

3-2 Linear Functions

Vocabulary:

Linear equation in two variables:

x and y is an equation that can be written in the form $y = mx + b$ where m and b are constant

Linear Function: is a function whose graph is a nonvertical line.

Nonlinear Function: does not have a constant rate of change..graph is not a line

Discrete and Continuous Domains

A **discrete domain** is a set of input values that consists of only certain numbers in an interval.

Example: Integers from 1 to 5



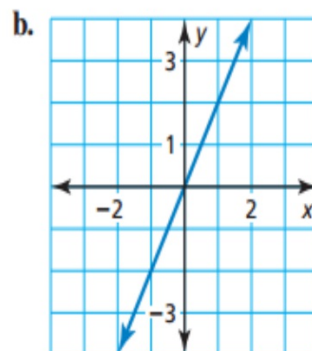
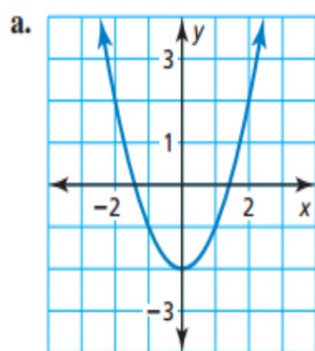
A **continuous domain** is a set of input values that consists of all numbers in an interval.

Example: All numbers from 1 to 5



EXAMPLE 1**Identifying Linear Functions Using Graphs**

Does the graph represent a *linear* or *nonlinear* function? Explain.



SOLUTION

a. The graph is *not* a line.

▶ So, the function is nonlinear.

b. The graph is a line.

▶ So, the function is linear.

EXAMPLE 2 Identifying Linear Functions Using Tables

Does the table represent a *linear* or *nonlinear* function? Explain.

a.

x	3	6	9	12
y	36	30	24	18

b.

x	1	3	5	7
y	2	9	20	35

SOLUTION

a.

x	3	6	9	12
y	36	30	24	18

As x increases by 3, y decreases by 6. The rate of change is constant.

► So, the function is linear.

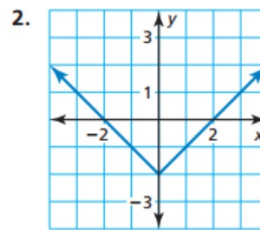
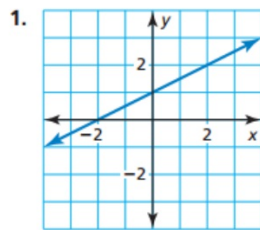
b.

x	1	3	5	7
y	2	9	20	35

As x increases by 2, y increases by different amounts. The rate of change is *not* constant.

► So, the function is nonlinear.

Does the graph or table represent a *linear* or *nonlinear* function? Explain.



3.

x	0	1	2	3
y	3	5	7	9

4.

x	1	2	3	4
y	16	8	4	2

1. linear; The graph is a line.
2. nonlinear; The graph is not a line.
3. linear; As x increases by 1, y increases by 2. The rate of change is constant.
4. nonlinear; As x increases by 1, y decreases by different amounts. The rate of change is not constant.

EXAMPLE 3 Identifying Linear Functions Using Equations

Which of the following equations represent linear functions? Explain.

$$y = 3.8, y = \sqrt{x}, y = 3^x, y = \frac{2}{x}, y = 6(x - 1), \text{ and } x^2 - y = 0$$

SOLUTION

You cannot rewrite the equations $y = \sqrt{x}$, $y = 3^x$, $y = \frac{2}{x}$, and $x^2 - y = 0$ in the form $y = mx + b$. So, these equations cannot represent linear functions.

► You can rewrite the equation $y = 3.8$ as $y = 0x + 3.8$ and the equation $y = 6(x - 1)$ as $y = 6x - 6$. So, they represent linear functions.

Does the equation represent a *linear* or *nonlinear* function? Explain.

5. $y = x + 9$

6. $y = \frac{3x}{5}$

7. $y = 5 - 2x^2$