

## Linear Vs Exponential Practice

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

Linear = Add      Exponential = 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.

Adds different #s each time

- b. Write an exponential model for the situation

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

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

$$10(2)^{30} \approx 1.074 \times 10^9 = 1,074,000,000$$

- d. When will the number of bacteria exceed 1 billion?  $1,000,000,000 = 1 \times 10^9$  - Day 29.

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

Does not multiply consistently

- 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?

$$\frac{26}{\frac{1}{8}} = \frac{\frac{1}{8} \cdot x}{\frac{1}{8}} \rightarrow x = 208 \text{ minutes}$$

$$x = 3 \text{ hr } 28 \text{ min}$$

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

a. What does he mean?

Salary is added to your bank, investments multiply the principle

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.

$$Y = 50,000 \cdot 0.70 X - 10,000 = 35,000X - 10,000$$

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.

$$Y = 5,000 (1.03)^X$$

d. Why is the plan in part c exponential?

Multiplies the money by 103%

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

Table or Calc.  $X = 253$ . 253 years.

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.

Nepe. 2 pts aren't enough to determine the pattern.

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

$$f(2) = \$6,999$$

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

$$f(2) = \$8,065.74$$

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

$$f(x) = 14,999 - 4,000X$$

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

$$f(x) = 14,999(0.73)^X$$

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

$$f(15) = -45,601$$

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

$$f(15) = 1,330.63$$

6. What is the difference between linear and exponential functions?

Add Mult.

No! Cars can't have negative worth. Not really, unless the car is wrecked.