4.2 Graph Linear Equations

Goal • Graph linear equations in a coordinate plane.

Your Notes

Ex.
$4x + 2y = 12$

(2,2) (-2,9) (0,6)

$4(2) + 2(2) \stackrel{?}{=} 12$

$8 + 4 \stackrel{?}{=} 12$

$12 = 12$ ✓

(2,2) is a solution

$4(-2) + 2(9) \stackrel{?}{=} 12$

$-8 + 18 \stackrel{?}{=} 12$

$10 = 12$ F

(-2,9) is not a solution

$4(0) + 2(6) \stackrel{?}{=} 12$

$12 = 12$ ✓

(0,6) is a solution

VOCABULARY

Solution of an equation in two variables – an ordered pair (x,y) that produces a true statement.

Graph of an equation in two variables
– a picture of the solution set

Linear equation – an equation whose graph is a line

Standard form of a linear equation
$Ax + By = C$ $-6x - 4y = 10$
try to keep A, B + C integers

Linear function – all linear equations except equations of vertical lines

Example 1 ***Graph an equation*** D: $-\infty < x < \infty$

Graph the equation $x + y = 4$. D: all real numbers
A = 1 B = 1 C = 4 D: $\mathbb{R}$

Solution

Step 1 Solve the equation for y. "get y alone"

$x + y = 4$
$-x \quad -x$
$y = 4 - x$

Step 2 Make a table. For hw – choose 3 easy x's. negative x, 0, positive x

Choose a few values for x and find the values for y.

x	−2	−1	0	1	2
y	6	5	4	3	2

$y = 4 - (-2)$
$y = 4 + 2 = 6$
$y = 4 + (+1) = 5$

Use convenient values for x when making a table. These should include a combination of negative values, zero, and positive values.

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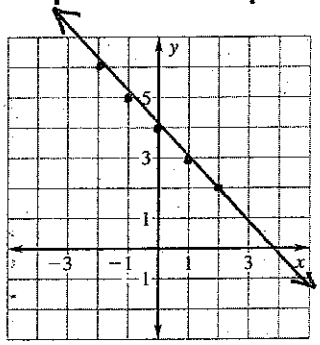
Your Notes

Step 3 **Plot** the points.



Step 4 **Connect** the points by drawing a line through them. Use arrows to indicate that the graph goes on without end.

Example 2 ***Graph y = b and x = a***

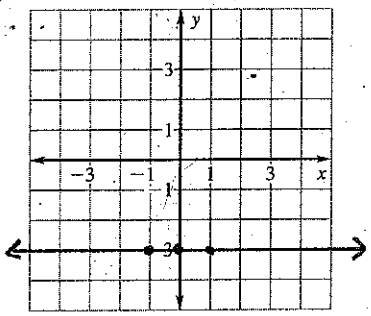
Graph (a) $y = -3$ and (b) $x = 2$.

a) $0x + 1y = -3$

b) $1x + 0y = 2$

Solution

a. Regardless of the value of x, the value of y is always -3. The graph of $y = -3$ is a horizontal line 3 units below the x-axis.



x	y
−1	−3
0	−3
1	−3

The equations $y = -3$ and $0x + 1y = -3$ are equivalent. For any value of x, the ordered pair $(x, -3)$ is a solution of $y = -3$.

Horizontal

0

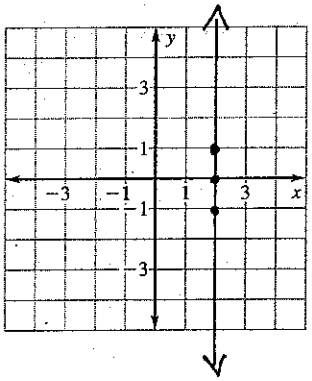
Y = #

↕ Vertical

U

X = #

b. Regardless of the value of y, the value of x is always 2. The graph of $x = 2$ is a vertical line 2 units to the right of the y-axis.



b)

x	y
2	−1
2	0
2	1

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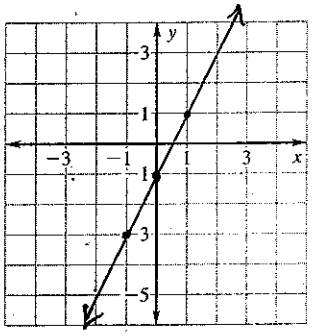
Your Notes

Checkpoint Graph the equation.

