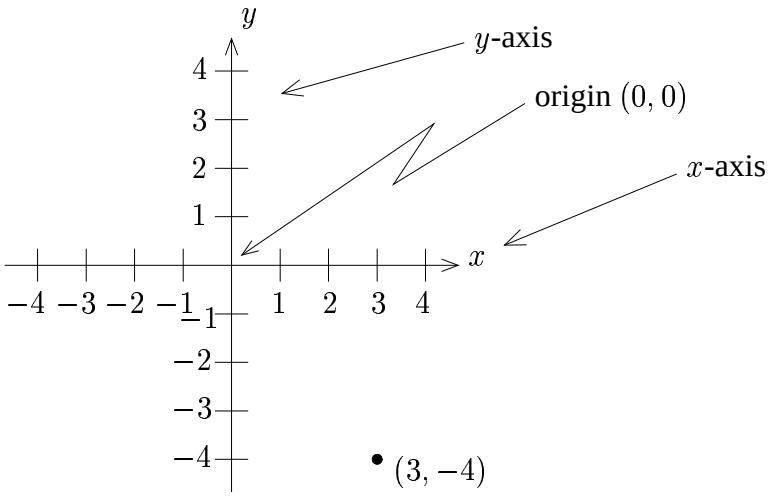
3.1 Introduction to Lines

A. Rectangular (Cartesian) Coordinate System



Points are identified by coordinate pairs: (,)

direction in x direction in y

B. Lines/Point Plotting

1. A **line** is represented by an equation containing x and y to only first degree powers.

2. **To draw a line:**

   a. "Randomly" pick values for x.
   b. Plug them in and determine y.
   c. Plot points (x, y) and connect.

Example: Graph $2x + 3y = 6$

Solution

We pick a bunch of x-values and figure out the y-values.

Good numbers to use: -3,-2,-1,0,1,2,3

Work:

$$x = -3 \implies 2(-3) + 3y = 6 \implies -6 + 3y = 6 \implies 3y = 12 \implies y = 4$$

$$x = -2 \implies 2(-2) + 3y = 6 \implies -4 + 3y = 6 \implies 3y = 10 \implies y = \frac{10}{3}$$

$$x = -1 \implies 2(-1) + 3y = 6 \implies -2 + 3y = 6 \implies 3y = 8 \implies y = \frac{8}{3}$$

$$x = 0 \implies 2(0) + 3y = 6 \implies 0 + 3y = 6 \implies 3y = 6 \implies y = 2$$

$$x = 1 \implies 2(1) + 3y = 6 \implies 2 + 3y = 6 \implies 3y = 4 \implies y = \frac{4}{3}$$

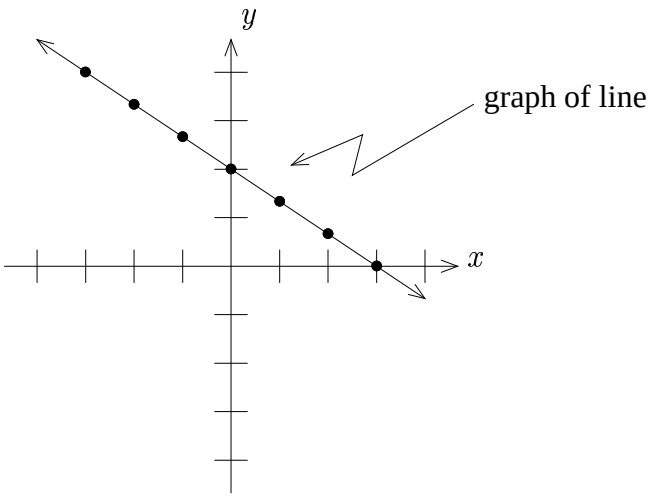
$$x = 2 \implies 2(2) + 3y = 6 \implies 4 + 3y = 6 \implies 3y = 2 \implies y = \frac{2}{3}$$

$$x = 3 \implies 2(3) + 3y = 6 \implies 6 + 3y = 6 \implies 3y = 0 \implies y = 0$$

Points:

$$(-3, 4), \left(-2, \frac{10}{3}\right), \left(-1, \frac{8}{3}\right), (0, 2), \left(1, \frac{4}{3}\right), \left(2, \frac{2}{3}\right), (3, 0)$$

Graph:



C. Intercepts

It is oftentimes faster and better to find where the line crosses the x and y axes.

These are called **intercepts**.

Sometimes finding the x and y intercepts is all that is necessary to graph a line!

1. **To find the x-intercept:** set $y = 0$ (and solve for x)

2. **To find the y-intercept:** set $x = 0$ (and solve for y)

Example: As above, consider $2x + 3y = 6$ and find the intercepts.

Solution

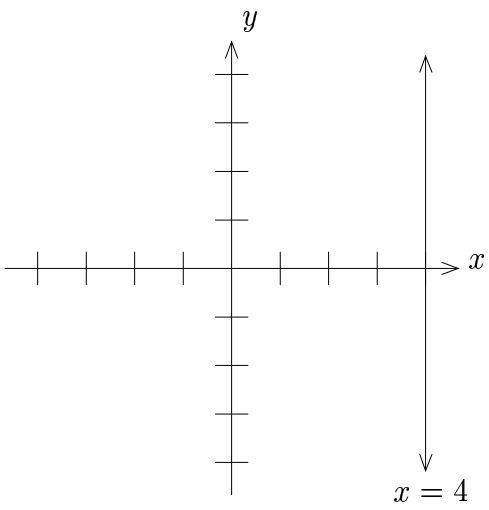
x-intercept: set $y = 0$: $2x + 3(0) = 6 \implies 2x = 6 \implies x = 3$

y-intercept: set $x = 0$: $2(0) + 3y = 6 \implies 3y = 6 \implies y = 2$

Thus the line crosses the x-axis at $(3, 0)$ and the y-axis at $(0, 2)$.

D. Horizontal and Vertical Lines

1. A **vertical line** has the equation $x = a$.



2. A **horizontal line** has the equation $y = b$.