Section 3.1 Functions

Relation

My Definition:

A set of ordered pairs

Characteristics:

Ordered pairs
graph
table
mapping
(See 3.2)

Example:

$\{(2,3);(4,5);(6,7)\}$

Non Example:

$\{(2,3);(4,5);7\}$

Function

My Definition: a relation that assigns exactly one unique value of the domain. (No x-value can repeat).

Characteristics:

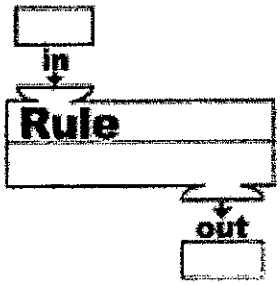
- Every function is a relation!
- All x-values are different

Example:

D R

5 → 2
6
7 → 3
8 → 4

or



$\{(5,2);(7,3);(8,4)\}$

Non Example:

$\{(1,2);(1,3);(1,4\}$

D R

1 ← 3
← 4
2 ← 5

Determine whether the relation is a function. Explain.

1. No

Input, x	-2	0	1	-2
Output, y	4	5	4	5

X-value of (-2) repeats

2.

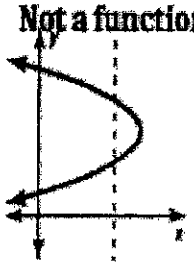
(0, 3); (1,1); (2,1); (3, 0)

yes, input does not repeat.

VERTICAL LINE TEST

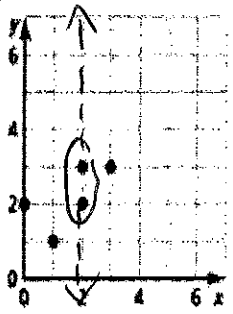
Function

Not a function



Determine whether the graph represents a function. Explain.

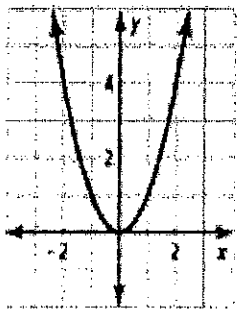
3.



Not a function

Does not pass the V-L test

4.



yes,

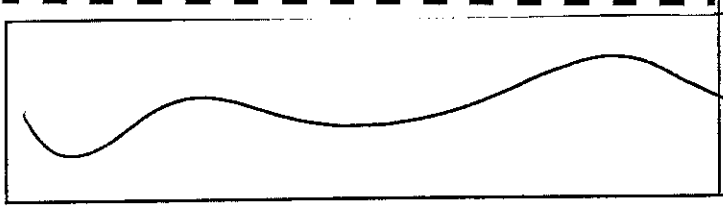
Does pass the V-L test

Independent Variable:

input

Dependent Variable:

output

Independent Variable	Dependent Variable
A. The number of people attending a potluck picnic.	A. The number of servings total of pasta salad.
B. The number of brownies made.	B. The amount of money they will make at the bake sale.
C. The number of songs performed.	C. The duration of the concert.
D. The number of people ahead of you in line	D. The length of time you will need to wait.
E. The hours spent working.	E. The total amount earned.
	

Domain: (x-values) input

Range: (y-values) out put

Determine if the relation is a function. If it is a function, state the domain and range.

5. { (-2, 2); (0, 1); (4, 2); (1, 5) }

Function: yes, all x-values unique

Domain: {-2, 0, 1, 4}

Range: {1, 2, 5}

* Do not write 2 twice

6.

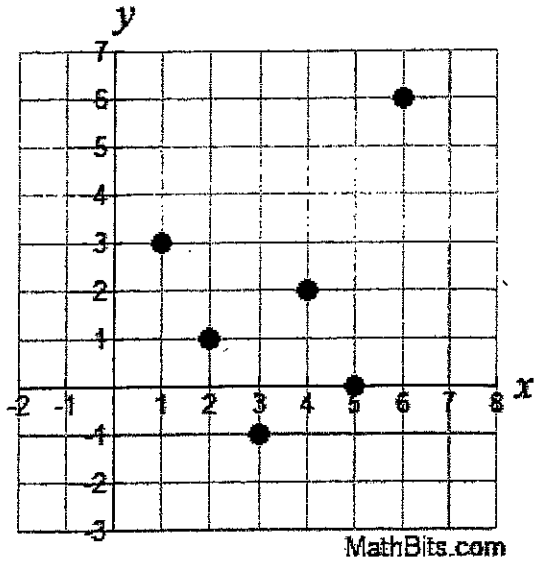
Input	1	3	3	5
Output	7	8	9	10

Function: No, x-value of 3 repeats

Domain: {1, 3, 5}

Range: {7, 8, 9, 10}

7.

