Name: _____ Algebra 1B

Date: _____ Linear vs. Exponential Continued

Linear vs. Exponential Word Problems

At separate times in the course, you've learned about linear functions and exponential functions, and done word problems involving each type of function. Today's assignment combines those two types of problems. In each problem, you'll need to make a choice of whether to use a linear function or an exponential function. Below is some advice that will help you decide.

Linear Function	Exponential Function
$f(x) = mx + b$ or $f(x) = m(x - x_1) + y_1$	$f(x) = a \cdot b^x$
b is the *starting value*, m is the *rate* or the *slope*. m is positive for growth, negative for decay.	a is the *starting value*, b is the *base* or the *multiplier*. $b > 1$ for growth, $0 < b < 1$ for decay. See below for ways to find the base b.

Choosing linear vs. exponential

In growth and decay problems (that is, problems involving a quantity increasing or decreasing), here's how to decide whether to choose a linear function or an exponential function.

- If the growth or decay involves increasing or decreasing by a fixed number, use a **linear** function. The equation will look like:

$$y = mx + b$$

$$f(x) = (\textbf{rate})\, x + (\textbf{starting amount}).$$

- If the growth or decay is expressed using multiplication (including words like "doubling" or "halving") use an **exponential** function. The equation will look like:

$$f(x) = (\textbf{starting amount}) \cdot (\textbf{base})^x.$$

PRACTICE

1. Decide whether the word problem represents a linear or exponential function. Circle either linear or exponential. Then, write the function formula.

a. "A library has 8000 books, and is adding 500 more books each year."

Linear or exponential? $y =$ _____.

b. "A gym's customers must pay \$50 for a membership, plus \$3 for each time they use the gym."

Linear or exponential? $y =$ _____.

c. "A bank account starts with \$10. Every month, the amount of money in the account is tripled."

Linear or exponential? $y =$ _____.

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d. "At the start of a carnival, you have 50 ride tickets. Each time you ride the roller coaster, you have to pay 6 tickets."

Linear or exponential? $y =$ _____.

e. "There are 20,000 owls in the wild. Every decade, the number of owls is halved."

Linear or exponential? $y =$ _____.

2. Decide whether the table represents a linear or exponential function. Circle either linear or exponential. Then, write the function formula.

a.

x	0	1	2	3	4	5	6	7
y	2	5	8	11	14	17	20	23

Linear or exponential? $y =$ _____.

b.

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

Linear or exponential? $y =$ _____.

c.

x	0	1	2	3	4	5	6	7
y	10	5	2.5	1.25	.625	.3125	.15625	.078125

Linear or exponential? $y =$ _____.

d.

x	0	1	2	3	4	5	6	7
y	12	8	4	0	-4	-8	-12	-16

Linear or exponential? $y =$ _____

e.

x	0	1	2	3	4	5	6	7
y	50	35	24.5	17.15	12.005	8.4035	5.88245	4.117715

Linear or exponential? $y =$ _____

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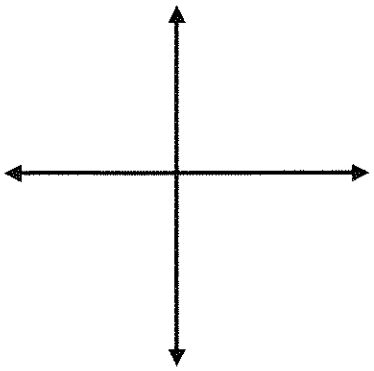
3. Sketch a graph of the function $y = 3 \cdot 2^x$ on the axes below.

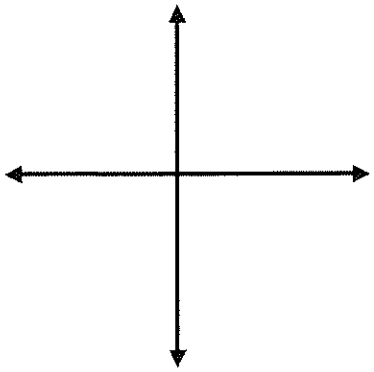
Be sure to label the y-intercept.

Hint: the y-intercept is the starting amount



4. Sketch a graph of the function $y = 5 \cdot \left(\frac{3}{4}\right)^x$ on the axes below.

Be sure to label the y-intercept.



5. Sketch a graph of the function $y = \left(\frac{5}{2}\right)^x$ on the axes below.

Be sure to label the y-intercept.