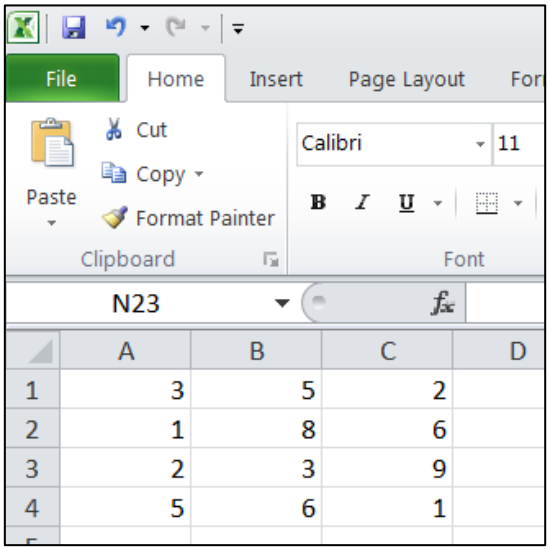
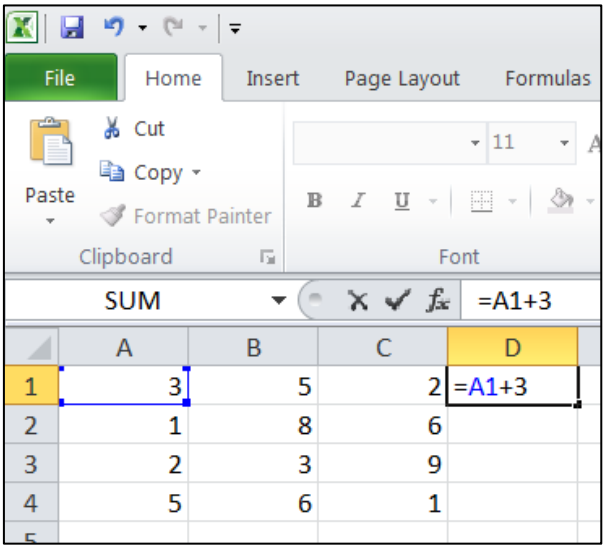
Excel Tutorial

Relative References

Type the following values into cells A1 to C4:

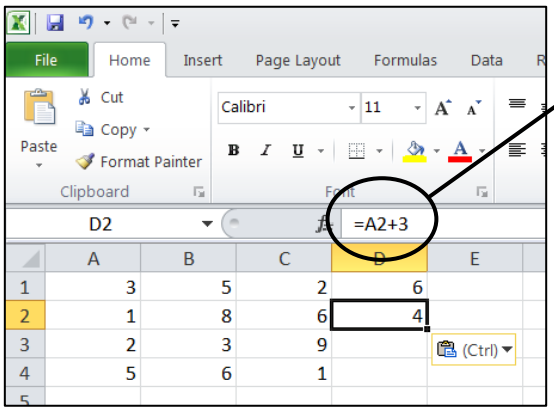


Type the following equation into cell D1:



Press *Enter* and the value displayed in cell D1 should be equal to 6.

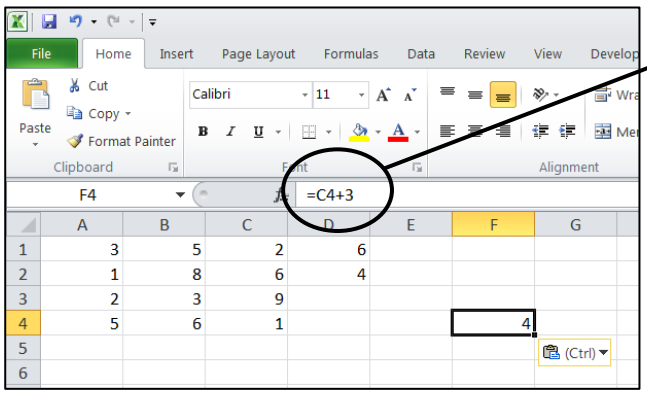
Copy and paste cell D1 to cell D2:



Notice that the equation in cell D2 becomes A2+3.

This is because we pasted one row below cell D1, so the reference A1 becomes A2 (the row number increases by one).

Copy and paste cell D1 into cell F4:



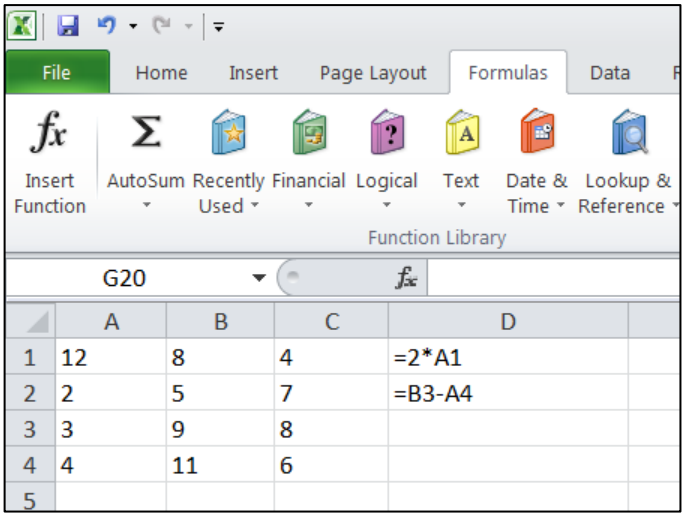
Notice that the equation in cell F4 becomes C4+3.

