

Name \_\_\_\_\_  
Mrs. Roumbos

Date \_\_\_\_\_  
8R Period \_\_\_\_\_

## Rate of Change

A **rate of change** is a ratio that compares the amount of change in a dependent variable to the amount of change in an independent variable.

$$\text{rate of change} = \frac{\text{change in dependent variable}}{\text{change in independent variable}}$$

The rates of change for a set of data may vary, or they may be constant.

\*\*the dependent variable is  $y$  and the independent variable is  $x$

### Identifying Constant and Variable Rates of Change in Data

Determine whether the rates of change are constant or variable.

**A**

		+1	+2	+3	+2
$x$	0	1	3	6	8
$y$	0	4	8	8	6
		+4	+4	+0	-2

Find the differences between consecutive data points.

$$\frac{4}{1} = 4 \quad \frac{4}{2} = 2 \quad \frac{0}{3} = 0 \quad \frac{-2}{2} = -1$$

Find each ratio of change in  $y$  to change in  $x$ .

The table shows nonlinear data. The rates of change are variable.

**B**

		+1	+3	+2	+1
$x$	0	1	4	6	7
$y$	1	2	5	7	8
		+1	+3	+2	+1

Find the differences between consecutive data points.

$$\frac{1}{1} = 1 \quad \frac{3}{3} = 1 \quad \frac{2}{2} = 1 \quad \frac{1}{1} = 1$$

Find each ratio of change in  $y$  to change in  $x$ .

The table shows linear data. The rates of change are constant.

## Examples

Determine whether the rates of change are constant or variable.

①

<b>x</b>	0	1	3	7	8
<b>y</b>	1	3	7	15	17

②

<b>x</b>	2	4	5	6	7
<b>y</b>	2	6	7	13	14

Determine whether the rates of change are constant or variable.

③

<b>x</b>	-1	0	3	5	9
<b>y</b>	1	3	6	10	4

④

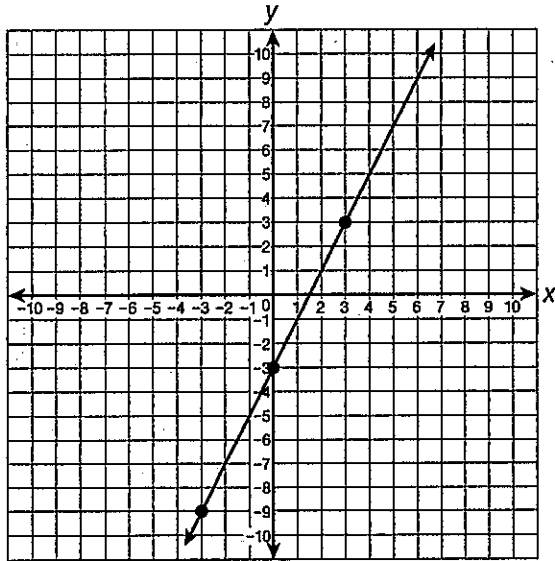
<b>x</b>	2	4	6	7	8
<b>y</b>	8	4	0	-2	-4

# Lesson 20: Linear and Nonlinear Functions

When a function is represented by a graph, a line represents a linear function and a curve represents a nonlinear function.

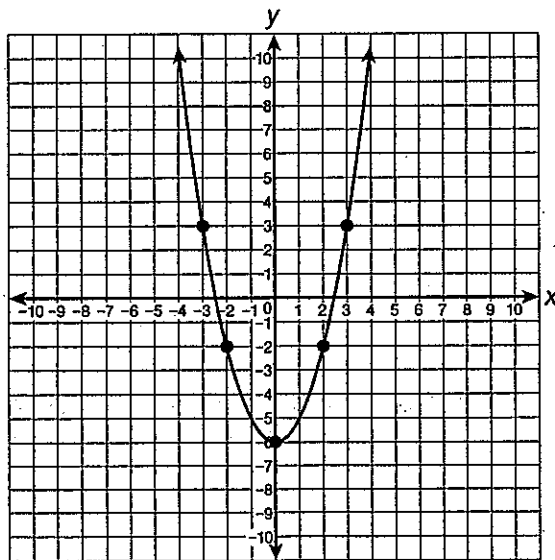
## ▶ Example

The following graph represents a linear function.



## ▶ Example

The following graph represents a nonlinear function.



A linear function has a constant rate of change. A nonlinear function does not have a constant rate of change. A table can help show whether a function is linear or nonlinear. Examine the rate of change using the ordered pairs to see if there is a constant rate of change.

### ► Example

The following table represents a function with the rate of change between rows shown on each side of the table. Is the relationship linear or nonlinear?

	x	y	
3	-6	-1	1
6	-3	0	2
9	3	2	3
12	12	5	4
	24	9	

$$\frac{1}{3} = \frac{2}{6} = \frac{3}{9} = \frac{4}{12}$$

Since the rate of change is constant, the function is linear.

### ► Example

The following table represents a function with the rate of change between rows shown on each side of the table. Is the relationship linear or nonlinear?

	x	y	
2	-1	-13	10
4	1	-3	8
3	5	5	9
1	8	14	4
	9	18	

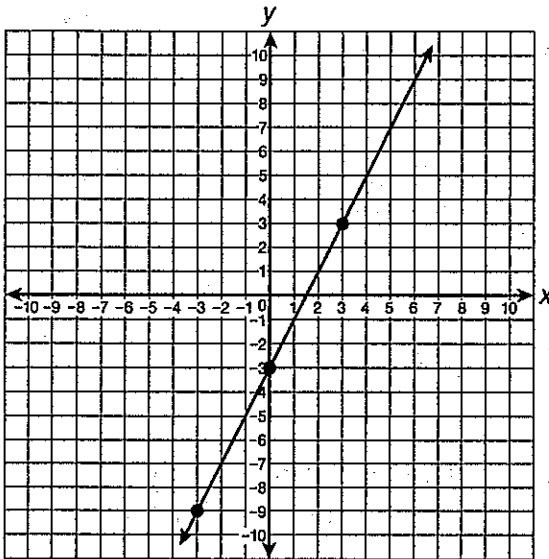
$$\frac{10}{2} \neq \frac{8}{4} \neq \frac{9}{3} \neq \frac{4}{1}$$

Since the rate of change is not constant, the function is nonlinear.

**Practice**

**Directions:** For questions 1 and 2, determine whether the given graph or table represents a linear or nonlinear function.

1.



linear or nonlinear function? \_\_\_\_\_

2.

x	y
-4	8
-2	6
0	2
2	-2
4	-4

linear or nonlinear function? \_\_\_\_\_

CCSS: 8.F.3

**Directions:** For questions 3 and 4, determine whether the given table represents a linear function. If it does, write the equation of the function in slope-intercept form.

3.

$x$	$y$
-1	1
1	1
3	3
5	5
7	7

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4.

$x$	$y$
8	-3
16	-4
24	-5
32	-6
48	-8

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5. If the following table represents a linear function, write an equation in slope-intercept form to represent the function.

$x$	$y$
3	10
-1	-2
5	16
-2	-5
0	1

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Explain how you were able to identify whether the table represents a linear or nonlinear function.

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