

TUTORIAL SETS 42, 43, 44, 45 AND 46 COMBINED

Exercise for Plotting and Writing Equations of Straight Lines

Tutorial Set 42- Plotting Straight Lines Using Excel

Excel is part of the Office package. Most people will have Office installed on their computers. Data can be plotted using Excel. There are various ways of plotting data. We will give a demonstration.

Example 1: Enter and plot the data for the straight line given by $y = 4x$ for x going from -5 to $+5$ in steps of 1 .

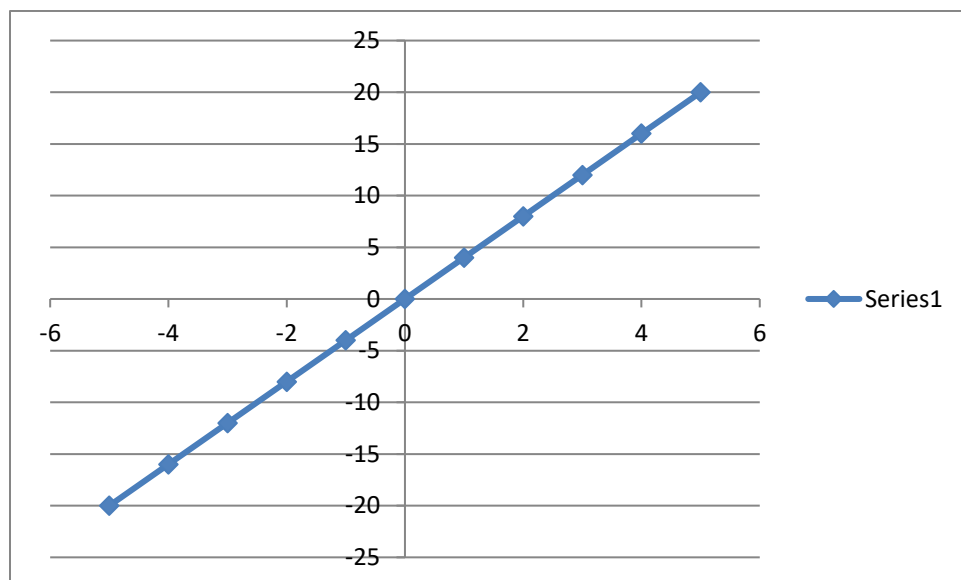
Solution: Enter the data as shown below. It is best to do this on the left of the page so as to leave room for the plot. You are encouraged to also view instructions and examples on Youtube. Later, we will show that in Excel, we can enter just part of the data and the system will generate the rest. We will especially show that if there is an equation for y in terms of x , all the values for y can easily be generated.

x	y
-5	-20
-4	-16
-3	-12
-2	-8
-1	-4
0	0
1	4
2	8
3	12
4	16
5	20

To make the plot in Excel, perform the following:

1. Select the data on the as shown above.
2. Go to Home.
3. Go to Insert
4. Select the scatter curve on the top right.

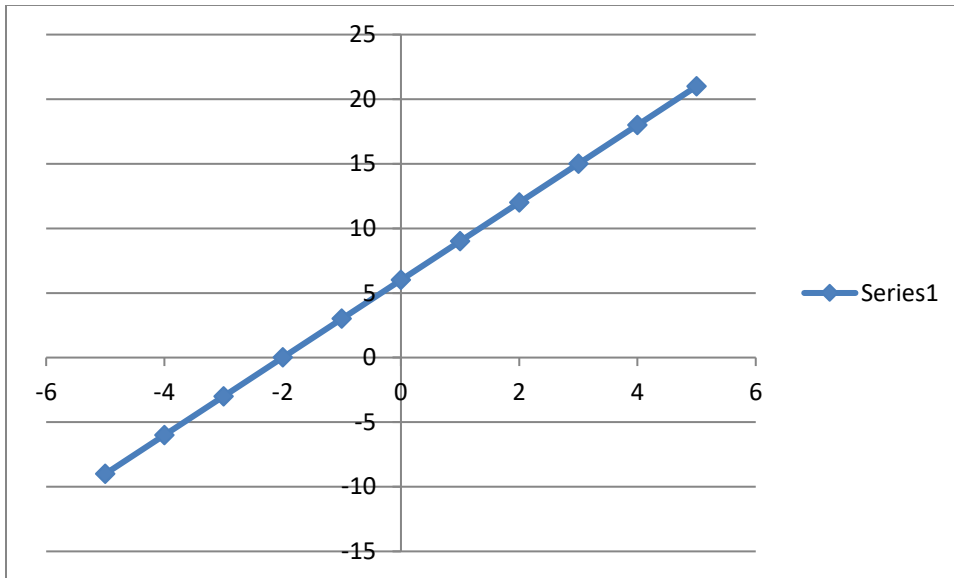
The following plot will result. (The x-axis is horizontal and the y-axis is vertical.)



