A. Bay
Algebra 1

Name: Key
Date: _____

Linear Functions
3.2

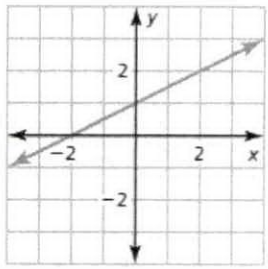
A **linear equation in two variables**, x and y, is an equation that can be written in the form $\boldsymbol{y = mx + b}$, where m and b are constants. The graph of a linear equation is a **line**. Likewise, a **linear function** is a function whose graph is a nonvertical line. A linear function has a constant rate of change and can be represented by a linear equation in two variables. A **nonlinear function** does not have a constant rate of change. So, its graph is **not a line**.

Example 1: Does the graph represent a *linear* or *nonlinear* function? Explain.

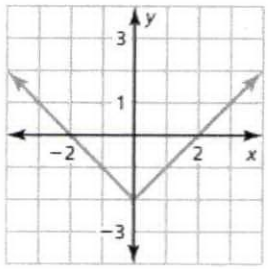
the graph is a line

Linear

a.



b.



the graph is not a line

Nonlinear

Example 2: Does the table represent a *linear* or *nonlinear* function? Explain.

has a constant rate of change

Linear

a.

x	0	1	2	3
y	3	5	7	9

+1 +1 +1

+2 +2 +2

b.

x	1	2	3	4
y	16	8	4	2

+1 +1 +1

−8 −4 −2

the rate of change is not constant

Non Linear

Example 3: Which of the following equations represents linear function? Explain.

a. $y = 3.8$ Linear
$y = 0x + 3.8$

b. $y = \sqrt{x}$ Not Linear
$y^2 = x$

c. $y = \frac{2}{x}$ Not Linear
$y = \frac{1}{x} \cdot 2$

* $y = mx + b$

d. $y = 6(x - 1)$ Linear
$y = 6x - 6$

e. $y = \frac{3x}{5}$ Linear
$y = \frac{3}{5}x + 0$

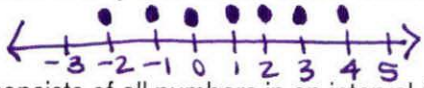
f. $y = 3^x$ Not Linear

g. $0 = x^2 - y$ Not Linear
$y = x^2$

A **solution of a linear equation in two variables** is an ordered pair (x, y) that makes the equation true. The graph of a linear equation in two variables is a set of points (x, y) in a coordinate plane that represent **all solutions** of the equation. Sometimes the points are distinct (separate, discrete), and other times the points are all connected (continuous).

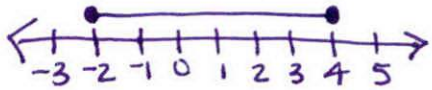
A **discrete domain** is a set of input values that consists of only certain numbers in an interval (the are separate, or distinct).

Example: The integers from -2 to 4



A **continuous domain** is a set of input values that consists of all numbers in an interval (they are connected).

Example: All numbers from -2 to 4



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Example 4: Graphing Discrete Data

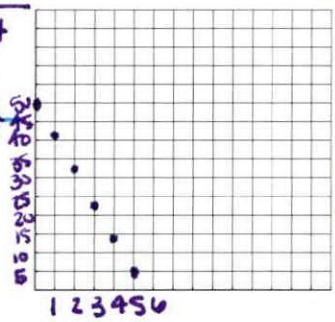
The linear function, $m = 50 - 9d$ represents the amount m (in dollars) of money you have after buying d DVDs.

(a) Find the domain of the function. Is the domain discrete or continuous? Explain.

domain: {0, 1, 2, 3, 4, 5}

d	m = 50 - 9d	m
0	50 - 9(0)	50
1	50 - 9(1)	41
2	50 - 9(2)	32
3	50 - 9(3)	23
4	50 - 9(4)	14
5	50 - 9(5)	5
6	50 - 9(6)	-4

(b) Graph the function using its domain.



discrete (cannot buy a fraction of a DVD)

(c) Find the range of the function.

Range: {5, 14, 23, 32, 41, 50}

Example 5: Graphing Continuous Data

A 20-gallon bathtub is draining at a rate of 2.5 gallons per minute. The number g of gallons remaining is a function of the number m of minutes.

(a) Does this situation represent a linear function? Explain.

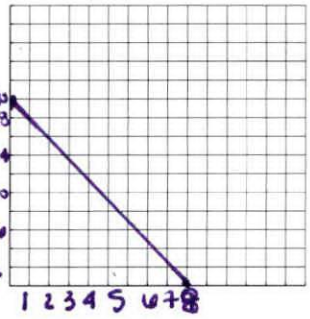
2.5 gallons per minute is a constant rate of change. Linear

(b) Find the domain of the function.

domain: {0 ≤ x ≤ 8}

m	g = 20 - 2.5m	g
0	20 - 2.5(0)	20
1	20 - 2.5(1)	17.5
2	20 - 2.5(2)	15
3	20 - 2.5(3)	12.5
4	20 - 2.5(4)	10
5	20 - 2.5(5)	7.5
6	20 - 2.5(6)	5
7	20 - 2.5(7)	2.5
8	20 - 2.5(8)	0

(c) Graph the function using its domain.



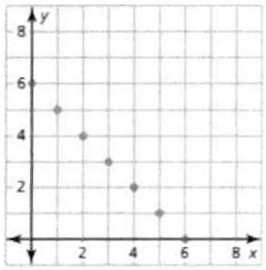
continuous (water will drain constantly until gone)

(c) Find the range of the function.

Range: {0 ≤ y ≤ 20}

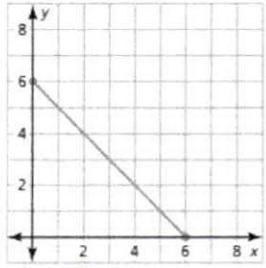
Example 6: Write a real-life problem to fit the data shown in each graph.

a.



you want to buy a ticket to feed birds at the zoo. You have $16 and it costs $1 for each bag of feed. How many times can you feed the birds?

b.



you have $16 to spend on apples at the store. Apples are $1 per pound. How many lbs of apples can you buy?

Homework: pg 103: 1, 5-25 odd, 26-30, 36, 37