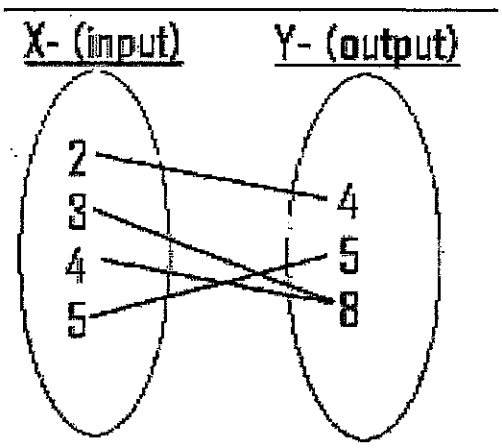


Function: yes

Domain: {-1, 0, 1, 2, 3, 6}

Range: {1, 2, 3, 4, 5, 6}

8.

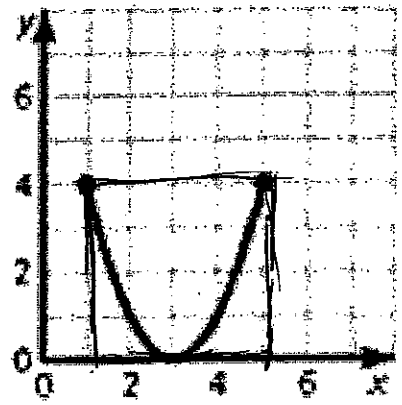


Function: yes

Domain: {2, 3, 4, 5}

Range: {4, 5, 8}

7.



Function: yes

Domain: $\{x \mid 1 \leq x \leq 5\}$

Range: $\{y \mid 0 \leq y \leq 4\}$

8. The function $y = 12x$ represents the number y of pages of text a computer printer can print in x minutes.

a. Identify the independent and dependent variables.

independent is minutes (x)
dependent is # of pages (y)

b. The domain is 1, 2, 3, and 4. What is the range?

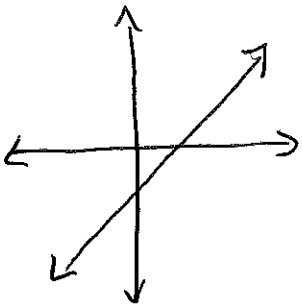
domain $\{x \mid x = 1, 2, 3, 4\}$

Range $\{y \mid y = 12, 24, 36, 48\}$

x	y = 12x	y
1	12(1)	12
2	12(2)	24
3	12(3)	36
4	12(4)	48

Section 3.2 Linear Functions

LINEAR FUNCTIONS



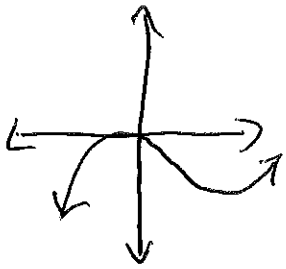
$y = 4x - 5$

$y = mx + b$

$Ax + By = C$

$y = 2$

NONLINEAR FUNCTIONS

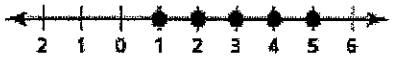


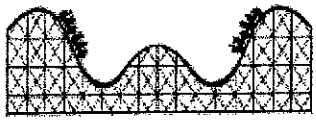
$y = \frac{5}{x} - 8$

$f(x) = 2x^2 + 7$

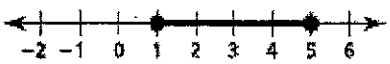
$x = 4$

Discrete



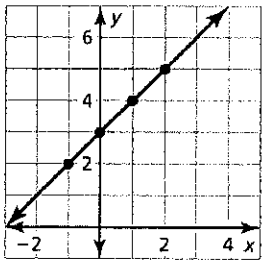


Continuous



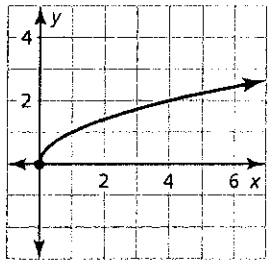
Use notes 3.2

Representing Functions:

Equation	Mapping Diagram	Graphing	Input-Output Table
$y=x+3$	Input, x: $-1, 0, 1, 2$ → Output, y: $2, 3, 4, 5$		Input, x: $-1, 0, 1, 2$ / Output, y: $2, 3, 4, 5$

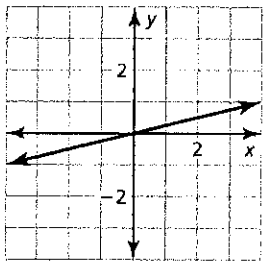
Determine whether the graph represents a *linear* or *nonlinear* function. Explain.

