nd</sup> observation?

$$1,853,020,188,851,841 \text{ cells}$$

d. What would be the mold cell count in your backpack on the 100<sup>th</sup> observation?

$$5.15 \times 10^{47} \text{ cells}$$

e. What observation would you need to look at to see when the mold cells get to 10,000?

between 5 and 6 looks

- 8) Create the equation of a line going through the points (0, 3) and (-3, 15)

$$\frac{15-3}{-3-0} = \frac{12}{-3} = -4$$

$$y - 3 = -4(x - 0)$$

$$y - 3 = -4x \Rightarrow y = -4x + 3$$

- 9) Create the equation of the exponential going through the point (0, 1) and (4, 1296).

$$r = 6 \quad 1(6)^x \text{ OR } 6(6)^{x-1}$$

x	y
0	1
4	1296

Jumps: 2, 3, 4

$$1296^{1/4} = 6$$

- 10) Solve for y in the following equations:

a.  $4y - 8x = 32$

$$y = 2x + 8$$

b.  $4x^2 - y = 12$

$$y = 4x^2 - 12$$

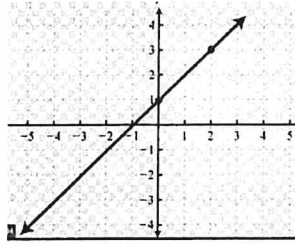
c.  $y - 10 = -\frac{1}{3}(x - 9)$

$$y = -\frac{1}{3}x + 13$$



### Concept 3: Domain and Range

- **Domain** represents all the **x-values** of a function. We count the numbers from left to right. We use either brackets or parentheses for domain.
- **Range** represents all the **y-values** of a function. We count the numbers from bottom to top. We use either brackets or parentheses for range.



Arrows mean the graph goes on forever.

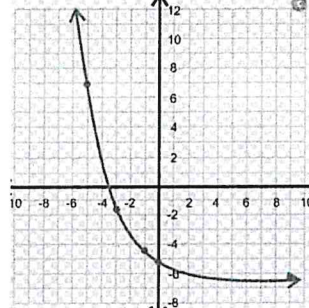
Dom:  $(-\infty, \infty)$   $-\infty < x < \infty$

Range:  $(-\infty, \infty)$   $-\infty < y < \infty$

Interval

Inequality

[ ] equal to  
( ) not equal to



Exponentials have asymptotes, where the graph flattens out. The only thing affected is the Range.

Dom:  $(-\infty, \infty)$  \*arrows

Range:  $(-7, \infty)$   
(asymptote,  $\infty$ )

You are graduating high school. As a present, you get \$1,000. Each month for the next year, you get \$150 more dollars and deposit it into the account. At the end of the 12 months, you take your money out and see how much you have.

**Domain:** Time – 12 months [0, 12]  $0 \leq x \leq 12$  {0, 1, 2, ..., 12}

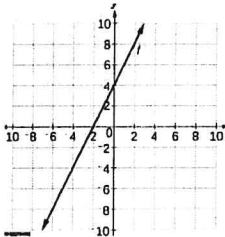
Interval                      Inequality                      Set

**Range:** Money – start at 1,000 [1000, 2800]  $1000 \leq y \leq 2800$  {1000, 1150, 1300, ..., 2800}

Interval                      Inequality                      Set

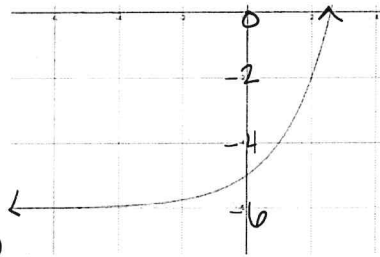
Complete these problems.

Tell what the domain and range are.



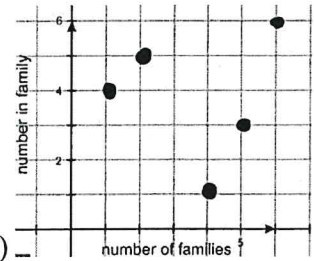
1)

Interval:  $(-\infty, \infty)$   
Inequality:  $-\infty < x < \infty$   
Range:  $(-\infty, \infty)$   
Inequality:  $-\infty < y < \infty$



2)

Interval:  $(-\infty, \infty)$   
Inequality:  $-\infty < x < \infty$   
Range:  $(-6, \infty)$   
Inequality:  $-6 < y < \infty$



3)

Set: {1, 2, 4, 5, 6}  
Dom: {1, 2, 4, 5, 6}  
Range: {1, 3, 4, 5, 6}

4) When driving for Lyft there is a base fee, which is the flat fee regardless of where you go that you have to pay. The base fee is \$2. The charge per mile is \$0.40. You are riding in a Lyft for 10 miles. Tell what the domain and range is in interval and inequality notation.

