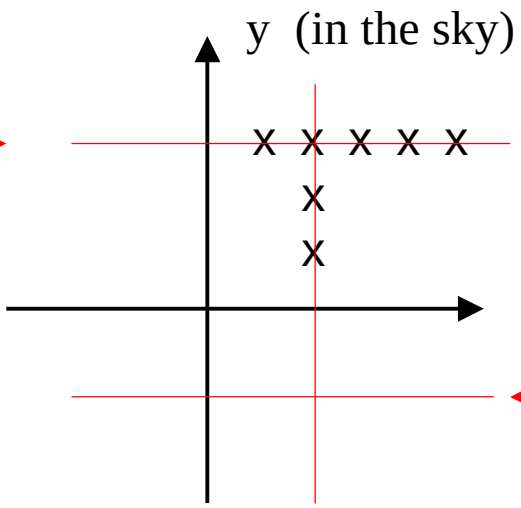
STRAIGHT LINES



These points are
(1,4)
(2,4)
(3,4)
(4,4) and
(5,4)

Look! The y values are all 4.
The points lie on the line y = 4

This line is named y = -2

This is the line x = 2, because the x values are all 2. (2,1) (2,2) and (2,3). There are an infinite number of points that lie on a line.

What about sloping lines?

The points (1,2), (2,4), (3,6), all have the property that the y value is twice the x value so it seems logical that we name this line y = 2x.

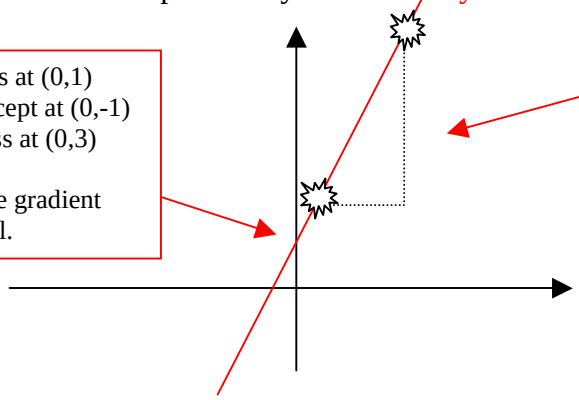
The points (1,3), (2,5), (3,7), (4,9) and (5,11) all have the property that the y value is twice the x value plus 1. The line through these points is named y = 2x + 1.

If we look at the **sequence** of y values here, we have 3 5 7 9 11
Thinking back to sequences, the gap is 2 every time.
The formula for the nth term was 2n + something.
If we go back to the first term, 2 x 1 = 2 so we need one more to get 3.
2n + 1 is the formula for the nth term of the sequence and this is similar to the equation of the line y = 2x + 1.

The gap was 2 and this is the increase in the y value for every increase of 1 in the x value.
For y = 2x + 1, 2 is known as the gradient. The figure at the end of the equation is the constant and tells us where the line crosses the y-axis. (Easily found by putting x = 0).

So all equations of sloping lines will have the form **y = mx + c**

m is the gradient and c is the intercept on the y axis. y = 2x + 1



The intercept on the y-axis is at (0,1)
The line y = 2x -1 will intercept at (0,-1)
The line y = 2x + 3 will cross at (0,3)

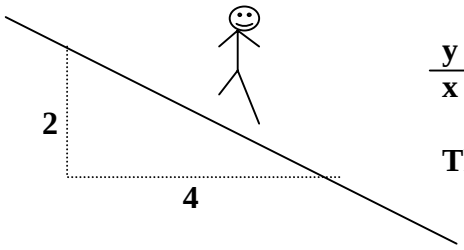
All these lines have the same gradient and will therefore be parallel.

The gradient will be 2.

To verify this, we could take any two points on the line and measure the y step and the x step. Divide the y step by the x step to get the gradient.

Any two points will do - the further apart the better.

NEGATIVE GRADIENTS will slope downwards as we move from left to right.



$$\frac{\text{y step}}{\text{x step}} = \frac{2}{4} = \frac{1}{2}$$

The gradient is - ½

POSITIONING A LINE ON THE AXES

To correctly position the line $y = 2x + 3$: set up a table with your own choice of x values and use the formula $2x + 3$ to obtain the y values.

x	1	3	5
y	5	9	13

plot the points (1,5) (3,9) (5,13) and draw the line through these points. There will be lots of other points on this line eg. (7,17).

(9, 20) will not lie on the line. Why not?

CROSSROADS

The intersection of two lines can be viewed as the point where the two lines meet.

This is also the solution of the simultaneous equations. (See other methods of solving simultaneous equations on the appropriate factsheet).

$y = 2x - 3$ and $y = -½ x + 1$ are simultaneous equations and the equations of two lines or roads.

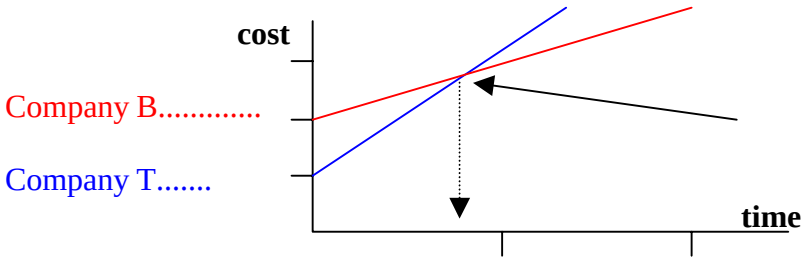
If we plot them on graph paper and read off the position where they cross we get the point (2,1).

The solution of the simultaneous equations $y = 2x - 3$ and $y = -½x + 1$ is $x = 2$, $y = 1$

MOBILE PHONES

Suppose one company **Bananaphone** charges 100pence line rental and 20p per minute for calls. Another company **Tellnet** charges 50pence line rental but 40p per minute.

B = 20m + 100 and T = 40m + 50 are the two equations of the lines representing the costs.



After this number of minutes it becomes cheaper to use company B.