This is because we pasted two columns to the right and three rows below cell D1, so the reference A1 becomes C4 (the column letter increases by two and the row number increases by three).

These are examples of *relative references*.

Task 1

The following screenshot shows the contents of various cells (Note that you will not see the equations on your screen after you press *Enter*).



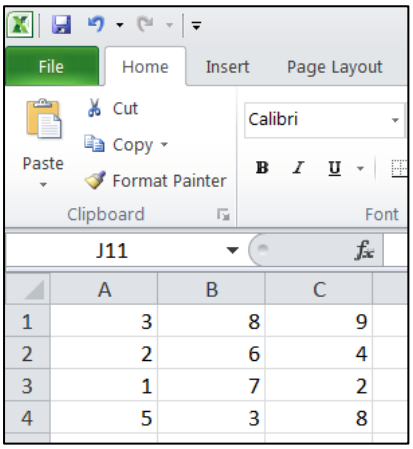
Complete the following table *without* using Excel. Then, check your answers using Excel.

For example, if we copy and paste cell D1 to cell E2, cell E2 will contain the equation 2*B2 and will display the value of 10.

Copied From	Pasted To	Displayed Equation	Displayed Value
D1	E2	2*B2	10
D1	D4		
D1	E3		
D2	E1		
D2	F2		
D2	E3		

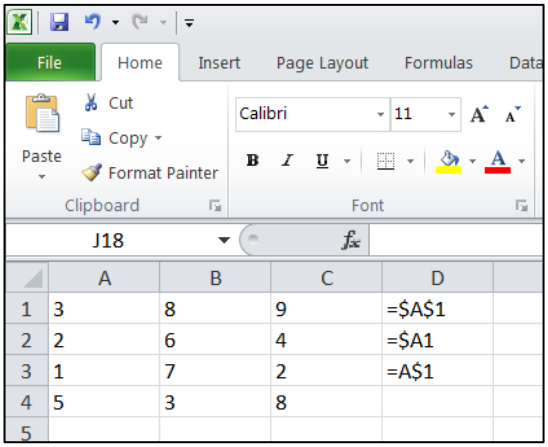
Absolute References

Type the following values in cells A1 to C4:



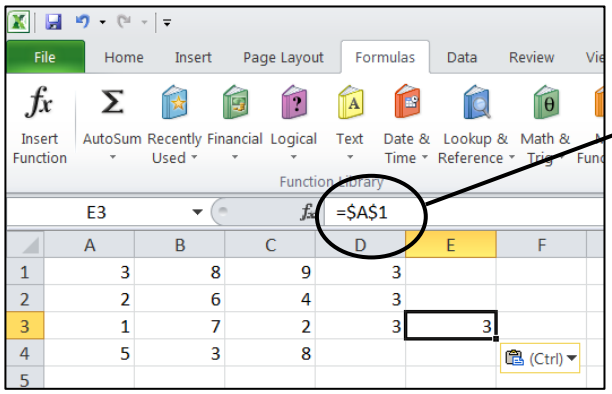
	A	B	C
1	3	8	9
2	2	6	4
3	1	7	2
4	5	3	8

Type the following equations into cells D1 to D3:



	A	B	C	D
1	3	8	9	=A1
2	2	6	4	=$A1
3	1	7	2	=A$1
4	5	3	8	
5				

Copy and paste cell D1 to E3:



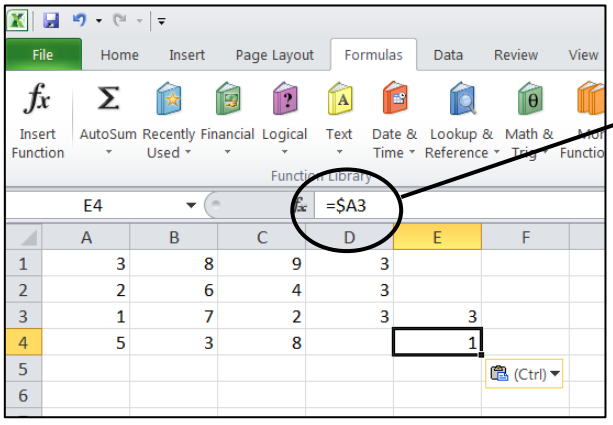
	A	B	C	D	E	F
1	3	8	9	3		
2	2	6	4	3		
3	1	7	2	3	3	
4	5	3	8			
5						

Notice that even though we pasted to a new column and row, the cell reference doesn't change.

Placing a $ sign in front of the column letter means the column letter will never change.

Placing a $ sign in front of the row number means the row number will never change.