Domain: Miles  $[0, 10]$   $0 \leq x \leq 10$   
Range: cost  $[2, 6]$   $2 \leq y \leq 6$   
 $y = 2 + 0.4x$

5) Penny is saving up for retirement. She puts \$1000 into an account that doubles every year. She wants to pull the money out after 12 years. Find the domain and range is in interval, inequality and set notation.

Dom: years  $[0, 12]$   $0 \leq x \leq 12$  {0, 1, 2, ..., 12}  
Range: Money  $[1000, 4096, 000]$   $1000 \leq y \leq 4,096,000$   
{1000, 2000, ..., 4,096,000}

6) Jasmine is trying to bulk up for hibernation. She starts by eating 3 cookies on the first day and each day after that for 30 days she eats two more. Tell what the domain and range are in interval, inequality and set notation.

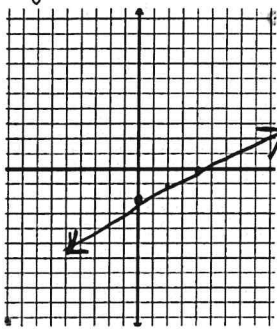
$y = 1 + 2x$   
Dom: days  $[1, 30]$   $1 \leq x \leq 30$  {1, 2, ..., 30}  
Range: cookies  $[3, 61]$   $3 \leq y \leq 61$   
{3, 5, ..., 61}

### Concept 4a: Graphing lines

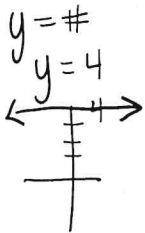
- 3 forms of a line
  - o Point slope -  $y - y_1 = m(x - x_1)$
  - o Slope intercept:  $y = mx + b$
  - o Standard form:  $ax + by = c$
- Easiest form to graph in - SLOPE INTERCEPT
- Easiest form to find x and y intercepts - STANDARD

Slope - intercept

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



$m = \frac{1}{2}$   
 $\uparrow 1$   
 $\rightarrow 2$   
 $b = -2$   
 start @  
 -2 on y axis



Point Slope

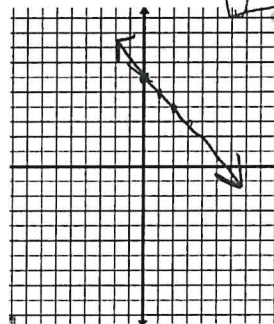
$$\boxed{(4, 2)} \quad (-4, 10)$$

$$\frac{10 - 2}{-4 - 4} = \frac{8}{-8} = -1 \text{ m}$$

$$y - 2 = -1(x - 4) \quad \text{* convert to Slope Intercept}$$

$$y - 2 = -x + 4$$

$$y = -x + 6$$



$y = -x + 6$   
 slope: -1  
 $b = 6$   
 y-int

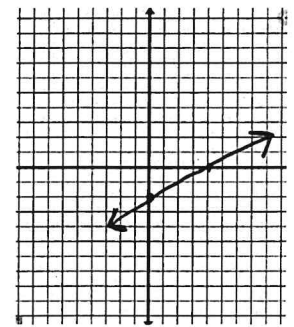
Standard

$$4x - 8y = 16$$

\* solve for x & y ints.

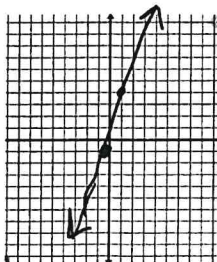
X-int  
 $4x = 16$   
 $x = 4$   
 $(4, 0)$

y-int  
 $-8y = 16$   
 $-y = 2$   
 $y = -2$   
 $(0, -2)$



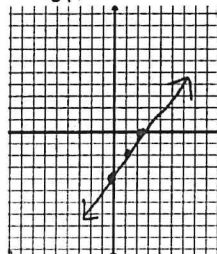
Graph the following lines. Be sure to show all work necessary.

1)  $y = 5x - 1$



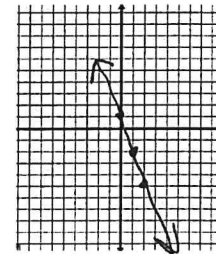
slope: 5  
 y-int: -1

2)  $10x - 5y = 20$   
 $-10x$        $-10x$



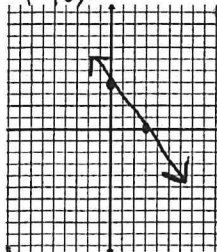
$-5y = -10x + 20$   
 $-y = -2x + 4$   
 $y = 2x - 4$   
 slope: 2  
 y-int: -4

