Name _____ Date _____

Graphs of Linear Functions and Rate of Change

1. Sylvie claims that the table of inputs and outputs below will be a linear function. Is she correct? Explain.

Input	Output
-3	-25
2	10
5	31
8	54

2. A function assigns the inputs and corresponding outputs shown in the table to the right.

   a. Is the function a linear function? Check at least three pairs of inputs and their corresponding outputs.

Input	Output
-2	3
8	-2
10	-3
20	-8

b. What equation describes the function?

c. What will the graph of the function look like? Explain.

1. A function assigns the inputs and corresponding outputs shown in the table below.

Input	Output
3	9
9	17
12	21
15	25

   a. Is the function a linear function? Check at least three pairs of inputs and their corresponding outputs.
   b. What equation describes the function?
   c. What will the graph of the function look like? Explain.

2. A function assigns the inputs and corresponding outputs shown in the table below.

Input	Output
-1	2
0	0
1	2
2	8
3	18

   a. Is the function a linear function?
   b. What equation describes the function?

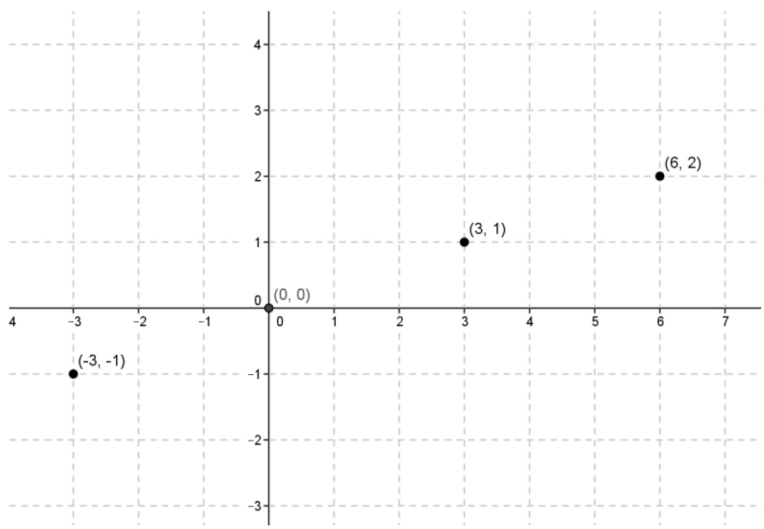
3. A function assigns the inputs and corresponding outputs shown in the table below.

Input	Output
0.2	2
0.6	6
1.5	15
2.1	21

   a. Is the function a linear function? Check at least three pairs of inputs and their corresponding outputs.
   b. What equation describes the function?
   c. What will the graph of the function look like? Explain.

4. Martin says that you only need to check the first and last input and output values to determine if the function is linear. Is he correct? Explain. Hint: Show an example with a table that is not a function.

5. Is the following graph a graph of a linear function? How would you determine if it is a linear function?



6. A function assigns the inputs and corresponding outputs shown in the table below.

Input	Output
-6	-6
-5	-5
-4	-4
-2	-2

   a. Is the function a linear function? Check at least three pairs of inputs and their corresponding outputs.
   b. What equation describes the function?
   c. What will the graph of the function look like? Explain.

1. **Sylvie claims that the table of inputs and outputs will be a linear function. Is she correct? Explain.**

Input	Output
-3	-25
2	10
5	31
8	54

$$\frac{-25-(10)}{-3-2}=\frac{-35}{-5}=7 \qquad \frac{10-31}{2-5}=\frac{-21}{-3}=7 \qquad \frac{31-54}{5-8}=\frac{-23}{-3}=\frac{23}{3}$$

No. This is not a linear function. The rate of change was not the same for each pair of inputs and outputs inspected, which means that it is not a linear function.

2. **A function assigns the inputs and corresponding outputs shown in the table below.**

   a. **Is the function a linear function? Check at least three pairs of inputs and their corresponding outputs.**

Input	Output
-2	3
8	-2
10	-3
20	-8

$$\frac{3-(-2)}{-2-8}=\frac{5}{-10}=-\frac{1}{2}$$
$$\frac{-2-(-3)}{8-10}=\frac{1}{-2}=-\frac{1}{2}$$
$$\frac{-3-(-8)}{10-20}=\frac{5}{-10}=-\frac{1}{2}$$

Yes. The rate of change is the same when I check pairs of inputs and corresponding outputs. Each time it is equal to $-\frac{1}{2}$. Since the rate of change is the same, then I know it is a linear function.

   b. **What equation describes the function?**

Using the assignment of 3 to -2:

$$3=-\frac{1}{2}(-2)+b$$
$$3=1+b$$
$$2=b$$

The equation that describes the function is $y=-\frac{1}{2}x+2$.

   c. **What will the graph of the function look like? Explain.**

The graph of the function will be a line. Since the function is a linear function that can be described by the equation $y=-\frac{1}{2}x+2$, then it will graph as a line because equations of the form $y=mx+b$ graph as lines.