Copy and paste cell D2 to E4:

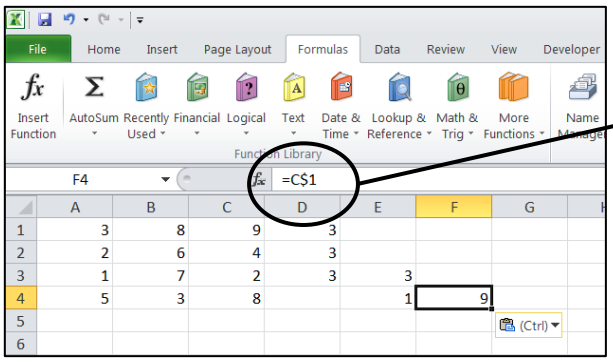


	A	B	C	D	E	F
1	3	8	9	3		
2	2	6	4	3		
3	1	7	2	3	3	
4	5	3	8		1	
5						
6						

Since there is a $ sign in front of the column letter, the column letter will never change.

Cell E4 is two rows below cell D2, so the row number increases by two.

Copy and paste cell D3 into cell F4:



	A	B	C	D	E	F	G
1	3	8	9	3			
2	2	6	4	3			
3	1	7	2	3	3		
4	5	3	8		1	9	
5							
6							

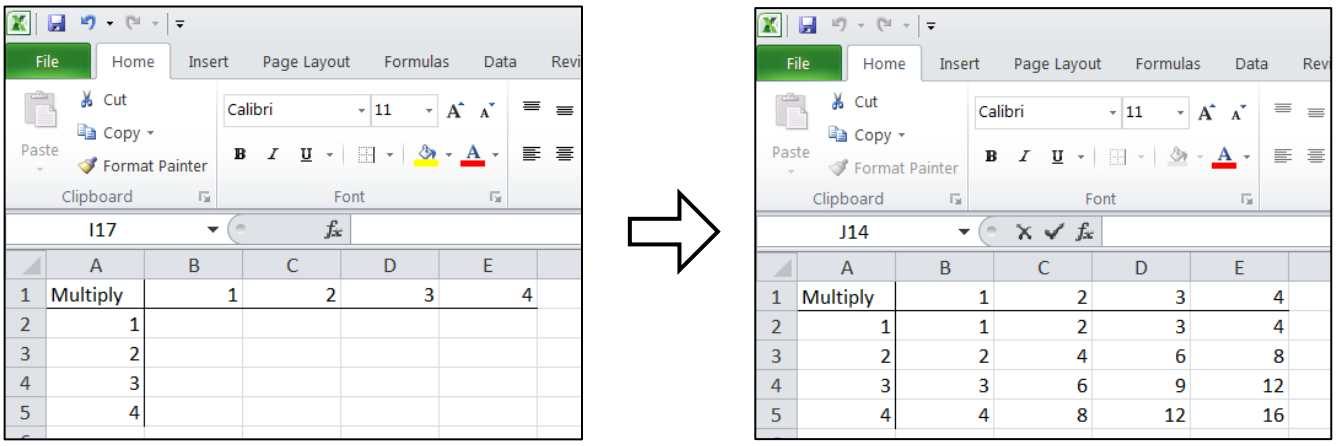
Since there is a $ sign in front of the row number, the row number will never change.

Cell F4 is two columns to the right of cell D3, so the column letter increases by two.

These are examples of *absolute references*.

Task 2

Enter one equation into cell B2, so that when it is copied and pasted into all of the other cells it correctly fills in the multiplication table:

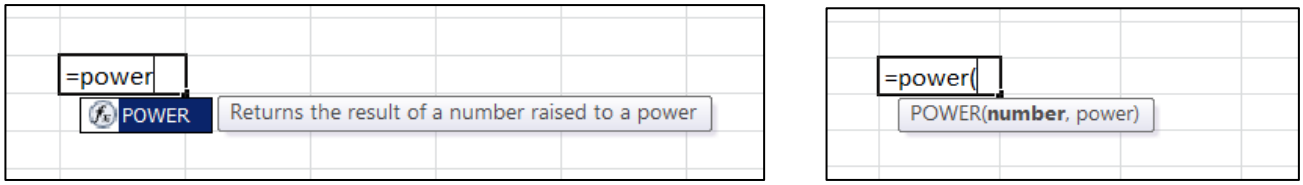


Mathematical Functions

Excel contains many mathematical functions. For example:

sin(), cos(), tan(), asin(), acos(), atan(), sqrt(), power(), int(), randbetween(), sum(), average(),countif()

As you type the function into Excel, you will often be given a description of the function and what kind of values it accepts:



Examples

- Typing =power(3,4) will display the value of 81
- Type =sqrt(9) will display the value of 3
- Typing =sum(A1:A6) will calculate the sum of the contents of cells A1 to A6

Task 3

Use Excel to determine the following:

a) the square root of 20
b) the mean value of 20, 18, 23, 11, 25 and 19
c) a randomly generated number between 5 and 13
d) the inverse sine of 1
e) the sum of all positive integers less than 10