3)  $y - 4 = -3(x + 1)$



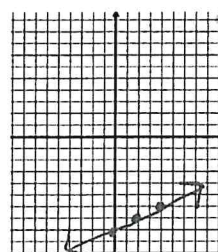
$y - 4 = -3x - 3$   
 $+4$        $+4$   
 $y = -3x + 1$   
 slope: -3  
 y-int: 1

4)  $-40x - 30y = -120$   
 $+40x$        $+40x$



$-30y = 40x - 120$   
 $-y = \frac{4}{3}x - 4$   
 $y = -\frac{4}{3}x + 4$   
 slope:  $-\frac{4}{3}$   
 y-int: 4

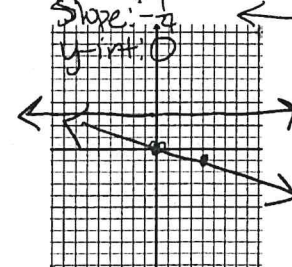
5)  $y + 4 = \frac{1}{2}(x - 8)$



$y + 4 = \frac{1}{2}x - 4$   
 $y = \frac{1}{2}x - 8$   
 slope:  $\frac{1}{2}$   
 y-int: -8

Graph both lines on same graph

6)  $y = -\frac{1}{4}x$      $y = 3$



slope:  $-\frac{1}{4}$   
 y-int: 0



**Concept 4b – solving for x and y intercepts**

- Slope intercept form

$$y = mx + b$$

$$y = 4x + 2$$

$$y\text{-int: } (0, 2)$$

$$x\text{-int: } (-\frac{1}{2}, 0)$$

X-intercept you have to solve for

$$* y = 0$$

$$0 = 4x + 2$$

$$-2 = 4x$$

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

- Standard form

$$ax + by = c$$

$$4x - 9y = 36$$

X-int Cover up y

$$\frac{4x}{4} = \frac{36}{4}$$

$$x = 9$$

$$(9, 0)$$

x-int

y-int Cover up x

$$-9y = \frac{36}{-9}$$

$$y = -4$$

$$(0, -4)$$

y-int

- Point slope form

$$y - y_1 = m(x - x_1)$$

$$y - 4 = \frac{1}{2}(x + 8)$$

\* solve for y

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

$$y = \frac{1}{2}x + 8$$

$$y = \frac{1}{2}x + 8$$

$$y\text{-int: } (0, 8)$$

$$x\text{-int: } y = 0$$

$$0 = \frac{1}{2}x + 8$$

$$-8 = \frac{1}{2}x$$

$$x\text{-int: } (-16, 0)$$

$$x = -16$$

**Practice problems. Find the x and y intercepts.**

1)  $8x - 5y = 40$

$$\frac{8x}{8} = \frac{40}{8}$$

$$x = 5$$

$$y\text{-int}$$

$$-5y = 40$$

$$y = -8$$

2)  $y = -\frac{1}{3}x + 5$

$$y\text{-int: } (0, 5)$$

$$x\text{-int: } 0 = -\frac{1}{3}x + 5$$

$$-5 = -\frac{1}{3}x$$

$$x = 15$$

3)  $y - 14 = \frac{1}{3}(x + 27)$

$$y = \frac{1}{3}x + 9 + 14$$

$$y = \frac{1}{3}x + 23$$

$$y\text{-int: } (0, 23)$$

$$0 = \frac{1}{3}x + 23$$

$$-23 = \frac{1}{3}x$$

$$x = -69$$

4)  $y = 4x - 2$

$$y\text{-int: } (0, -2)$$

$$x\text{-int: } 0 = 4x - 2$$

$$2 = 4x$$

$$(\frac{1}{2}, 0)$$

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

5)  $-x + y = 10$

$$x = 10$$

$$y = 10$$

$$(0, 10)$$

$$(-10, 0)$$

6)  $y = 4x + 1$

$$y = 4x + 1$$

$$y\text{-int: } (0, 1)$$

$$x\text{-int}$$

$$0 = 4x + 1$$

$$-1 = 4x$$

$$x = -\frac{1}{4}$$

Label what form each one is in. Then tell what the slope and y-intercept are.

7)  $y - 4 = 3(x - 1)$

Convert me to slope intercept

$$y - 4 = 3x - 3$$

$$y = 3x + 1$$

slope: 3

y-int: (0, 1)

8)  $y = -\frac{1}{6}x$  slope intercept

slope:  $-\frac{1}{6}$

y-int: (0, 0)

9)  $-8y = 16$

Convert me to slope intercept

$$-8y = -x + 16$$

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

y-int: (0, -2)

slope:  $\frac{1}{8}$

**Concept 5: Function notation and greater rate of change (slope)**

- **Function notation** is just a fancy way to write  $y$

o  $y = 4x + 2 \rightarrow f(x) = 4x + 2$

o  $y = -4(2)^{x+1} \rightarrow f(x) = -4(2)^{x+1}$

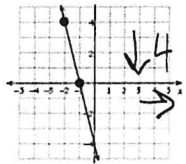
- **Slope** -  $\frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$  there **MUST** be two points

o Having a **greater rate of change** means whatever we are talking about is moving at a faster rate/pace. Even when you have a negative slope on a graph, look at the positive value to see which one is moving faster.