1.



Not linear
does not make a line

2.



linear
makes a line

Determine whether the table represents a *linear* or *nonlinear* function. Explain.

3.

x	1	2	3	4
y	-1	2	5	8

(+1, +1, +1 across x; +3, +3, +3 across y)

linear,
x goes up by same value
y increases by the same value

4.

x	-1	0	1	2
y	0	-1	0	3

(x: +1, +1, +1; y: -1, +1, +3)

x increases by 1
No common value

Not linear.

Determine whether the equation represents a *linear* or *nonlinear* function. Explain.

5. $y = 3 - 2x$

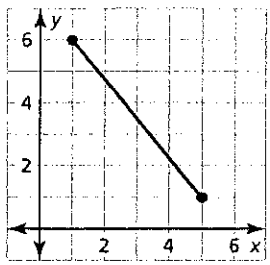
$y=-2x+3$ yes, $y=mx+b$ form

6. $y=-\sqrt{x}$

Not Linear,
$\sqrt{x}$

Find the domain of the function represented by the graph. Determine whether the domain is *discrete* or *continuous*. Explain.

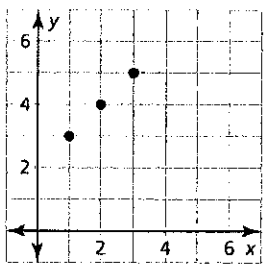
7.



Continous
Connected points

Domain $\{x \mid 1 \le x \le 5\}$
Range $\{y \mid 1 \le y \le 6\}$

8.

