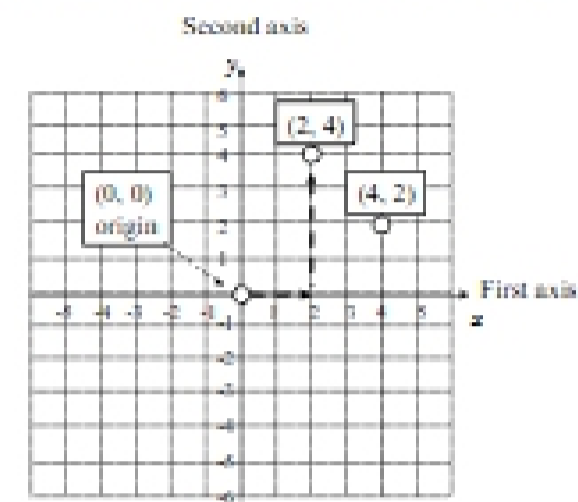


2.1 Graphs

- Points and Ordered Pairs
- Quadrants
- Solutions of Equations
- Nonlinear Equations

Points and Ordered Pairs

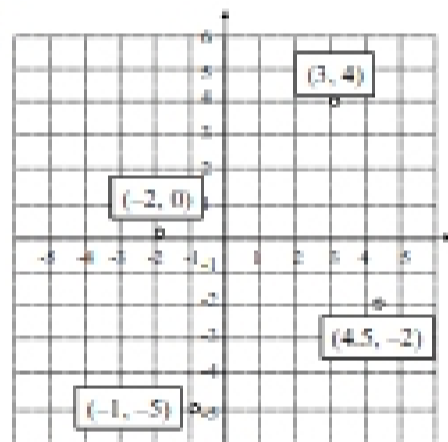
Label points (x, y) . Order is important.



Example

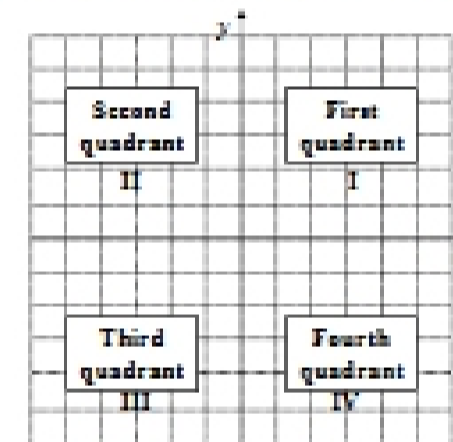
Plot the points $(3, 4)$, $(-2, 0)$, $(4.5, -2)$ and $(-1, -5)$.

Solution



Quadrants

The axes divide the plane into four regions called **quadrants**, as shown below.



Which quadrant?

- $(-2, 4)$
- $(5, 2)$
- $(-6, -1)$
- $(-2, 10)$
- $(0, 4)$
- $(-2, 0)$

Solutions of Equations

If an equation has two variables, its solutions are pairs of numbers. When such a solution is written as an ordered pair, the first number listed in the pair generally replaces the variable that occurs first alphabetically.

Example

Determine whether $(2, 5)$ and $(-2, 1)$ are solutions to $y = 2x + 1$.

Solution

$$\begin{array}{r} y = 2x + 1 \\ 5 \quad | \quad 2(2) + 1 \\ \quad \quad | \quad 4 + 1 \end{array}$$

$5 = 5$
True, so $(2, 5)$ is a solution.

$$\begin{array}{r} y = 2x + 1 \\ 1 \quad | \quad 2(-2) + 1 \\ \quad \quad | \quad -4 + 1 \end{array}$$

$1 = -3$
False, so $(-2, 1)$ is not a solution.

Solutions?

Are the following ordered pairs solutions of the equation $2x + 3y = 6$?

a) $(2, \frac{2}{3})$

$$2(2) + 3\left(\frac{2}{3}\right) \stackrel{?}{=} 6$$

$$4 + 2 \stackrel{?}{=} 6$$

$$6 = 6 \quad \text{Yes}$$

b) $(-3, 1)$

$$2(-3) + 3(1) \stackrel{?}{=} 6$$

$$-6 + 3 \stackrel{?}{=} 6$$

$$-3 \neq 6 \quad \text{No}$$

c) $(0, 2)$

$$2(0) + 3(2) \stackrel{?}{=} 6$$

$$0 + 6 \stackrel{?}{=} 6$$

$$6 = 6 \quad \text{Yes}$$

Solutions?