Which one has a greater rate of change?

(4, 0) and (2, 10)

$$\frac{10 - 0}{2 - 4} = \frac{10}{-2} = -5$$



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

-5 vs. -4  $\rightarrow$  -5 steeper  
Greater Rate

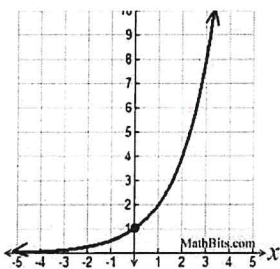
x	y
2	0
4	6
6	12
8	18

$$\frac{6}{2} = 3$$

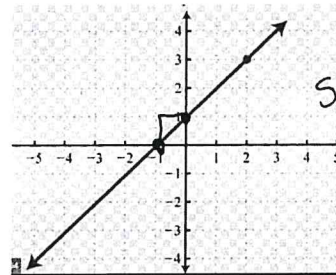
$$y = -10x - 4$$

$$m = -10$$

3 vs. -10  $\rightarrow$  -10 greater  
Rate of change



$y = 2^x$   
Rate of Change  $\rightarrow \times 2$



slope = 1  
Rate of Change  $\rightarrow +1$

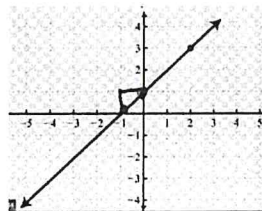
Times by 2 vs. Adding 1  $\rightarrow \times 2$  greater

o o

x	y
1	2
2	4
3	6
4	8

Write the equations in function notation

$f(x) = 2x$



$f(x) = 1/x + 1$

- Filling out function charts – you will need a calculator. Substitute each value in for x for the equation.

← Fill in these two →

$$f(x) = -3x - 8$$

0	-8
1	-11
2	-14
3	-17
4	-20
5	-23

$$\begin{aligned} -3(0) - 8 \\ -3(1) - 8 \\ -3(2) - 8 \\ -3(3) - 8 \\ -3(4) - 8 \\ -3(5) - 8 \end{aligned}$$

$$g(x) = 4(2)^x$$

x	g(x)
0	4
1	8
2	16
3	32
4	64
5	128

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

x	h(x)
0	-1
1	-4
2	-13
3	-28
4	-49
5	-76

Tell which of the following have a higher rate of change.

1) You are jogging and increase your mileage by 3 miles a week vs. Your friend is losing 6 pounds a week.

lose more

2) You open 10 Snapchats a minute vs. Your sister who sends 6 Snapchats a minute.

yw

3) (0, -10) (4, -7) vs.  $y = -4x + 3$

$$\frac{-7 - (-10)}{4 - 0} = \frac{3}{4} \text{ vs. } -4$$

4)  $y = 3(4)^{x-1}$  vs.  $y = -3(\frac{1}{2})^x - 1$

$$\times 4$$

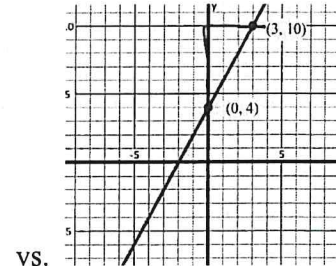
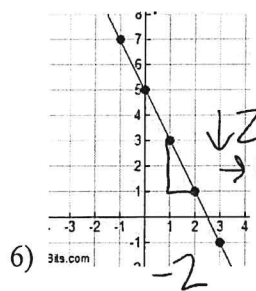
$$\times \frac{1}{2}$$

x	y
-1	13
-3	16
-5	19
-7	22
-9	25

vs.

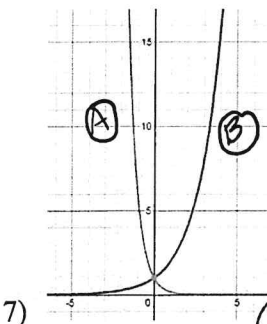
x	y
9	2
3	-2
-3	-6
-9	-10

$-\frac{4}{-6} = \frac{2}{3}$



$$\frac{6}{3} = 2$$

Same



Which one has a faster rate of change? Why?

(A) Steeper curve means it increases/decreases faster

$$8) f(x) = -\frac{1}{2}x + 1$$

x	-3	-1	0	2	3	8
f(x)	2.5	1.5	1	0	-0.5	-3