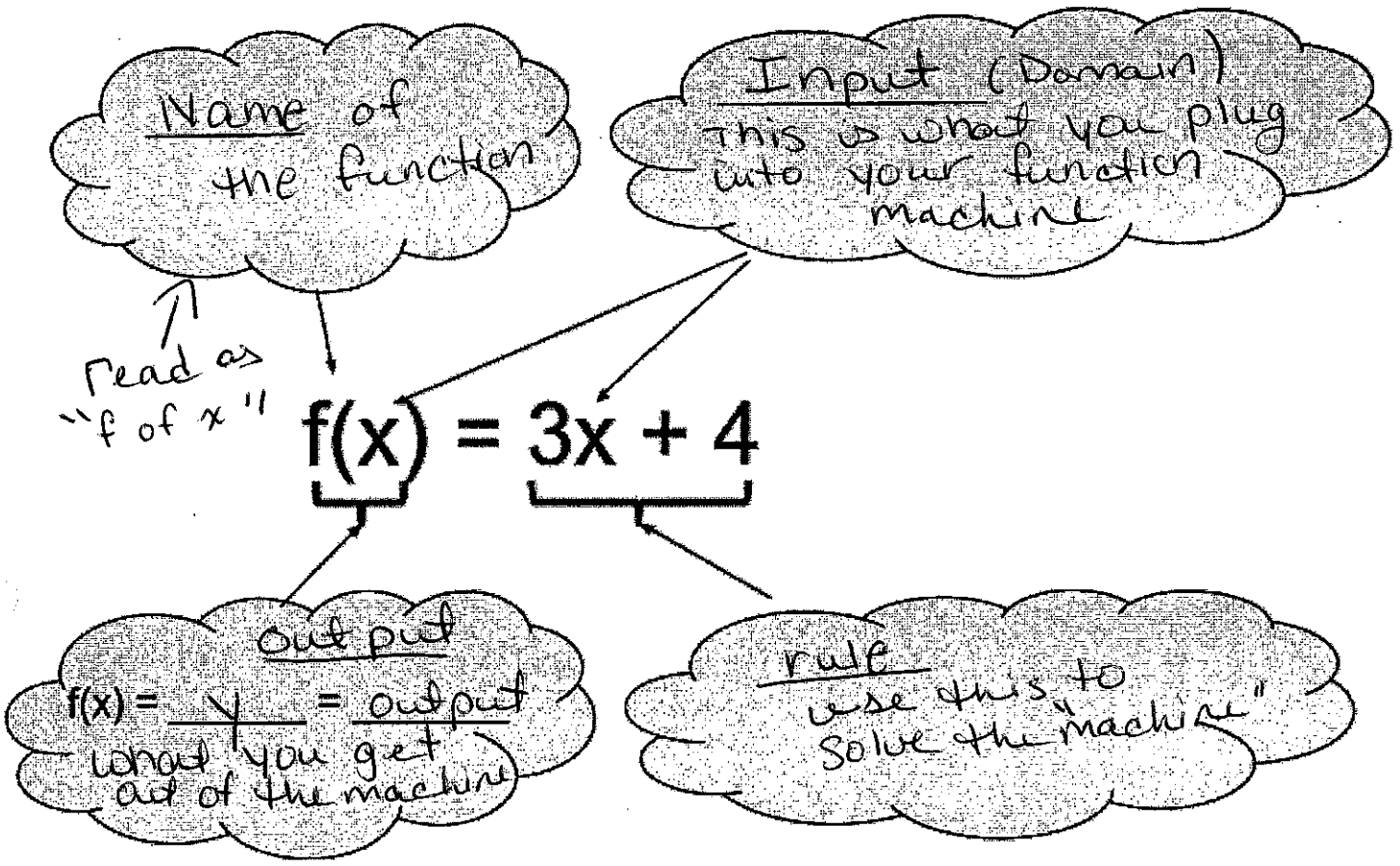


discrete
disconnected points

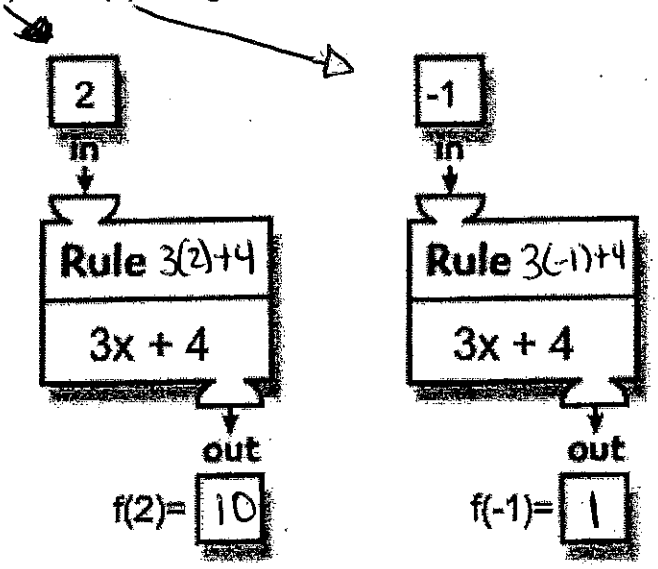
Domain $\{x \mid x = 1, 2, 3\}$
$\{y \mid y = 3, 4, 5\}$

Section 3.3 Function Notation

A function can be thought of as a Machine that assigns one output to every Input.



Find and illustrate f(2) and f(1) using the function machines below.



Evaluate the function when x = {-4, 0, 2}.

1. $f(x) = -x + 5$

a. f(-4)= -(-4) + 5 f(-4)=9

b. f(0)= -(0) + 5 f(0)=5

c. f(2)= -(2) + 5 f(2)=3

2. $g(x) = \frac{1}{2}x$

a. g(-4)= ½ (-4) g(-4)=-2

b. g(0)= ½ (0) g(0)=0

c. g(2)= ½ (2) g(2)=1

Now you try... Evaluate the function $d(e) = 15 - 6e$ **for** $e = 2$

$d(2) = 15 - 6(2)$

$d(2) = 15 - 12$

$d(2) = 3$

Find the value of x so that the function has the given value.

3. $f(x) = 4x - 3$; $f(x) = 33$

$33 = 4x - 3$

$36 = 4x$

$x = 9$

4. $b(x) = -3x + 1$; $b(x) = -20$

$-20 = -3x + 1$

$-21 = -3x$

$x = 7$

5. $m(n) = -\frac{3}{5}n - 4$; $m(n) = 2$

$2 = -\frac{3}{5}n - 4$

$(6 = -\frac{3}{5}n)5$

$30 = -3n$

$n = -10$

6. Application: Let n(t) be the number of DVDś you have in your collection after t trips to the video store. Explain the meaning of each statement. t = times (trips)

