

Linear Vs Exponential Practice

1. What is different about a linear pattern versus an exponential pattern?

*Add*                      *Multiply*

2. Mr. Maurer is studying bacteria on a piece of bread that a student left in his classroom. He made the following table to keep track of the amount of bacteria.

X = days	0	1	2	3	4	5
Y = # of bacteria	10	20	40	80	160	320

a. Why can this NOT be a linear pattern? Be specific.

*The y-values double*

b. Write an exponential model for the situation

$$y = 10(2)^x$$

c. Find how many bacteria there will be after one month

$$y = 10(2)^{30} = 1.07 \times 10^{10} = 11,000,000,000$$

d. When will the number of bacteria exceed 1 billion?

*27<sup>th</sup> day → 1.34E9  
1,340,000,000*      *27<sup>th</sup> day → 1.68E8 = 168,000,000*  
*oops*

3. Mr. Maurer is training for his marathon and keeps track of how far he has run over time.

X = minutes	0	8	16	24	32	40
Y = miles	0	1	2	3	4	5

a. Why can this NOT be an exponential pattern? Be specific

*Because the y-values increase by 1.*

b. Write a linear model for the situation

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

c. Find how far he will run after one hour

$$y = \frac{1}{8}(60) = 7.5 \text{ miles}$$

d. When will he have run 26 miles?

$$8 \cdot (26 = \frac{1}{8} \cdot x) \cdot 8$$

$$208 = x \quad 208 \text{ minutes}$$

4. Mr. Maurer claims that your salary is linear but your investments are exponential.

a. What does he mean?

Salary adds money. Investments multiply

b. A teacher's gross salary is \$50,000 annually. They pay an average of 30% in taxes. They currently have \$10,000 in student loan debt. Write a linear model to represent the amount of money a teacher has, ignoring all other incomes and expenses.

Pay 30%  
means Keep 70%

$$y \rightarrow .70 \cdot 50000x - 10000 = 35000x - 10000$$

c. My savings account currently has \$5,000 and earns an interest rate of 3%. Write a formula for the amount of money in the savings account, ignoring all other deposits or withdrawals.

$$y = 5000(1.03)^x$$

d. Why is the plan in part c exponential?

Multiples by 1.03 each year.

e. When will the savings account be worth more than the teacher's salary?

2 Equations meet when  $x = 253$ .

Then  $y = 8.85E6$ .

5. A new car becomes a used car as soon as it is driven off the lot. Used cars *depreciate* in value (in other words, they decrease in value). This makes buying a new car a poor investment if you only consider the dollar amount of the car. Suppose you buy a new car anyway, because you just love that "new car smell." The price of the original car is \$14,999. The price of a used car of the same make and model that is 1 year old is \$10,999. Let  $f(x)$  model the price of the car over time, where  $f(x)$  = price (\$) and  $x$  = time (years)

a. Do you know if the function  $f(x)$  is linear or exponential? Explain.

Nope 2 points isn't enough.

b. If  $f(x)$  is linear, what is  $f(2)$ ?

$$f(2) = 6999$$

c. If  $f(x)$  is exponential, what is  $f(2)$ ?

$$f(2) = 8065.74$$

d. Write an equation for  $f(x)$  if  $f$  is linear.

$$f(x) = -4000x + 14999$$

e. Write an equation for  $f(x)$  if  $f$  is exponential.

$$f(x) = 14999(0.73)^x$$

f. What is  $f(15)$  if  $f$  is linear? Does that answer make sense?

-45000. No!

g. What is  $f(15)$  if  $f$  is exponential? Does that answer make sense?

133.63 Yes!