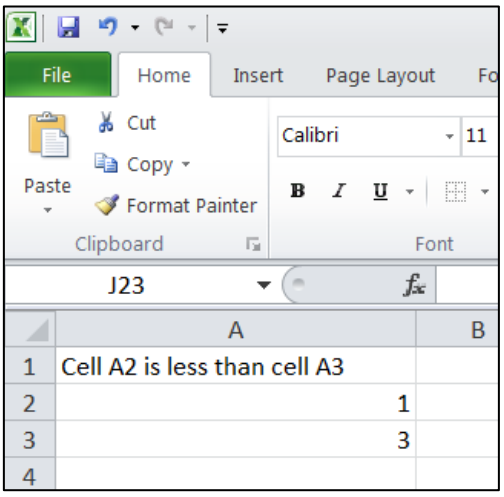
Conditional Logic

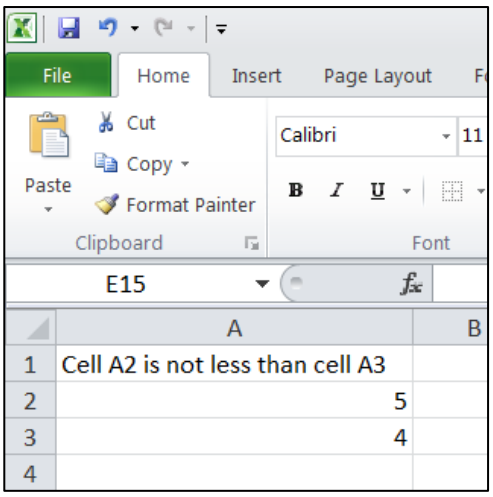
Excel contains an IF statement that works according to the following:

=IF(condition, value to display if true, value to display if false)

For example, in cell A1 type =IF(A2<A3,"Cell A2 is less than cell A3","Cell A2 is not less than cell A3").

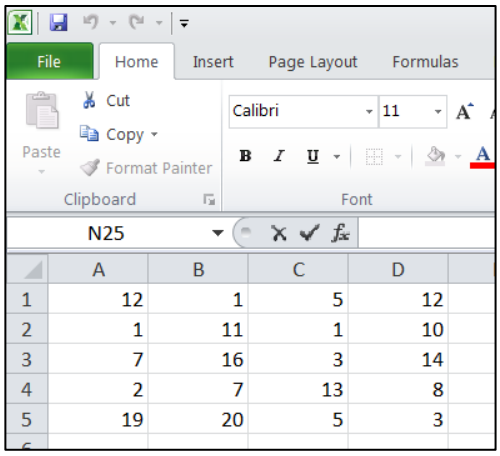
Change the contents of cells A2 and A3 and notice what happens to cell A1, depending on the values of cells A2 and A3.





Task 4

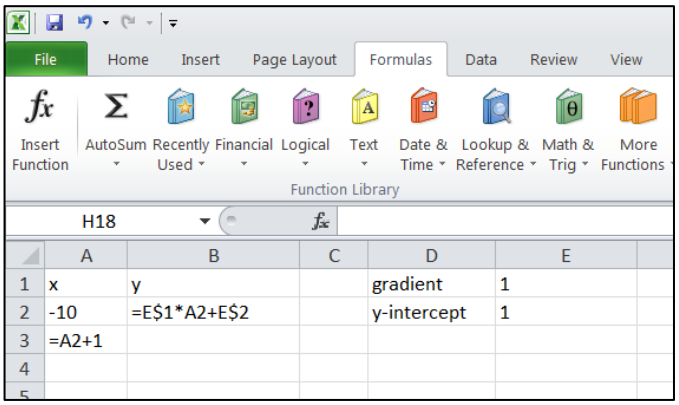
Without using Excel complete the table based on the screenshot. Then, use Excel to check your answers.



Conditional Statement	Displayed Value
=IF(B1=C1,A4,A3)	7
=IF(C2<B4,"Yes","No")	
=IF(A4=2,"Two","Not two")	
=IF(D5*C3>C5+1,B3,2*D1)	
=IF(SUM(A1:A5)<100,SQRT(4),SQRT(9))	
=IF(AVERAGE(A4:D4)>AVERAGE(B3:D4),0,1)	

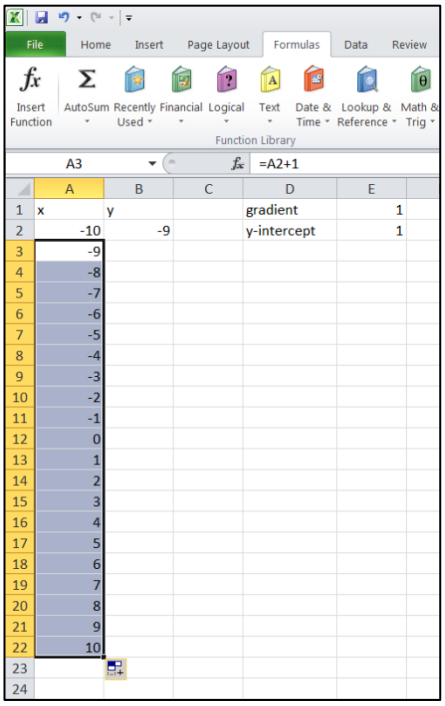
Creating Graphs

Enter this following into a new worksheet:

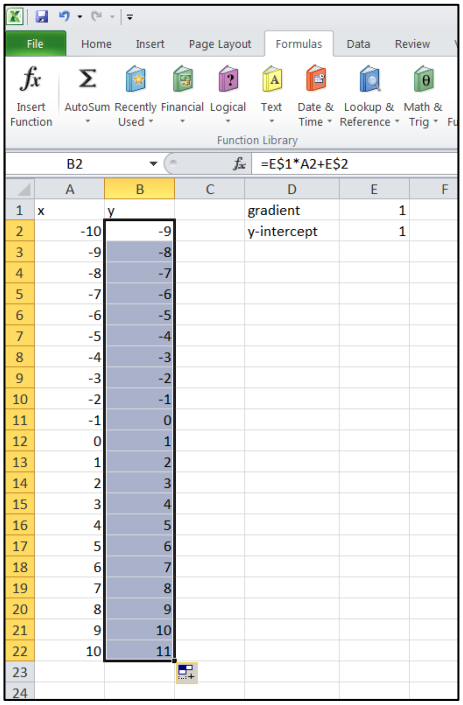


	A	B	C	D	E
1	x	y		gradient	1
2	-10	=E$1*A2+E$2		y-intercept	1
3	=A2+1				
4					
5					

Copy cell A3 and paste into cells A4 to A22. Copy cell B2 and paste in cells B3 to B22.

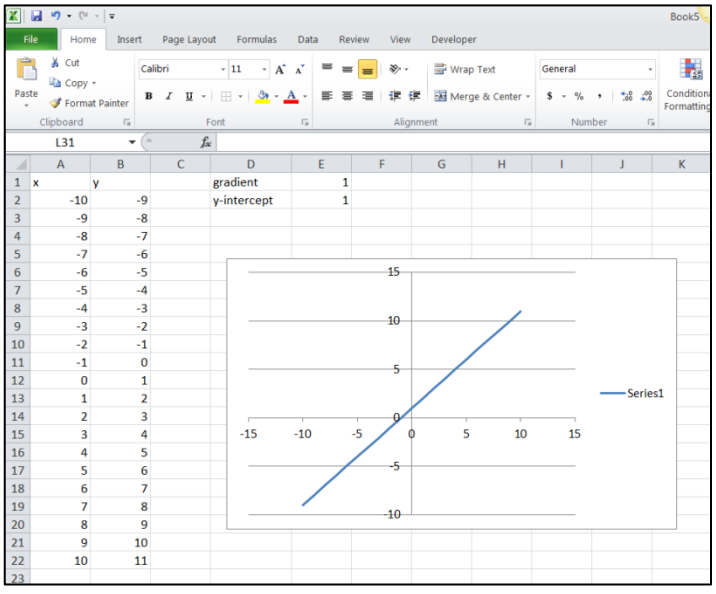


	A	B	C	D	E
1	x	y		gradient	1
2	-10	-9		y-intercept	1
3	-9				
4	-8				
5	-7				
6	-6				
7	-5				
8	-4				
9	-3				
10	-2				
11	-1				
12	0				
13	1				
14	2				
15	3				
16	4				
17	5				
18	6				
19	7				
20	8				
21	9				
22	10				
23					
24					



	A	B	C	D	E	F
1	x	y		gradient	1	
2	-10	-9		y-intercept	1	
3	-9	-8				
4	-8	-7				
5	-7	-6				
6	-6	-5				
7	-5	-4				
8	-4	-3				
9	-3	-2				
10	-2	-1				
11	-1	0				
12	0	1				
13	1	2				
14	2	3				
15	3	4				
16	4	5				
17	5	6				
18	6	7				
19	7	8				
20	8	9				
21	9	10				
22	10	11				
23						
24						

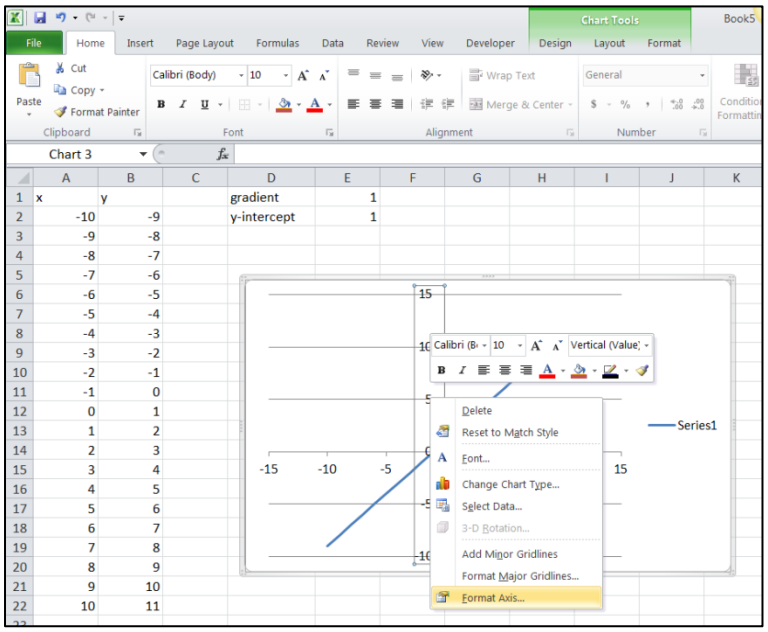
Highlight cells A2 to B22. Click *Insert* > *Chart* > *Scatter with Straight Lines*.

