

# STRAIGHT LINES

# 1 Linear equations in two variables

A first degree equation in two variables:  $3x - y - 2 = 0$

First degree means that  $x$  and  $y$  are raised to first power.

Standard form:  $ax + by + c = 0$  implicit form

Linear refers to the graph of the solutions  $(x, y)$  of the equation, in a Cartesian Plane, which is a straight line

$$3x - y - 2 = 0 \quad \text{What about solutions ?}$$

$$\text{If } x = 2 \text{ then } y = \dots? \quad y = 4$$

( 2 ; 4 ) is a solution

$$\text{If } y = 7 \text{ then } x = \dots? \quad x = 3$$

( 3 ; 7 ) is another solution

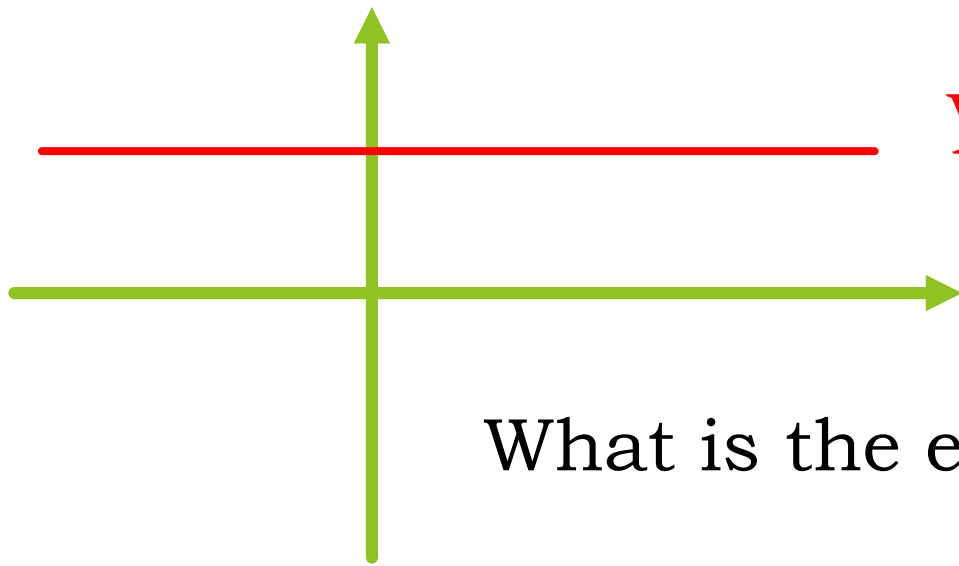
So... how many solutions ?

***Endless solutions !***

if  $a = 0$  the equation has this expression:

$$b y + c = 0$$

$$3y - 6 = 0 \longrightarrow y = 2 \quad \text{explicit form}$$



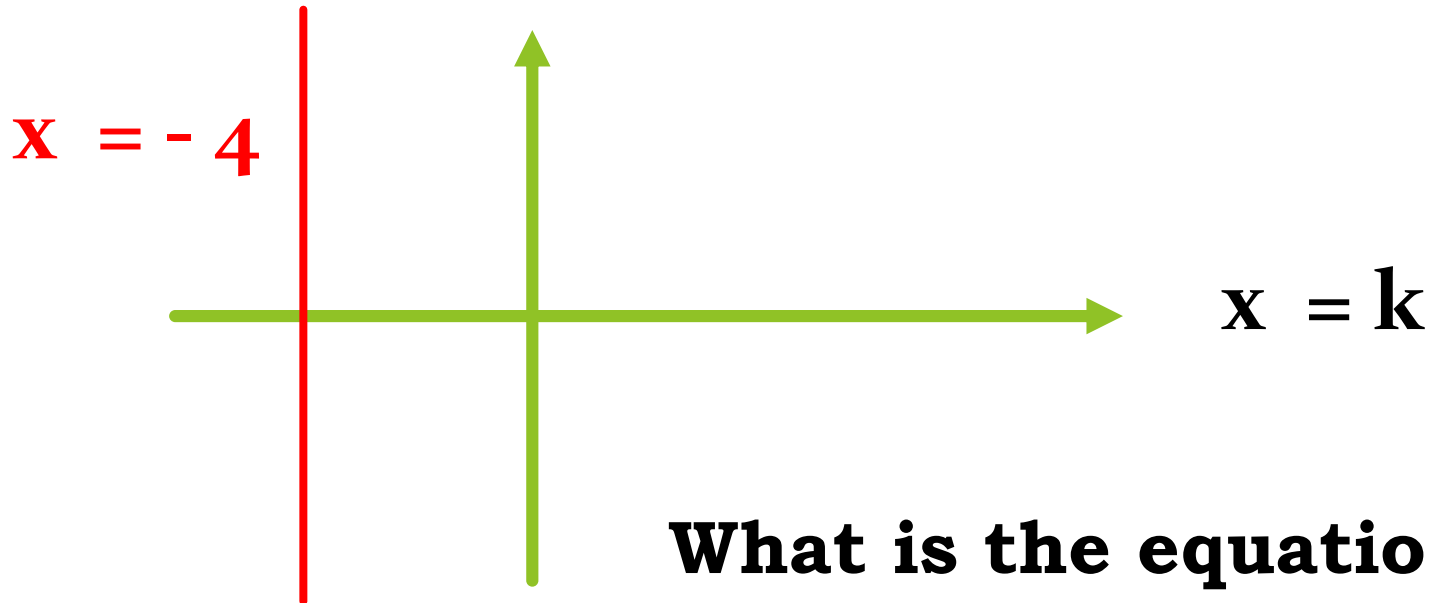
$$y = k$$

What is the equation for the x – axis ?

if  $b = 0$  the equation has this expression:

$$a x + c = 0$$

$$2x + 8 = 0 \longrightarrow x = -4 \quad \text{explicit form}$$



**What is the equation for the y – axis ?**

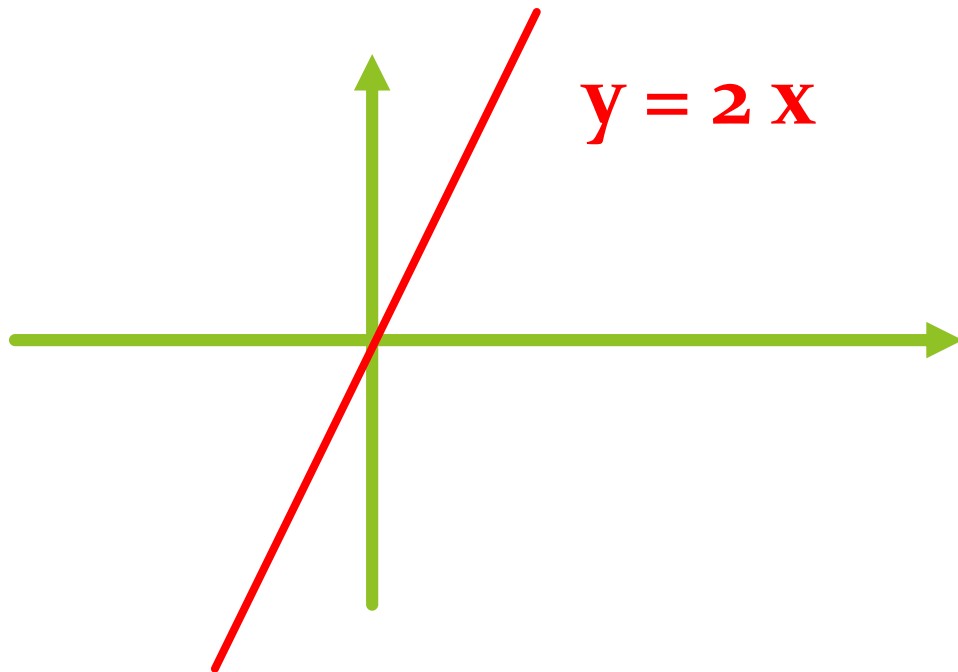
if  $c = 0$  the equation has this expression:

$$a x + b y = 0$$

$$4 x - 2 y = 0 \longrightarrow$$

$$y = 2 x \quad \text{explicit form}$$

$$\frac{y}{x} = 2$$



$$\frac{y}{x} = m$$

$$y = m x$$

**Given the equation:  $y = m x$**

$$y = 3 x$$

$$y = -2 x$$

**The x-coefficient  $m$  is the gradient, the slope of the straight line;**

**If  $m > 0$  the line.... .... rises from the left to the right**

**If  $m < 0$  the line.... .... falls**

**If  $m = 0$  the line.... .... is parallel to the x-axis  $y = k$**

**What about bisectors of the quadrants.. ?**

**Given the equation:  $ax + by + c = 0$**

It can be written in this way:  $y = mx + q$

$$y = 3x - 2$$

$$y = -2x + 1$$

**q is the y-intercept**

**If  $q > 0$  the line crosses the y-axis....**

**above the origin**

**If  $q < 0$  the line crosses the y-axis....**

**below the origin**

**If  $q = 0$  the line crosses the y-axis....**

**at the origin**



## Graph the line: $2x + y - 1 = 0$

1. Leave  $y$  on the left and “move” anything else on the right
2. Set up a table of values (choose some values for  $x$  and calculate the corresponding values of  $y$ )
3. Plot points on the Cartesian Plane
4. Join them by a line

# Graph the line: $2x + y - 1 = 0$

Faster...!!