Are the following solutions of $n = \frac{3}{2}m + 2$?

a) $(-\frac{4}{3}, 0)$

$$0 \stackrel{?}{=} \frac{3}{2}\left(-\frac{4}{3}\right) + 2$$

$$0 \stackrel{?}{=} -2 + 2$$

$$0 = 0 \quad \text{Yes}$$

b) $(\frac{1}{2}, \frac{5}{2})$

$$\frac{5}{2} \stackrel{?}{=} \frac{3}{2}\left(\frac{1}{2}\right) + 2$$

$$\frac{5}{2} \stackrel{?}{=} \frac{3}{4} + 2$$

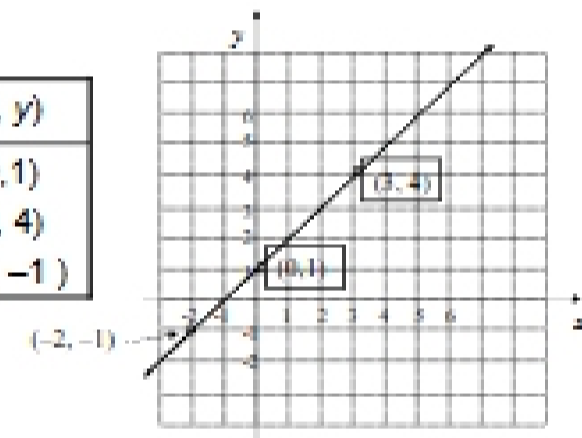
$$\frac{5}{2} \neq \frac{11}{4} \quad \text{No}$$

Example

Graph the equation $y = x + 1$.

Solution

x	y	(x, y)
0	1	(0, 1)
3	4	(3, 4)
-2	-1	(-2, -1)

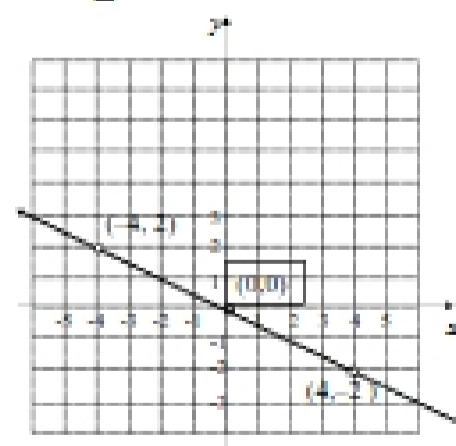


Example

Graph the equation $y = -\frac{1}{2}x$.

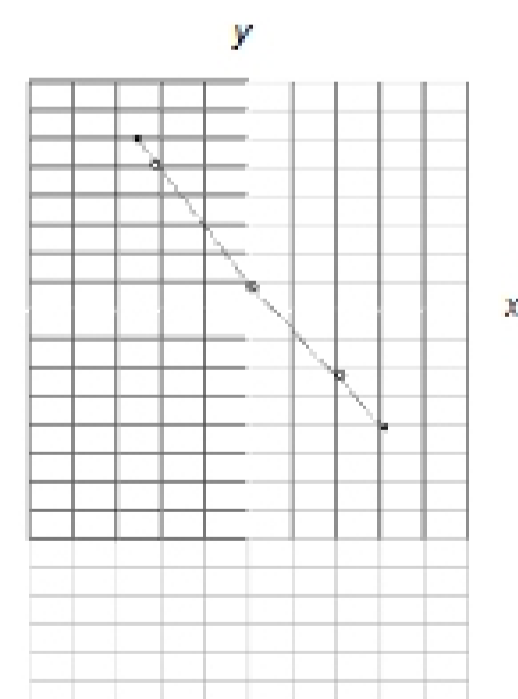
Solution

x	y	(x, y)
0	0	(0, 0)
-4	2	(-4, 2)
4	-2	(4, -2)