Example 2: Enter and plot the data for the straight line given by $y = 3x + 6$ for x going from -5 to $+5$ in steps of 1.

The Result is as shown below.

x	y
-5	-9
-4	-6
-3	-3
-2	0
-1	3
0	6
1	9
2	12
3	15
4	18
5	21



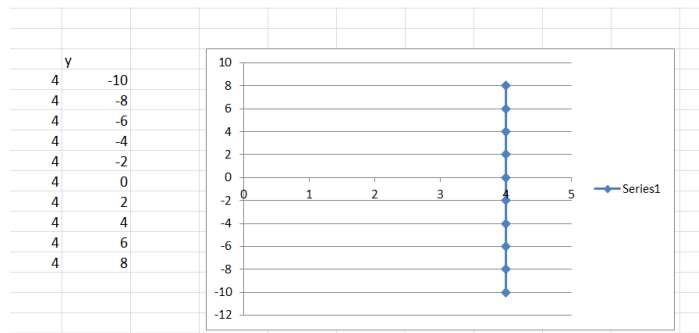
Your assignment: Enter data and plot the following straight lines for x going from -6 to +6 in steps of :

1. $y = 2x$
2. $y = 6x - 3$
3. $y = -3x + 6$

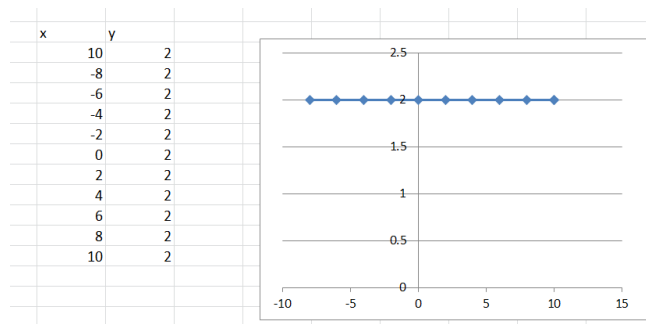
Tutorial Set 43- Writing Equations of Straight Lines Using the Intercept Method and Excel Plotting

A straight line is determined by two points. Straight lines will intercept or cross both the x and the y axis except for two types of lines, vertical lines and horizontal lines.

The two examples are shown in these plots.



