

Warm Up

3/29/19

1. The total cost, in dollars, of membership in a fitness center is given by the function $c(m) = 20m + 40$, where m is the number of months a person is a member. In dollars, how much is the cost of a membership for 1 year?

12 months

$$20(12) + 40$$

$$\boxed{\$280}$$

2. What is the value of x in the system of equations below:

$$5x + 4y = 1$$

$$y = 1 - x$$

$$5x + 4(1 - x) = 1$$

$$5x + 4 - 4x = 1$$

$$x + 4 = 1$$

$$\begin{array}{r} -4 \\ -4 \end{array}$$

$$\boxed{x = -3}$$

3. What is the equation of the line that is perpendicular to the graph of $4x + 3y = 9$ and passes through $(-2, 3)$?

$$\frac{3y}{3} = \frac{-4x + 9}{3}$$

$$y = \left(-\frac{4}{3}\right)x + 3$$

$$m = \frac{3}{4} \quad (-2, 3)$$

$$y - 3 = \frac{3}{4}(x + 2)$$

$$\begin{array}{r} y + 3 = \frac{3}{4}x + \frac{6}{4} \\ +3 \end{array}$$

$$\boxed{y = \frac{3}{4}x + \frac{18}{4}}$$

$$\boxed{y = \frac{3}{4}x + \frac{9}{2}}$$

Linear versus Exponential Functions

Linear and exponential functions share many characteristics. This is because they are based on two different, but similar, sets of principles.

• LINEAR VERSUS EXPONENTIAL

Linear functions are based on *adding/subt.* the same amount

The slope (m) – Constant rate of change- Common difference

Exponential functions are based on *multiplying* by the same amount

The base (b)- Growth or decay factor- Common Ratio

Example #1: The two tables below represent a linear function and an exponential function.

Part 1 : Which type is each function below? Explain how you arrive at your answer.

TABLE 1

| | | | | | |
|---|---|----|----|----|----|
| x | 0 | 1 | 2 | 3 | 4 |
| y | 5 | 10 | 20 | 40 | 80 |

Type

exponential

$$y = a \cdot b^x$$

$$y = 5(2)^x$$

TABLE 2

| | | | | | |
|---|---|----|----|----|----|
| x | 0 | 1 | 2 | 3 | 4 |
| y | 8 | 11 | 14 | 17 | 20 |

Type

+3 +3 +3 +3

linear

$$y = mx + b$$

$$y = 3x + 8$$

Part 2 : Find equations in standard form for each of the functions from Example #1.

Table 1 Equation : $y = 5(2)^x$

Table 2 Equation : $y = 3x + 8$

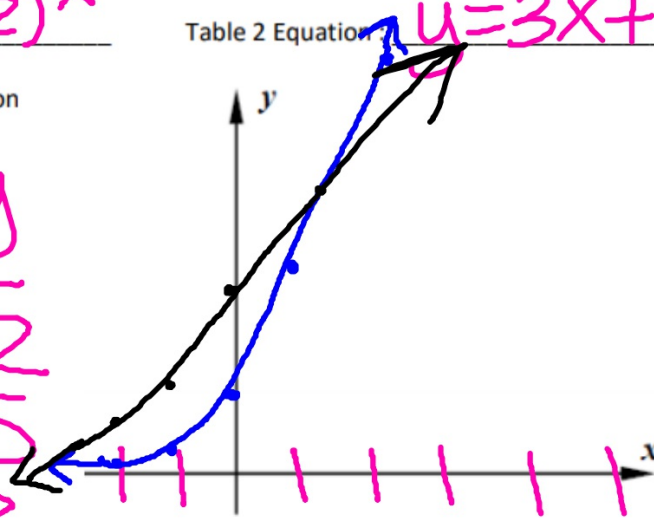
Part 3 : Sketch the graph of each equation

T.1.