1. Leave  $y$  on the left and “move” anything else on the right

$$y = -2x + 1$$

2. Look at the  $y$  – intercept

3. Plot it on the  $y$ -axis

4. Look at the slope: it is  $-2$  , so you can draw the line moving...

<https://www.youtube.com/watch?v=AQ0tkNv9GY>

[http://www.mathsisfun.com/equation\\_of\\_line.html](http://www.mathsisfun.com/equation_of_line.html)

# Example 1

Given the equation of the line:  $y = \frac{4}{3}x - \frac{3}{2}$   
Write it using the implicit form.

2) Given the equation of the line  $2x - 3y + 5 = 0$ ,  
Write it in explicit form and specify the values of the  
slope and the y-intercept.

## Example 2

The equation of a straight line is  $3x - 6y + 2 = 0$

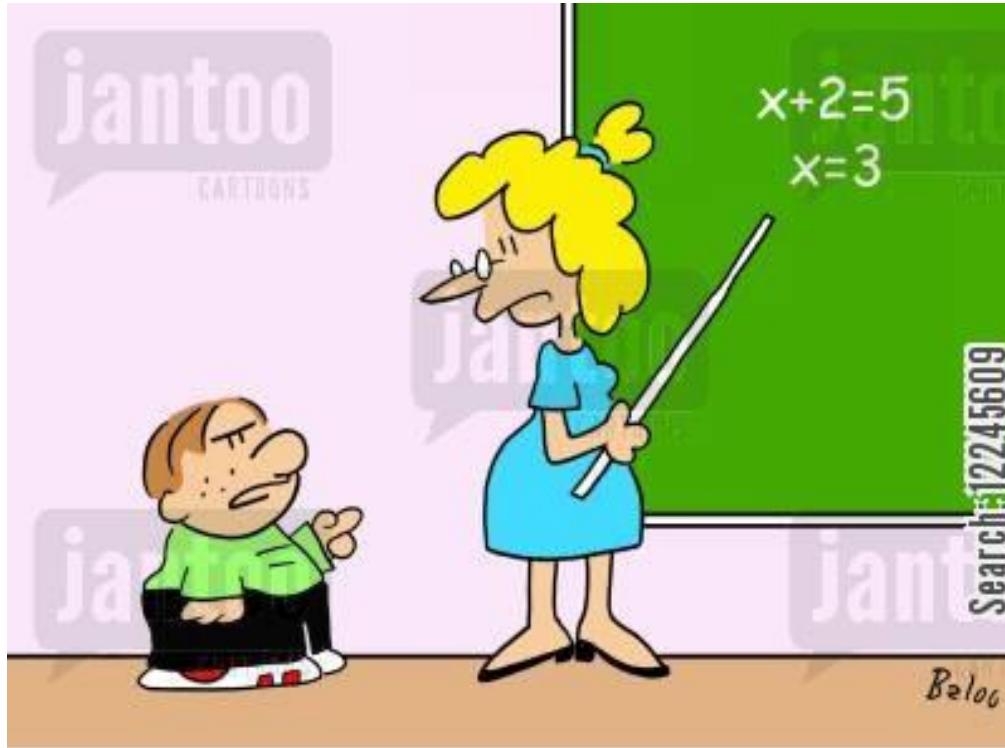
- 1) Determine if the points A  $(-2 ; -2/3)$  and B  $(1 ; 1/3)$  belong to it.
- 2) Determine the coordinates of the point C that belongs to the line, if you know that its x-coordinate is 3.
- 3) Determine the coordinates of the point D that belongs to the line, if you know that its y-coordinate is -1.

# Example 3

A function is defined by: 
$$\begin{cases} 2x - 1 & \text{if } x \leq 0 \\ -1 & \text{if } 0 < x \leq 4 \\ x & \text{if } x > 4 \end{cases}$$

1) Evaluate  $f(-1)$  ;  $f(0)$  ;  $f(2)$  ;  $f(4)$  ;  $f(7)$  ;  $f(9)$

2) Sketch the graph of the function.



"Just a darn minute! — Yesterday  
you said that X equals two!"