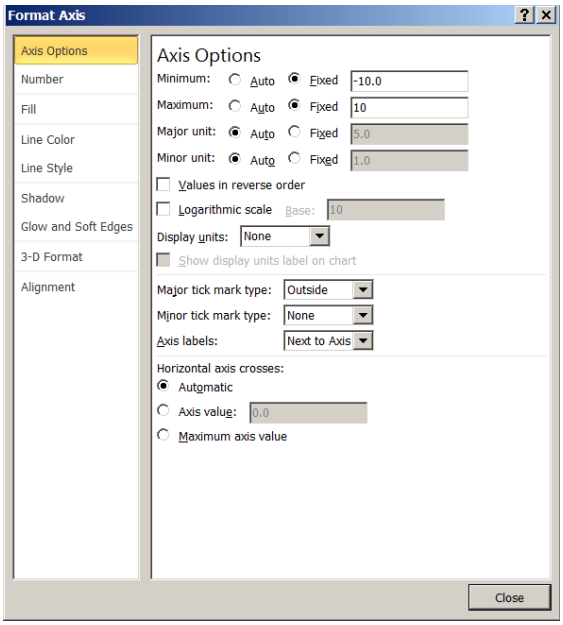


	A	B	C	D	E	F	G	H	I	J	K
1	x	y		gradient	1						
2	-10	-9		y-intercept	1						
3	-9	-8									
4	-8	-7									
5	-7	-6									
6	-6	-5									
7	-5	-4									
8	-4	-3									
9	-3	-2									
10	-2	-1									
11	-1	0									
12	0	1									
13	1	2									
14	2	3									
15	3	4									
16	4	5									
17	5	6									
18	6	7									
19	7	8									
20	8	9									
21	9	10									
22	10	11									
23											

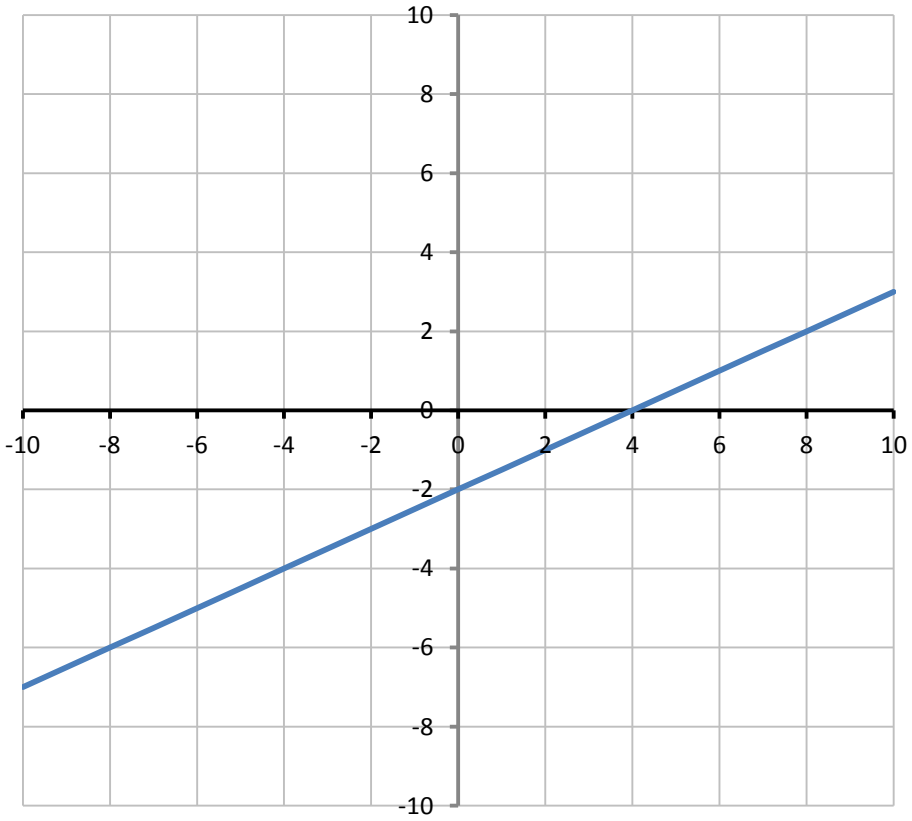
Now, change the values of cells E1 and E2. This will change the gradient and the *y*-intercept of the graph. However, you may notice that Excel rescales the axes to suit the graph. Sometimes we do not want this to happen.