1. **A function assigns the inputs and corresponding outputs shown in the table below.**

Input	Output
3	9
9	17
12	21
15	25

a. **Is the function a linear function? Check at least three pairs of inputs and their corresponding outputs.**

$$\frac{9-17}{3-9}=\frac{-8}{-6} \qquad \frac{17-21}{9-12}=\frac{-4}{-3} \qquad \frac{21-25}{12-15}=\frac{-4}{-3}$$
$$=\frac{4}{3} \qquad =\frac{4}{3} \qquad =\frac{4}{3}$$

Yes. The rate of change is the same when I check pairs of inputs and corresponding outputs. Each time it is equal to $\frac{4}{3}$. *Since the rate of change is the same, then I know it is a linear function.*

b. **What equation describes the function?**

Using the assignment of 9 *to* 3*:*

$$9=\frac{4}{3}(3)+b$$
$$9=4+b$$
$$5=b$$

The equation that describes the function is $y=\frac{4}{3}x+5$.

c. **What will the graph of the function look like? Explain.**

The graph of the function will be a line. Since the function is a linear function that can be described by the equation $y=\frac{4}{3}x+5$, *it will graph as a line because equations of the form* $y=mx+b$ *graph as lines.*

2. **A function assigns the inputs and corresponding outputs shown in the table below.**

Input	Output
−1	2
0	0
1	2
2	8
3	18

a. **Is the function a linear function?**

$$\frac{2-0}{-1-0}=\frac{2}{-1} \qquad \frac{0-2}{0-1}=\frac{-2}{-1}$$
$$=-2 \qquad =2$$

No. The rate of change is not the same when I check the first two pairs of inputs and corresponding outputs. All rates of change must be the same for all inputs and outputs for the function to be linear.

b. **What equation describes the function?**

I am not sure what equation describes the function. It is not a linear function.

3. **A function assigns the inputs and corresponding outputs shown in the table below.**

Input	Output
0.2	2
0.6	6
1.5	15
2.1	21

a. **Is the function a linear function? Check at least three pairs of inputs and their corresponding outputs.**

$$\frac{2-6}{0.2-0.6}=\frac{-4}{-0.4} \qquad \frac{6-15}{0.6-1.5}=\frac{-9}{-0.9} \qquad \frac{15-21}{1.5-2.1}=\frac{-6}{-0.6}$$
$$=10 \qquad =10 \qquad =10$$

Yes. The rate of change is the same when I check pairs of inputs and corresponding outputs. Each time it is equal to 10. Since the rate of change is the same, I know it is a linear function.

b. **What equation describes the function?**

Using the assignment of 2 to 0.2:

$$2=10(0.2)+b$$
$$2=2+b$$
$$0=b$$

The equation that describes the function is $y=10x$.

c. **What will the graph of the function look like? Explain.**

The graph of the function will be a line. Since the function is a linear function that can be described by the equation $y=10x$, it will graph as a line because equations of the form $y=mx+b$ graph as lines.

4. **Martin says that you only need to check the first and last input and output values to determine if the function is linear. Is he correct? Explain. Hint: Show an example with a table that is not a function.**

No, he is not correct. For example, determine if the following inputs and outputs in the table are a function.

Using the first and last input and output, the rate of change is

$$\frac{9-12}{1-3}=\frac{-3}{-2}$$
$$=\frac{3}{2}$$

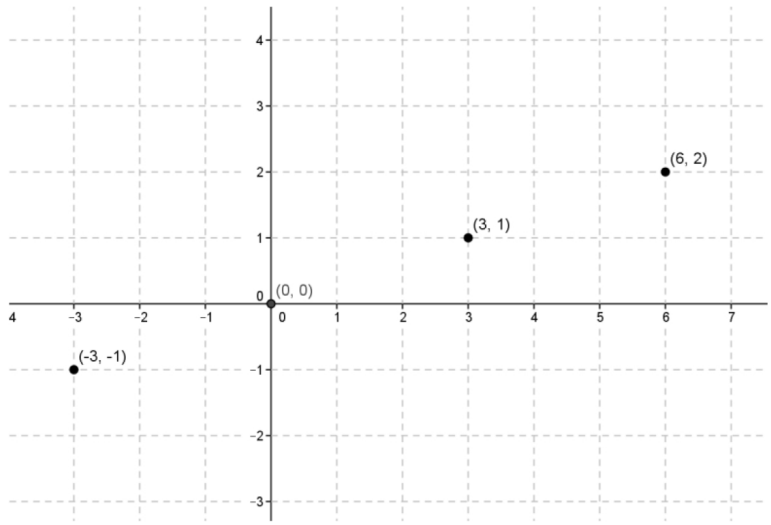
Input	*Output*
1	9
2	10
3	12

But when you use the first two inputs and outputs, the rate of change is

$$\frac{9-10}{1-2}=\frac{-1}{-1}$$
$$=1$$

Note to teacher: Accept any example where rate of change is different for any two inputs and outputs.

5. **Is the following graph a graph of a linear function? How would you determine if it is a linear function?**



It appears to be a linear function. To check, I would organize the coordinates in an input and output table. Next, I would check to see that all the rates of change are the same. If they are the same rates of change, I would use the equation $y = mx + b$ and one of the assignments to write an equation to solve for b. That information would allow me to determine the equation that represents the function.

6. **A function assigns the inputs and corresponding outputs shown in the table below.**

Input	Output
-6	-6
-5	-5
-4	-4
-2	-2

a. **Is the function a linear function? Check at least three pairs of inputs and their corresponding outputs.**

$$\frac{-6-(-5)}{-6-(-5)} = \frac{1}{1} = 1 \qquad \frac{-5-(-4)}{-5-(-4)} = \frac{1}{1} = 1 \qquad \frac{-4-(-2)}{-4-(-2)} = \frac{2}{2} = 1$$

Yes. The rate of change is the same when I check pairs of inputs and corresponding outputs. Each time it is equal to 1. Since the rate of change is the same, I know it is a linear function.

b. **What equation describes the function?**

Using the assignment of -5 to -5:

$$-5 = 1(-5) + b$$
$$-5 = -5 + b$$
$$0 = b$$

The equation that describes the function is $y = x$.

c. **What will the graph of the function look like? Explain.**

The graph of the function will be a line. Since the function is a linear function that can be described by the equation $y = x$, it will graph as a line because equations of the form $y = mx + b$ graph as lines.