Plot of the equation $x = 4$



Plot of the equation $y = 2$

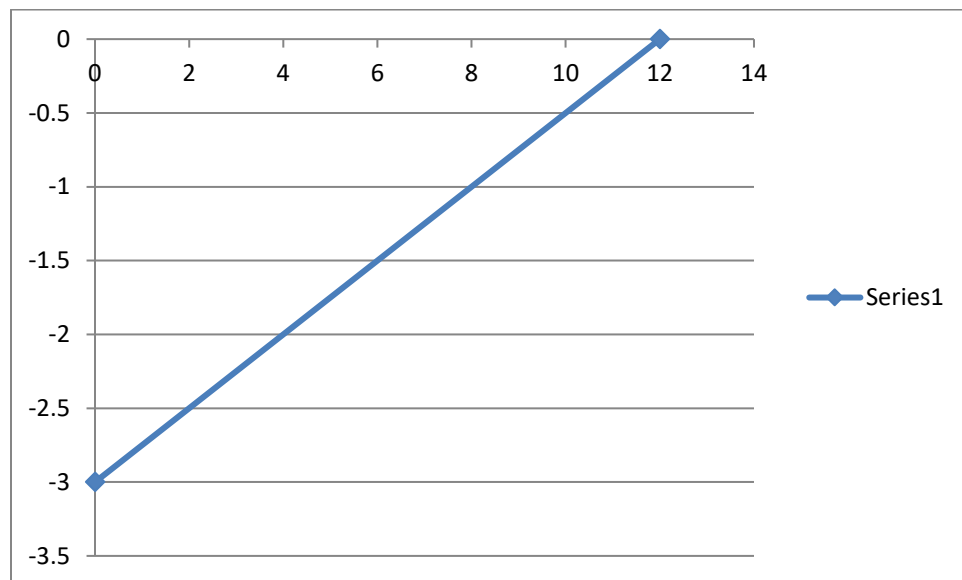
With a straight line being determined by two points, one way of getting two points is by determining where the line intercepts the x axis and where it intercepts the y axis. This method is called the intercept method of determining a straight line. These two points can easily be found as follows: Given the equation $y = mx + b$, find the y intercept by letting $x = 0$ to give $y = b$. Find the x intercept by letting $y = 0$ to give $0 = mx + b$ or $x = -b/m$.

Example: Find the x and y intercepts of the following line to get two points for the line $y = 3x + 12$

Solution: For $x = 0$, $y = 12$ and for $y = 0$, $x = -12/3 = -4$ so the two points are
P1; $x = 0$, $y = 12$
P2: $x = -4$, $y = 0$

Make an Excel plot with this data.

x	y
0	12
-3	0



Your assignment is to find two points using the x and y intercepts and to use Excel to plot the line for the following:

1. $y = 4x - 8$
2. $y = -3x + 9$

Tutorial Set 44- Writing Equations of Straight Lines Using the Point Slope Form and Excel Plotting

The slope of a line is given by a change in y divided by a corresponding change of x. We will designate a point by its x-coordinate and its corresponding y-coordinate as (x, y). We will give a point a name such as P1(x1,y1). Then given two points P1(x1,y1) and P2(x2,y2), we calculate the slope of the line as $s = (y_2 - y_1) / (x_2 - x_1)$ where s is the slope. Previously, we have given the equation of a line as $y = mx + b$. In this form, m is the slope.

We will now use a different (but equivalent) designation for the line. The general form of a line is $ax + by + c = 0$, representing a linear equation. We can easily manipulate this to get the form of $y = mx + b$. Still, the more general form that we will use is $y - y_1 = s(x - x_1)$.

In the above section the intercept form of the equation was used to give two points for plotting a line. It can be shown that using these two points can be used to write the intercept form as

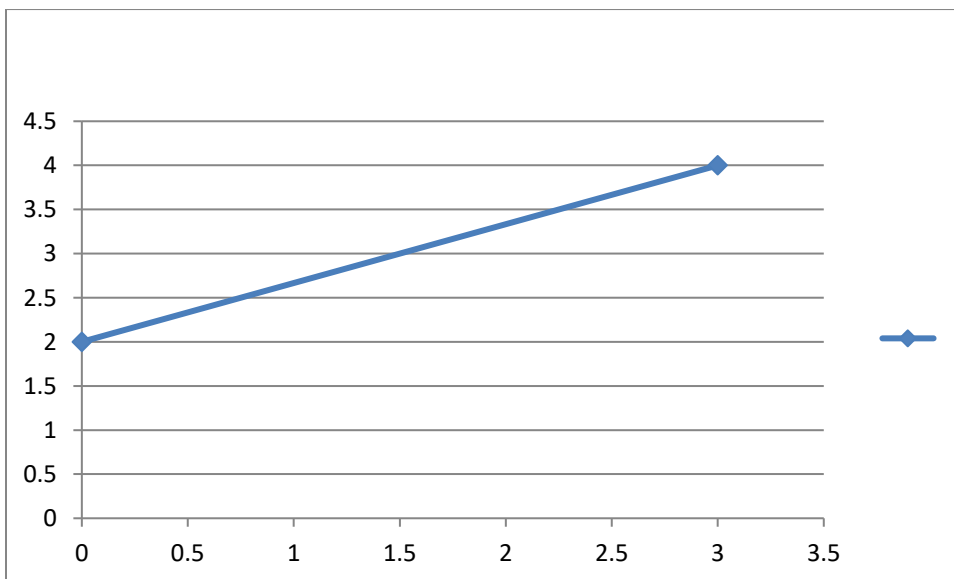
$x/x_0 + y/y_0 = 1$ where x_0 and y_0 are the two points, one where the line intercepts the x axis and one where the line intercepts the y axis.