Right-click on the *y*-axis and select *Format Axis*. Set the minimum and maximum value of *y* to -10 and 10 respectively. Right click on the *x*-axis and also set the minimum and maximum value of *x* to -10 and 10 respectively. Now, when you change the value of the gradient and *y*-intercept you can easily see the affect it has on the graph.





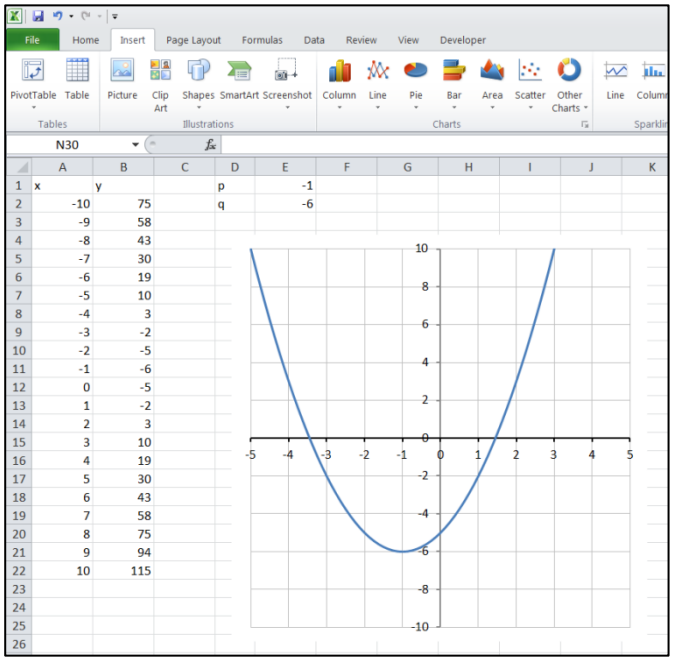
Make the graph more attractive by clicking on it and selecting relevant options from the *Layout* tab.

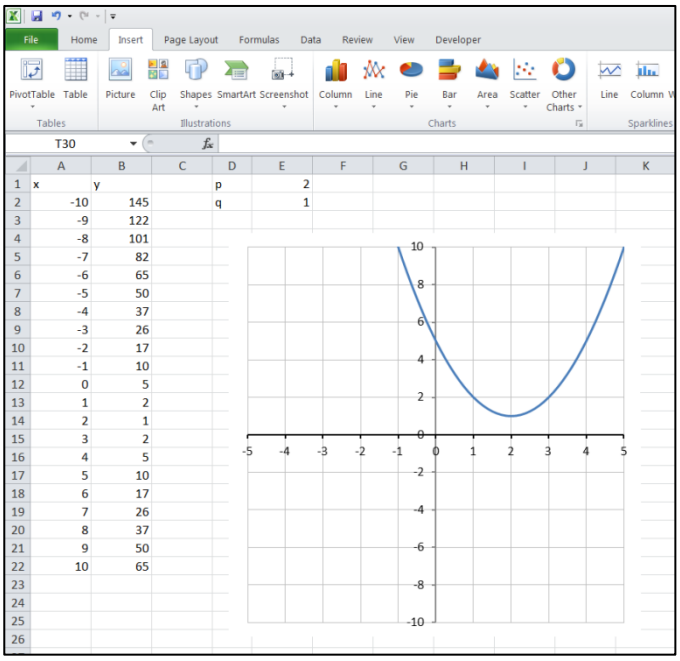


Task 5

Plot the graph of $y = (x - p)^2 + q$ where the values of p and q are each stored in a cell. Use integer values from -10 to 10 for the x-coordinates. Fix the minimum and maximum x-value on the x-axis to -5 and 5 respectively. Fix the minimum and maximum y-value of the y-axis to -10 and 10 respectively. The chart type should be *Scatter with Smooth Lines*.

Use the screenshots below to determine the accuracy of your spreadsheet (your gridlines may look different).