A. $n(0) = 8$ after No trips to the store I have 8 DVD's

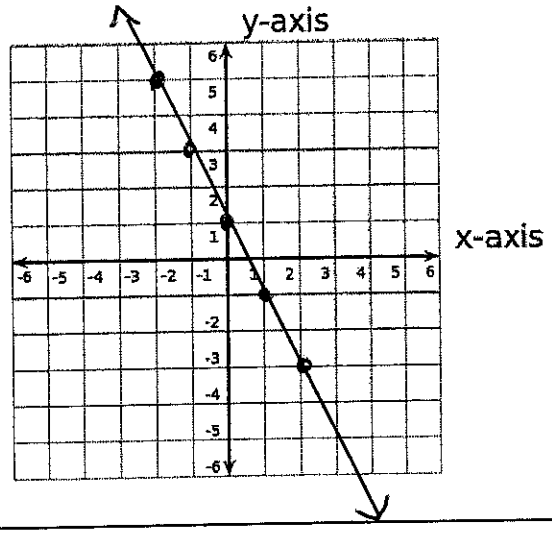
B. $n(3) = 14$ after 3 trips to the store, I have 14 DVD's

C. $n(5) > n(3)$ I have more DVD's after 5 trips than 3 trips.

Graph each function by making an input/output table of values.

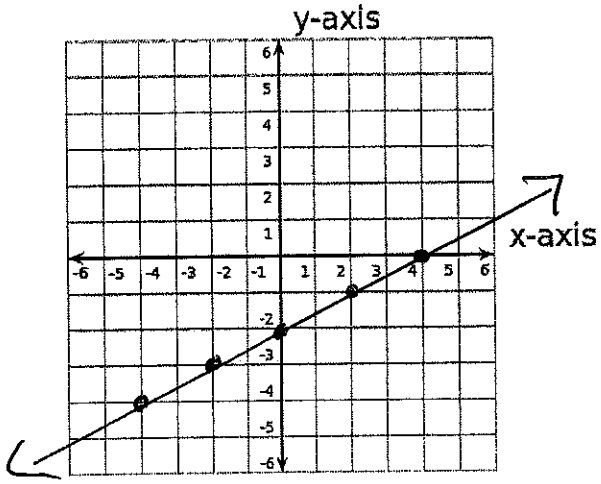
7. $r(x) = 1 - 2x$

x	1 - 2x	r(x)
-2	1 - 2(-2)	5
-1	1 - 2(-1)	3
0	1 - 2(0)	1
1	1 - 2(1)	-1
2	1 - 2(2)	-3



8. $f(x) = \frac{1}{2}x - 2$

x	½ x - 2	f(x)
-4	1/2(-4)-2	-4
-2	1/2(-2)-2	-3
0	1/2(0)-2	-2
2	1/2(2)-2	-1
4	1/2(4)-2	0



9. The function *B(m)= 50m + 150* represents the balance (in dollars) in your savings account after *m* months. The table to the right represents the balance of your friends savings account.

Month	Balance
2	$330
4	$410
6	$490

+$80 +$80

a. Explain the meaning of the function *B(m)= 50m + 150*.
You start with $150 in your account. You increase the account by $50 each month.

b. Evaluate B(m)= 50m + 150 for the domain m = 2, 4, 6
B(2) = 50(2) + 150
B(2) = $250
B(4) = 50(4) + 150
B(4) = $350
B(6) = 50(6) + 150
B(6) = $450

c. Who has the better savings plan? You or your friend? Explain.
my friend is saving more per month

d. How long will it take you to have $800 in your account? What does the $800 represent?
800 = 50m + 150
650 = 50m
650/50 = 50m/50
m = 13 months

Section 3.4 Graphing Linear Equations in Standard Form

STANDARD FORM

$$Ax + By = C$$

X-INTERCEPT

- Where your graph crosses the x-axis

$(x, 0)$

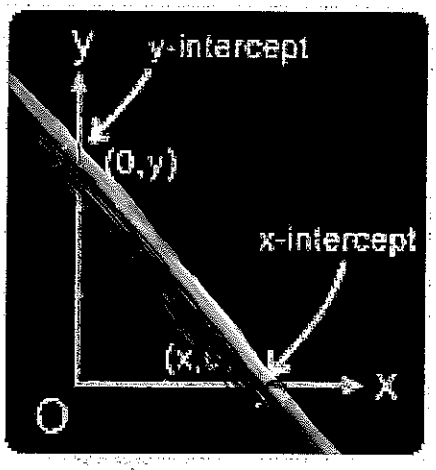
To find the x-intercept:
1) replace $y = 0$
2) Solve for x
3) rewrite $(x, 0)$

Y-INTERCEPT

- Where your graph crosses the y-axis

$(0, y)$

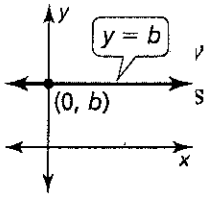
To find the y-intercept
1) replace $x = 0$
2) Solve y
3) rewrite $(0, y)$



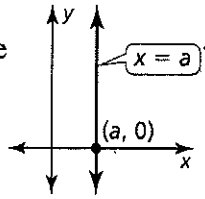
Steps to graphing a linear equation in standard form.

