 Name: ______________________________

5.1.D2 Comparing Linear & Exponential Functions

Describe the defining characteristics of each type of function by filling in the cells of each table as completely as possible.

	Linear Model	**Exponential Model**
	$y = 4 + 2x$	$y = 4 \cdot 2^x$

MAKE A TABLE OF VALUES

Linear Model ($y = 4 + 2x$)

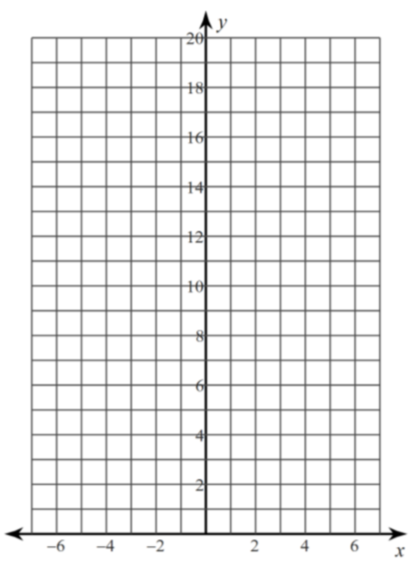
x	y
-2	
-1	
0	
1	
2	

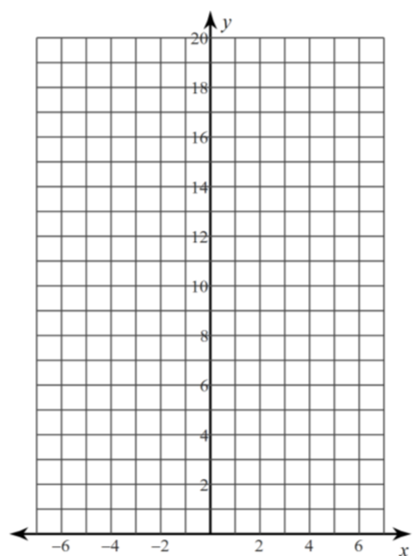
Exponential Model ($y = 4 \cdot 2^x$)

x	y
-2	
-1	
0	
1	
2	

RATE OF CHANGE

GRAPH





	Linear Model	Exponential Model
SIMILARITIES		
DIFFERENCES		
Y-INTERCEPT		

- Average rate of change between two points (x_1, y_1) & (x_2, y_2): $AROC = \frac{y_2 - y_1}{x_2 - x_1}$
- Linear Functions
  - Consider the **linear** function, $k(x) = 4x + 3$:

x	-2	-1	0	1	2	3	8
$k(x)$	-5	-1	3	7	11	15	35

    - Is the function an arithmetic sequence or a geometric sequence? Explain your reasoning.
    - Compute the average rate of change between $(0, 3)$ & $(1, 7)$.
    - Compute the average rate of change between $(1, 7)$ & $(2, 11)$.
    - Compare the average rates of change.
    - As the *x*-values increase by one, the *y*-values...
  - If a function is **linear** and you make a constant change in *x*-values, the **difference** of the corresponding *y*-values is constant.
    - $y = mx + b$
      - *m* represents the constant difference (aka slope) & *b* is the initial value (when *x* = 0)
- Exponential Functions
  - Consider the exponential function, $h(x) = 2 \cdot 3^x$:

x	-2	-1	0	1	2	3	8
$h(x)$	$\frac{2}{9}$	$\frac{2}{3}$	2	6	18	54	13122

    - Is the function an arithmetic sequence or a geometric sequence? Explain your reasoning.
    - Compute the average rate of change between $(0, 2)$ & $(1, 6)$.
    - Compute the average rate of change between $(1, 6)$ & $(2, 18)$.
    - Compare the average rates of change.
    - As the *x*-values increase by one, the *y*-values...
  - If a function is **exponential** and you make a constant change in *x*-values, the **ratio** of the corresponding *y*-values is constant.
    - $y = a(b)^x$
      - *b* represents the constant ratio & *a* is the initial value (when *x* = 0)

EXAMPLES

Examine the output pattern to determine which of the following data sets is linear and which is exponential. For the linear set, write a linear equation of the form $y = mx + b$; for the exponential set, write an exponential equation of the form $y = a(b)^x$.

1.

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

2.

x	0	1	2	3	4
y	2	8	32	128	512

3. A computer technician charges $40 per computer plus $75 per hour for repairing computers. The table shows her charges for repairing a computer based on the number of hours the job takes.

NUMBER OF HOURS	0	1	2	3	4
TOTAL COST	40	115	190	265	340

Examine the output pattern to determine whether the situation can be represented by linear function or an exponential function. For the linear set, write a linear equation of the form $y = mx + b$; for the exponential set, write an exponential equation of the form $y = a(b)^x$.

4. An experiment begins with a colony of 800 bacteria. Each minute, the population is reduced by 20%. The table shows the bacteria remaining based on the number of minutes passed.

NUMBER OF MINUTES	0	1	2	3	4
BACTERIA	800	640	512	410	328

Examine the output pattern to determine whether the situation can be represented by linear function or an exponential function. For the linear set, write a linear equation of the form $y = mx + b$; for the exponential set, write an exponential equation of the form $y = a(b)^x$.

5. Consider the wording in problems 3 & 4, how is the linear situation worded differently from the exponential situation?

Can the situation be represented by a linear function or an exponential function?

6. The number of students at Wilson High school has increased by 50 in each of the past four years. Four years ago, the student population was 750.

7. The price of a gallon of milk has been rising 3% each year. Five years ago the price as $2 for a gallon of milk.

8. Tax allows you to depreciate the value of your equipment by $200 per year. The equipment was purchased three years ago for $1000.

9. The price of high-definition TV sets has been falling about 25% per year. A high-definition TV set costs $1000 today.