We will now consider the point slope method given by $y - y_1 = s(x - x_1)$ where a point is given as P1(x1, y1) and the slope is already given.

Example: Write the equation of the line passing through the point $x_1 = 3$ and $y_1 = 4$ with a slope of $2/3$ and plot the line using Excel.

Solution: $y - 4 = 2/3(x - 3) = (2/3)x - 2$; $y = (2/3)x - 2 + 4$ or
 $y = (2/3)x + 2$

To plot the line, obtain another point by letting $x = 0$ to give $y = 2$. Then use P1(3,4) and P2(0,2) to plot the line.



Your assignment is to write the equation of the line passing through the point x_1 as given with the given slope and to plot the line using Excel.

1. Point has $x_1 = 1$ and $y_1 = 6$ and slope of 2
2. Point has $x_1 = 2$ and $y_1 = 4$ and slope of $1/2$

Tutorial Set 45- Writing Equations of Straight Lines Using the Slope intercept Form

In the above example, if we consider where the line intercepts the x axis ($x_0, 0$) or where it intersects the y axis ($0, y_0$), we have the slope intercept form of the line.

If in the equation $y - y_1 = s(x - x_1)$, for the point being ($x_0, 0$) we have $y - 0 = s(x - x_0)$ or
 $y = s(x) - s(x_0)$

If in the equation $y - y_1 = s(x - x_1)$, for the point being ($0, y_0$) we have $y - y_0 = s(x - 0)$ or
 $y = s(x) + y_0$

Example 1: Write the equation for the line where the line intercepts the x axis ($y = 0$) at the point $x_1 = x_0 = 2$ and the slope is $1/3$

Solution:

$$y = (1/3)(x - 2)$$

$$y = (1/3)x - 1/3(2)$$

$$y = (1/3)x - 2/3$$

Example 2: Write the equation for the line where the line intercepts the y axis ($x = 0$) at the point $y_1 = y_0 = 4$ and the slope is $1/2$

Solution:

$$y - 4 = (1/2)(x)$$

$$y = (1/2)x + 4$$

Your assignment:

1. Write the equation for the line where the line intercepts the x axis ($y = 0$) at the point $x_1 = x_0 = 4$ and the slope is $1/2$.
2. Write the equation for the line where the line intercepts the y axis ($x = 0$) at the point $y_1 = y_0 = 6$ and the slope is $1/3$

Tutorial Set 46- Writing Equations of Straight Lines Using the Two Point Form

We previously plotted an equation given two points. To write the equation of a line using the two point form, when given $P1(x_1, y_1)$ and $P2(x_2, y_2)$, we calculate the slope using $s = (y_2 - y_1)/(x_2 - x_1)$ and then use the equation

$y - y_1 = [(y_2 - y_1)/(x_2 - x_1)](x - x_1)$ which is simply

$y - y_1 = s(x - x_1)$, so we will usually just calculate s and substitute into the equation.

Example: Write the equation of the line given $P1(2, 3)$ and $P2(6, 9)$.

Solution:

$$s = (9 - 3)/(6 - 2) = 6/4 = 3/2$$

$$y - 3 = (3/2)(x - 2);$$

$$y = (3/2)x - (3/2)2 + 3$$

$$y = (3/2)x - 3 + 3$$

$$y = (3/2)x$$

Your assignment:

1. Write the equation of the line given $P1(4, 6)$ and $P2(12, 18)$.
2. Write the equation of the line given $P1(-4, 6)$ and $P2(2, 12)$.