1. find x-int $(x, 0)$
2. find y-int $(0, y)$
3. Plot both points & draw line

Horizontal and Vertical Lines



$y = b$ is a horizontal line. The graph passes through the point $(0, b)$.

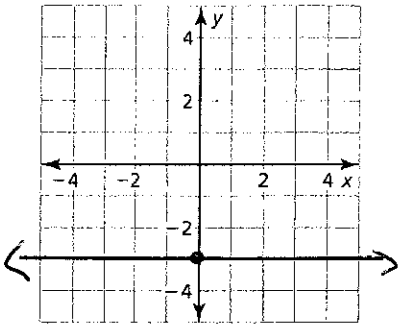


$x = a$ is a vertical line. The graph passes through the point $(a, 0)$.

HOY VUX

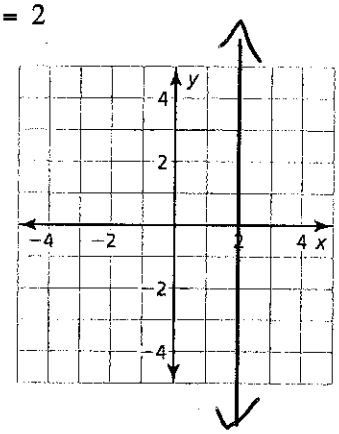
Graph the linear equation.

1. $y = -3$



x	y
−1	−3
0	−3
1	−3

2. $x = 2$



x	y
2	−1
2	0
2	1

Find the x- and y-intercepts of the graph of the linear equation.

3. $3x + 4y = 12$

$y=0$ $\quad 3x = 12$

x-int: $(4, 0)$ $\quad x = 4$

$x=0$ $\quad 4y = 12$

y-int: $(0, 3)$ $\quad y = 3$

4. $5x - 2y = -30$

$y=0$ $\quad 5x = -30$

x-int: $(-6, 0)$ $\quad x = -6$

$x=0$ $\quad -2y = -30$

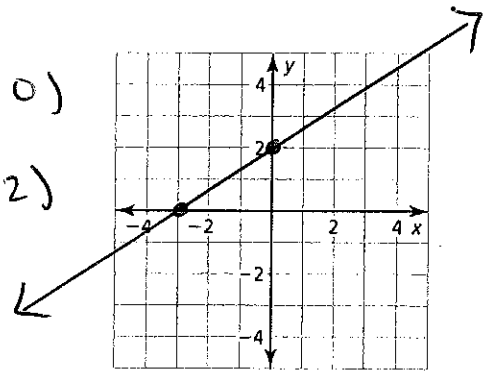
y-int: $(0, 15)$ $\quad y = 15$

Use intercepts to graph the linear equation. Label the points corresponding to the intercepts.

6. $-8x + 12y = 24$

x-int $(-3, 0)$

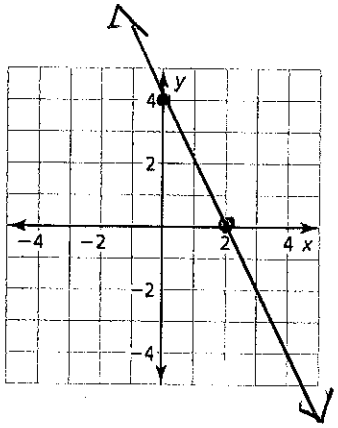
y-int $(0, 2)$



7. $2x + y = 4$

x-int $(2, 0)$

y-int $(0, 4)$



8. The school band is selling sweatshirts and baseball caps to raise \$9000 to attend a band competition. Sweatshirts cost \$25 each and baseball caps cost \$10 each. The equation $25x + 10y = 9000$ models this situation, where x is the number of sweatshirts sold and y is the number of baseball caps sold.

a. Find and interpret the intercepts. $y=0$ $25x=9000$

$x = 360$ sweatshirts

If No sweatshirts are sold, you must sell 900 baseball caps.