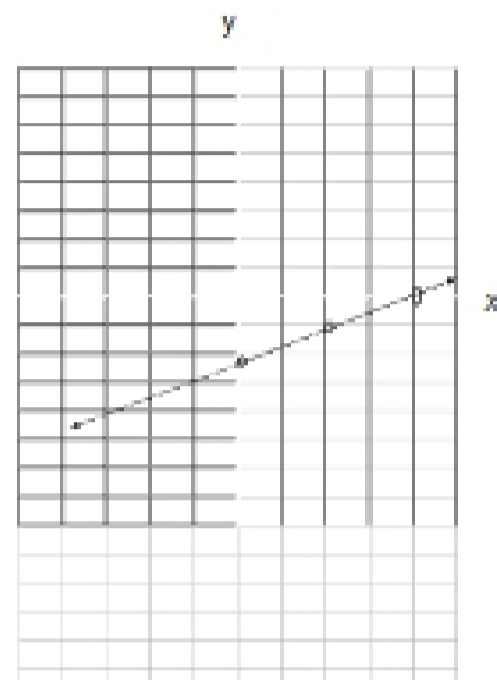
$$y = -\frac{3}{2}x + 1$$

x	y
0	1
2	-2
-2	4
4	-5



$$3x - 5y = 12$$

x	y
0	-12/5
4	0
2	-6/5



Nonlinear Equations

We refer to any equation whose graph is a straight line as a **linear equation**.

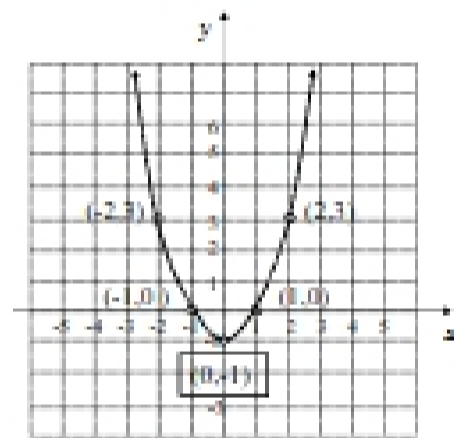
There are many equations for which the graph is not a straight line. Graphing these **nonlinear equations** often requires plotting many points to see the general shape of the graph.

Example

Graph the equation $y = x^2 - 1$.

Solution

x	y	(x, y)
0	-1	(0, -1)
1	0	(1, 0)
-1	0	(-1, 0)
2	3	(2, 3)
-2	3	(-2, 3)

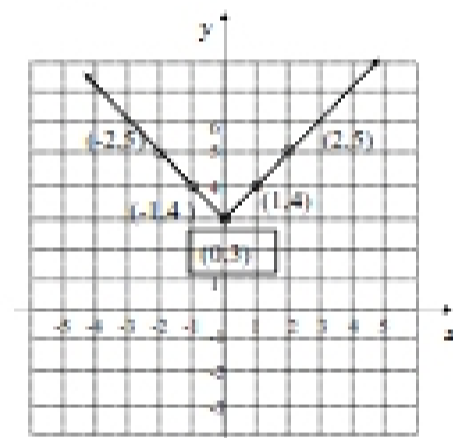


Example

Graph the equation $y = |x| + 3$.

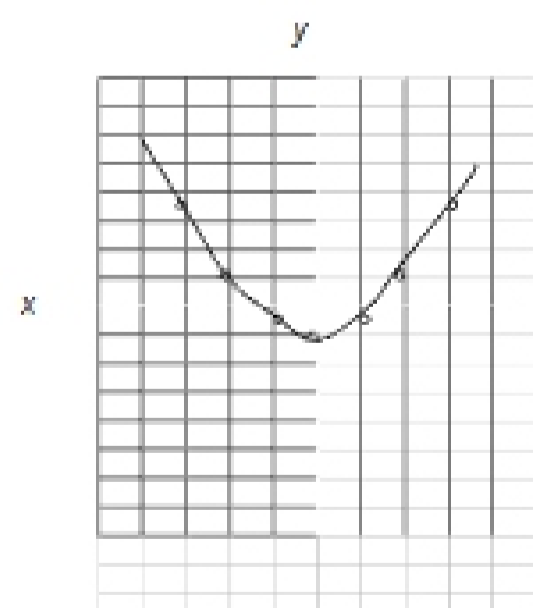
Solution

x	y	(x, y)
0	3	(0, 3)
1	4	(1, 4)
-1	4	(-1, 4)
2	5	(2, 5)
-2	5	(-2, 5)



$$y = \frac{1}{2}x^2 - 1$$

x	y
0	-1
1	-1/2
-1	-1/2
2	1
-2	1
3	7/2



$$y = |x - 1|$$

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