1. $y = 2x - 1$

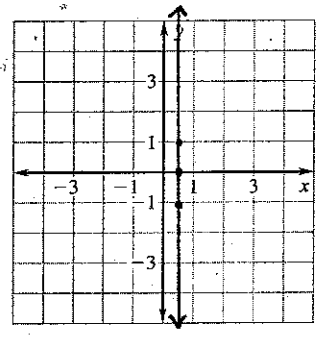


x	y
-1	-3
0	-1
1	1

$y = 2(-1) - 1$
$y = -2 - 1$
$y = -3$

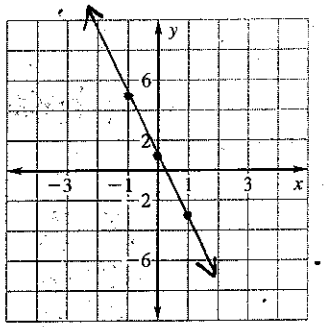
$0 - 1 = -1$

2. $x = 0.5$ vertical



x	y
.5	-1
.5	0
.5	1

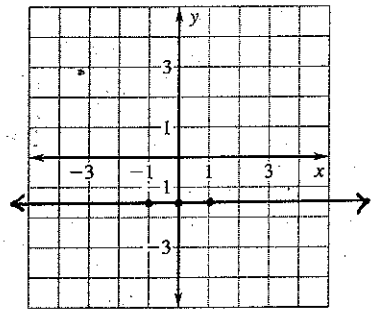
3. $y = -4x + 1$



x	y
-1	5
0	1
1	-3

$y = -4(-1) + 1$
$y = 4 + 1$
$= 5$

4. $y = -1.5$ horiz. line



x	y
-1	-1.5
0	-1.5
1	-1.5

EQUATIONS OF HORIZONTAL AND VERTICAL LINES

1. The graph of $y = b$ is a horizontal line.
2. The line of graph $y = b$ passes through the point $(0, b)$.
3. The graph of $x = a$ is a vertical line.
4. The line of graph $x = a$ passes through the point $(a, 0)$.

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Your Notes

Example 3 Graph a linear function

Graph the function $y = 2x + 2$ with domain $x \geq 0$. Then identify the range of the function.

restricted domain

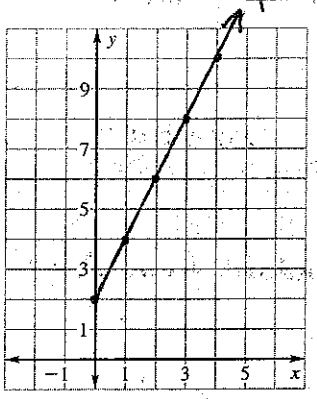
Solution

Step 1 Make a x/y table

x	0	1	2	3	4
y	2	4	6	8	10

$y = 2(0) + 2$
$y = 0 + 2 = 2$
$y = 2(1) + 2$
$y = 2 + 2 = 4$
$y = 2(2) + 2$
$y = 4 + 2 = 6$

Step 2 Plot the points.



Step 3 Connect the points with a ray because the domain is restricted.

Step 4 Identify the range. From the graph, you can see that all points have a y-coordinate of 2 or more, so the range of the function is $y \geq 2$.

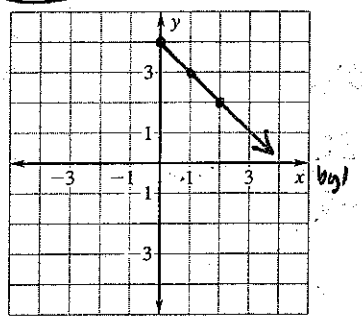
Domain: the set of allowable inputs

1. Discrete (Restricted)
   D = list of #'s
   Graph = points
   → lift pencil to draw

2. Continuous
   → don't lift pencil to draw
   a) Restricted type
   D: $x \leq, \geq, >, <$
   Graph = ray / segment
   b) Not restricted
   D: $\mathbb{R}$, $-\infty < x < \infty$ (won't see anything sometimes)
   Graph = line

Checkpoint **Complete the following exercise.**

5. Graph the function $y = -x + 4$ with domain $x \geq 0$. Then identify the range of the function.



x	y
0	4
1	3
2	2

$y = -0 + 4$
$y = 4$
$y = -(1) + 4$
$y = 3$
$y = -(2) + 4$
$y = 2$

$R: \{y \leq 4\}$

Homework

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