| X | Y |
|----|-------|
| -2 | $5/4$ |
| -1 | $5/2$ |
| 0 | 5 |
| 1 | 10 |
| 2 | 20 |

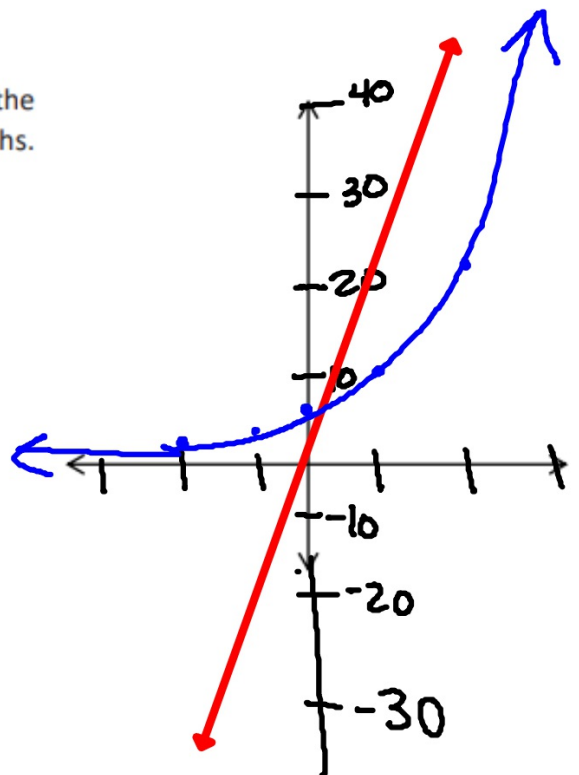
T.2

| X | Y |
|----|----|
| -2 | 2 |
| -1 | 5 |
| 0 | 8 |
| 1 | 11 |
| 2 | 14 |



Example 2: Consider the linear function $y = 20x + 5$ and the exponential function $y = 5(2)^x$. Make a sketch of their graphs. Which one of these grows faster?

| X | $20x+5$ | X | $5(2)^x$ |
|----|---------|----|----------|
| -2 | -35 | -2 | $5/4$ |
| -1 | -15 | -1 | $5/2$ |
| 0 | 5 | 0 | 5 |
| 1 | 25 | 1 | 10 |
| 2 | 45 | 2 | 20 |



Example 3

Which of the following functions would best describe the data in the table?

~~(1) $y = 10x + 2$~~

~~(2) $y = 8x + 2$~~

(3) $y = 5(2)^x$

(4) $y = 2(5)^x$

| | | | | | |
|---|---|----|----|-----|------|
| x | 0 | 1 | 2 | 3 | 4 |
| y | 2 | 10 | 50 | 250 | 1250 |

Handwritten annotations on the table:
 - Above the x-values 1, 2, 3, 4 are four upward-pointing arrows, each with a '+' sign above it, indicating a constant increase of 1 in x.
 - Below the y-values 10, 50, 250, 1250 are four downward-pointing arrows, each with a '(5)' below it, indicating a constant multiplication by 5 in y.

Example 4: Find the equation of the exponential function, in $y = a(b)^x$ form for the function given in the table below.

| | | | | | |
|-----|----|----|----|-----|-----|
| x | 0 | 1 | 2 | 3 | 4 |
| y | 10 | 30 | 90 | 270 | 810 |

(3) (3) (3) (3)

$$y = a(b)^x$$

$$y = 10(3)^x$$



Linear functions grow slowly while exponential functions grow rapidly

Example 5: Write an equation of the function represented in the table below.

| | | | | | | |
|-------------|---------------|---|---|----|----|-----|
| x | -1 | 0 | 1 | 2 | 3 | 4 |
| f(x) | $\frac{2}{3}$ | 2 | 6 | 18 | 54 | 162 |

Type

Expo.

Equation

$y = 2(3)^x$

Example 6: Write an equation of the function represented in the table below.

| | | | | | | |
|------|-----|----|-----|---|-----|---|
| x | -3 | -2 | -1 | 0 | 1 | 2 |
| f(x) | 5.5 | 5 | 4.5 | 4 | 3.5 | 3 |

\checkmark
-0.5 -0.5 -0.5 -0.5 -0.5

Type _____ Equation _____

linear

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

REASONING. You can determine the equation of a line or the equation of an exponential given any two points that lie on these curves. In this exercise we will pick two special points. Consider the points (0, 5) and (1, 15)

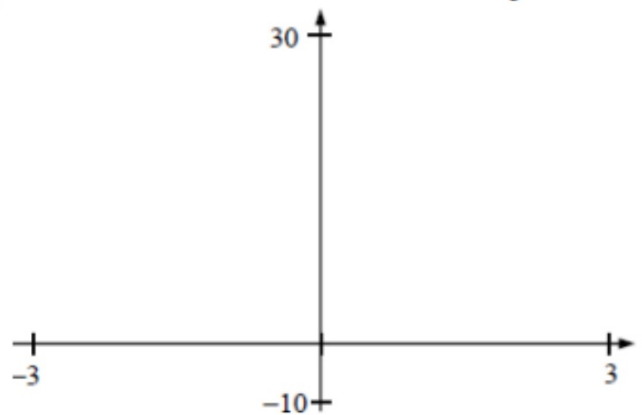
- a. Write the equation of the line that passes between these two points in $y = mx + b$ form.

$$y = 10x + 5$$

- b. Write the equation of the exponential that passes between these two points in

$$y = 5(3)^x$$

- c. Using your calculator, sketch the two graphs on the axes below. Label with their equations



- d. Is it fair to say that an exponential function always grows faster than a linear?
- e. What can we say about an increasing exponential function when compared with an increasing linear function?
- f. What is the difference between the way a linear function increases and the way an exponential function increases?