4.2 Graph Linear Equations

Goal • Graph linear equations in a coordinate plane.

Your Notes

VOCABULARY

Solution of an equation in two variables is an ordered pair (x, y)

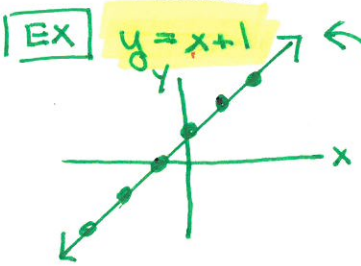
① Solutions are all the points (x, y) ON A LINE.

② CHECK ALGEBRAICALLY

* IF (x, y) CHECKS IN THE GIVEN EQUATION THEN IT IS A SOLUTION.

Linear equation – an EQUATION whose GRAPH is a LINE. (see below)

EX $y = x + 1$



Linear Functions have in 3 forms of Equations:

m = slope

1) SLOPE-INTERCEPT FORM (S/I) $y = mx + b$ b = y-intercept
2) STANDARD FORM : $Ax + By = C$ where A, B, C are integers.
3) POINT-SLOPE FORM (P/S)

$y - y_1 = m(x - x_1)$ where m = slope, point (x_1, y_1)

FUNCTION FORM : replace "y" with "f(x)"

$$f(x) = mx + b$$

Check solution to the EQUATION: $y = x + 1$

(a) POINT $(5, 6)$ (x y)

$y = x + 1$
$6 = 5 + 1$
$6 = 6$ ✓ Solution

(b) POINT $(10, 9)$

$y = x + 1$
$9 = 10 + 1$
$9 \neq 11$ NOT A SOLUTION

Example 1 *Graph an equation*

Graph the equation $x + y = 4$.

Solution

Step 1 Solve the equation for y; AND WRITE IN FUNCTION FORM.

$x + y = 4$

$-x \quad -x$

$y = -x + 4$ — S/I form

$f(x) = -x + 4$ ← FUNCTION FORM

FUNCTION FORM
- ISOLATE Y
- $f(x) = mx + b$

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

Step 2 **Make** a table.

Choose 3 values for x and find the values for y.

→ Pick easy values of x typically $x = -1, 0, 1$

Mentally

$-(-1) + 4$

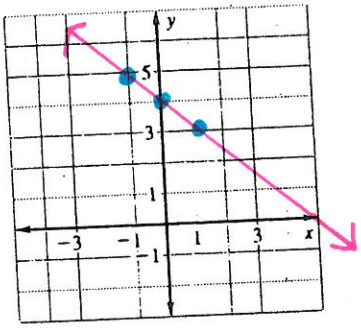
$-(0) + 4$

$-(1) + 4$

x	y
−1	5
0	4
1	3

x	−1	0	1
y	5	4	3

Step 3 **Plot** the points.



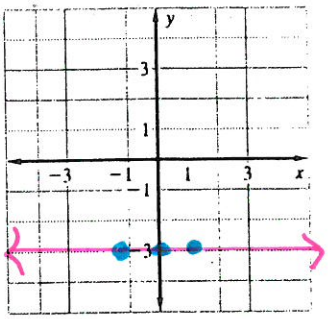
Step 4 **Connect** the points by drawing a line through them. Use arrows to indicate that the graph goes on without end.

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

Graph (a) $y = -3$ → function notation → $f(x) = -3$

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

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



FUNCTION because:
① No repeating x values
② passes Vertical line Test b/c a V Line hits the graph one time.

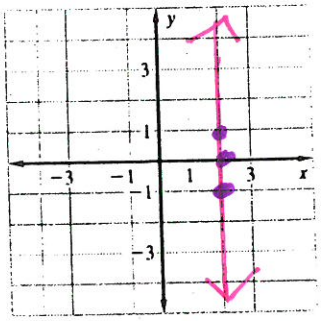
(a) Regardless of the value of x, the value of y is always -3. The graph of $y = -3$ is a HORIZONTAL line 3 units below the x-axis.

Graph (b) $x = 2$

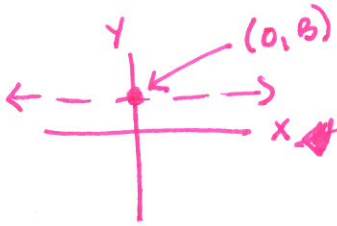
Cannot write in function form!

NOT A FUNCTION
① HAS REPEATING X VALUES
② FAILS VERTICAL LINE TEST

x	y
2	-1
2	0
2	1

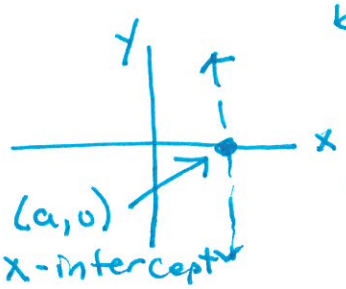


(b) Regardless of the value of y, the value of x is always 2. The graph of $x = 2$ is a VERTICAL line 2 units to the right of the y-axis.



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 $(a, 0)$.



Example 3 *Graph an equation*

Graph the equation

Solution

Step 1 Solve the equation for y. AND WRITE IN FUNCTION FORM.

$2x + 3y = 6$ ← ISOLATE y

$-2x \quad -2x$

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

$y = -\frac{2}{3}x + 2$ — SLI form → $f(x) = -\frac{2}{3}x + 2$ — function form

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

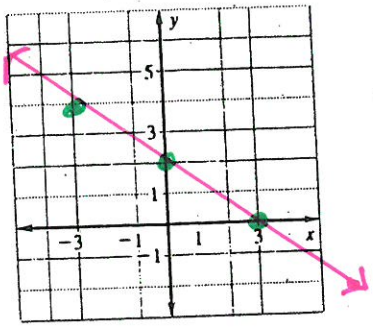
Step 2 Make a table.

Choose 3 EASY values for x and find the values for y.

When the slope is a fraction, use multiples of the denominator.

x	y	mental work
-3	4	$-\frac{2}{3}(-3) + 2$
0	2	$-\frac{2}{3}(0) + 2$
3	0	$-\frac{2}{3}(3) + 2$

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.