If No caps are sold, you must sell 360 sweatshirts $x=0$ $10y=9000$

$y = 900$ caps

b. ~~If 258 sweatshirts are sold,~~ how many baseball caps are sold?

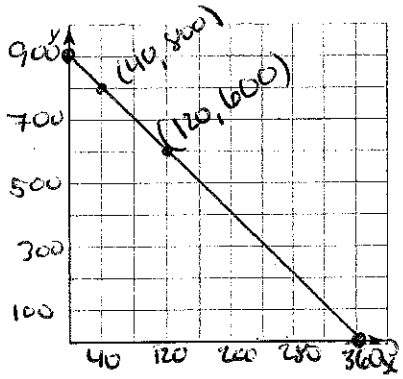
$25(258) + 10y = 9000$

$6450 + 10y = 9000$

$10y = 2550$

$y = 255$ caps → (258, 255)

c. Graph the equation. Find two more possible solutions in the context of the problem.



$25(40) + 10y = 9000$

$10y = 8000$

$y = 800$ (40, 800)

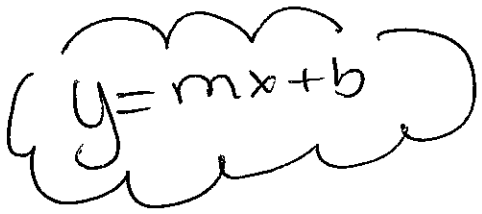
$25(120) + 10y = 9000$

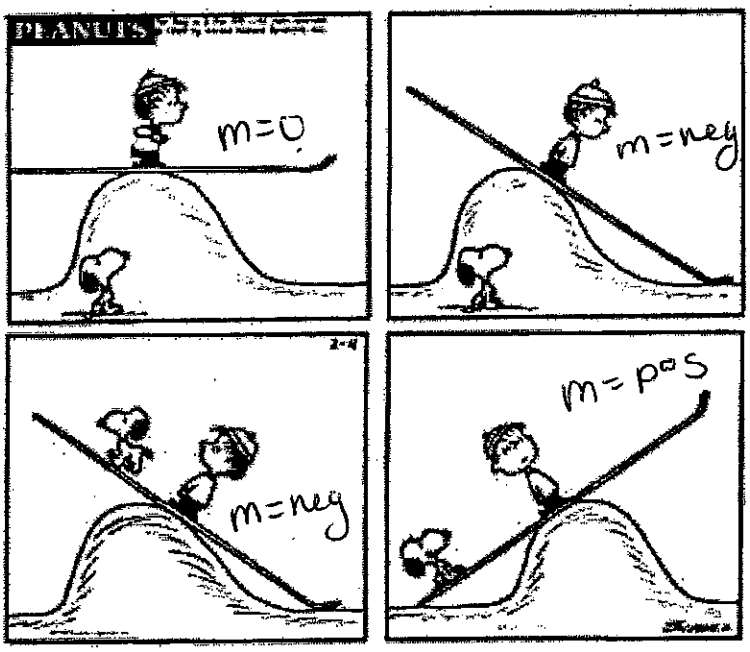
$10y = 6000$

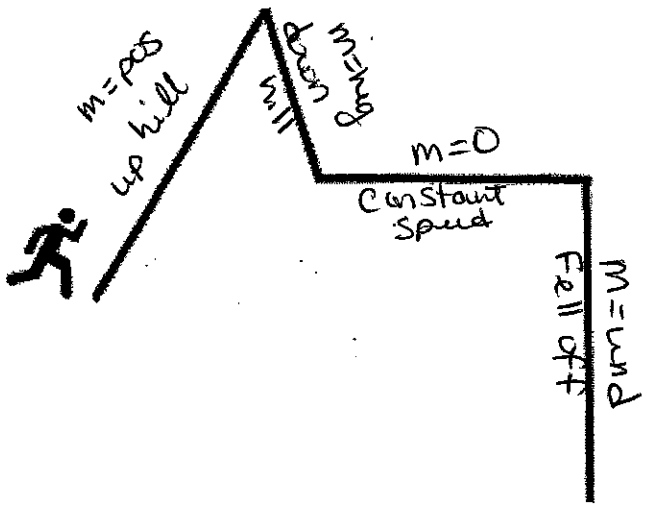
$y = 600$ (120, 600)

Section 3.5 Graphing Linear Equations in Slope-Intercept Form

Slope-intercept			EXAMPLE
y=	m	x + b	





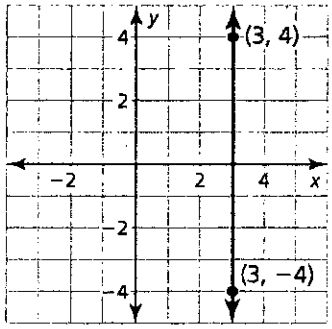


$\frac{0}{k}$ = 0k m=0

$\frac{k}{0}$ = undefined m=undefined

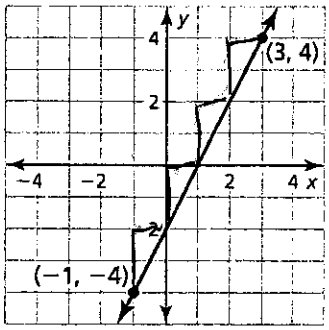
Describe the slope of the line. Then find the slope.

1.



m = und

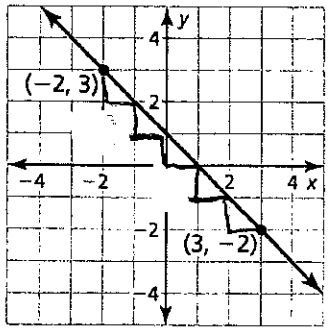
2.



$\frac{4-(-4)}{3-(-1)} = \frac{8}{4}$ m=2

$\frac{\Delta y}{\Delta x}$

3.



$\frac{3-(-2)}{-2-3} = \frac{5}{-5}$

m = −1

The points represented by the table lie on a line. Find the slope of the line.

4.

	+1	+1	+1	
x	1	2	3	4
y	−2	−2	−2	−2
	+0	+0	+0	

$\frac{\Delta y}{\Delta x} = \frac{0}{1}$

m=0

5.

	+2	+2	+2	
x	−3	−1	1	3
y	11	3	−5	−13
	−8	−8	−8	

$\frac{\Delta y}{\Delta x} = \frac{-8}{2}$

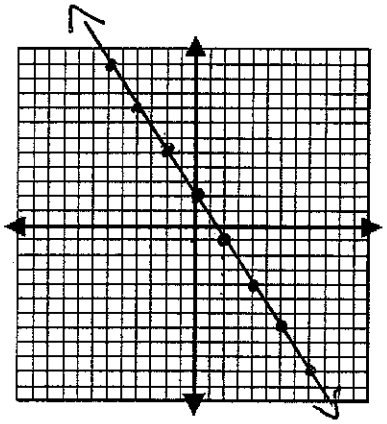
m=−4

Find the slope and the *y*-intercept of the graph of the linear equation.

6. $y = -\frac{3}{2}x + 2$

$m = -\frac{3}{2}$

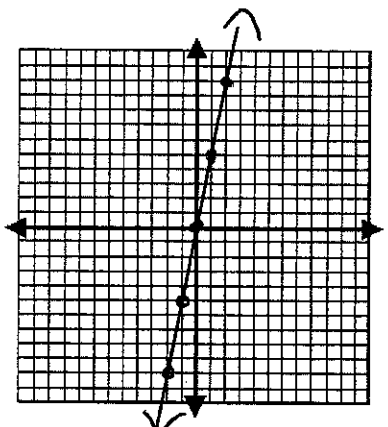
b=(0,2)



7. y = 5x

m=5

b=(0,0)



8. $6x + 4y = 24$

$-6x \quad -6x$

Solve for y

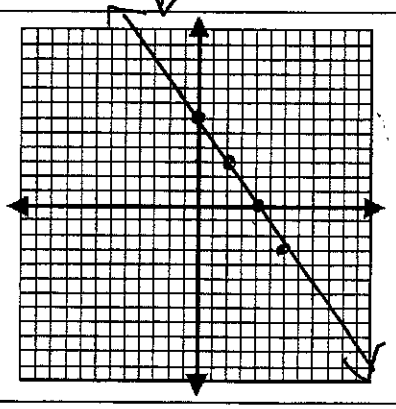
$\frac{4y = -6x + 24}{4}$

$y = -\frac{6}{4}x + \frac{24}{4}$

$y = -\frac{3}{2}x + 6$

$m = -\frac{3}{2}$

b=(0,6)



9. A linear function f models a relationship in which the dependent variable decreases 6 units for every 3 units the independent variable decreases. The value of the function at 0 is 4. Graph the function. Identify the slope, y-intercept, and x-intercept of the graph.

$x \to -6$ left 6

$y \to -6$ down 6

$b = (0, 4)$

$m = \frac{-6}{-6}$ $m = 1$