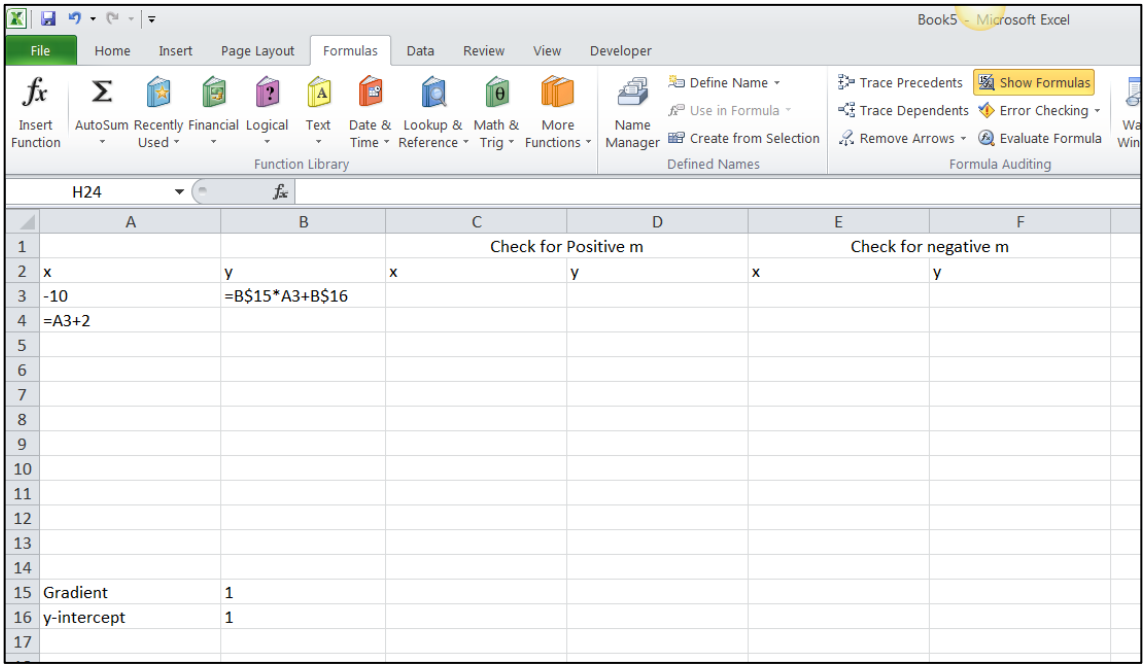




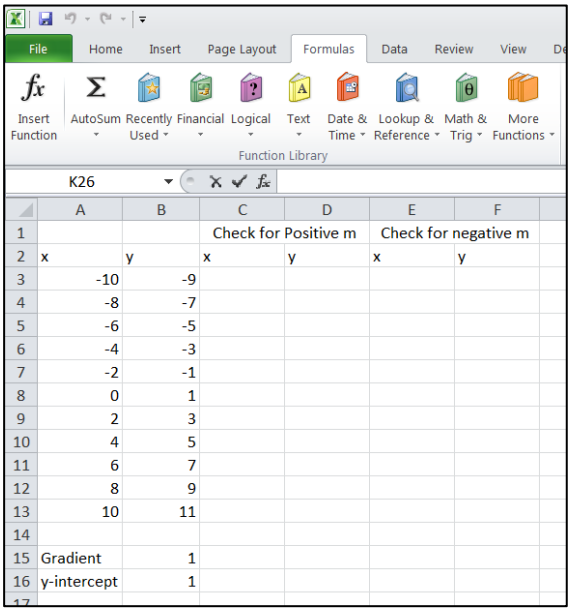
Conditional Formatting Graphs

Sometimes we may wish to change the style of a graph depending on certain conditions. For example, suppose we wished to plot the equation $y = mx + c$ in red if the value of m is positive, and in blue if the value of m is not positive.

Set the following up in Excel (note that cells C1 and D1 are merged, as are E1 and F1):



Copy cell A4 and paste it into cells A5 to A13. Copy cell B3 and paste into cells B4 to B13. You have now created the table of values for $y = mx + c$.



	A	B	C	D	E	F
1			Check for Positive m		Check for negative m	
2	x	y	x	y	x	y
3	-10	-9				
4	-8	-7				
5	-6	-5				
6	-4	-3				
7	-2	-1				
8	0	1				
9	2	3				
10	4	5				
11	6	7				
12	8	9				
13	10	11				
14						
15	Gradient	1				
16	y-intercept	1				

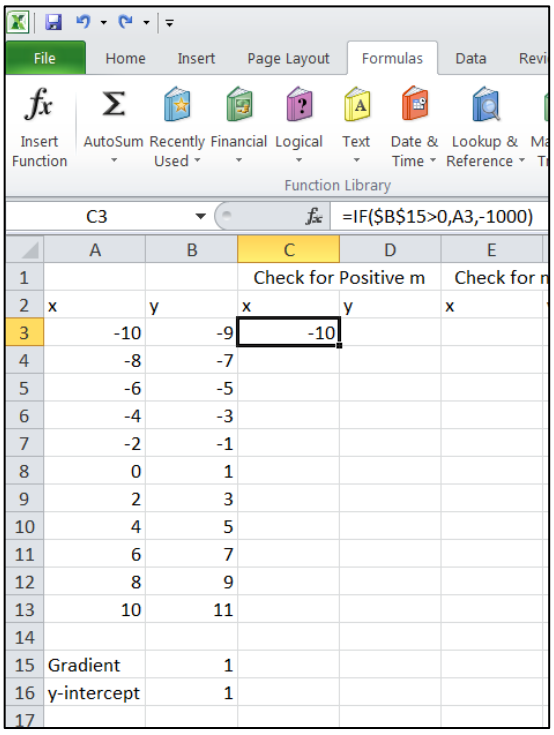
We will not use these values to plot the graph; we will use the next four columns. Columns C and D will contain coordinates of points we wish to plot in red, and columns E and F will contain coordinates of points we wish to plot in blue.

We only want to plot red points if the gradient is positive and we only want to plot blue points if the gradient is not positive.

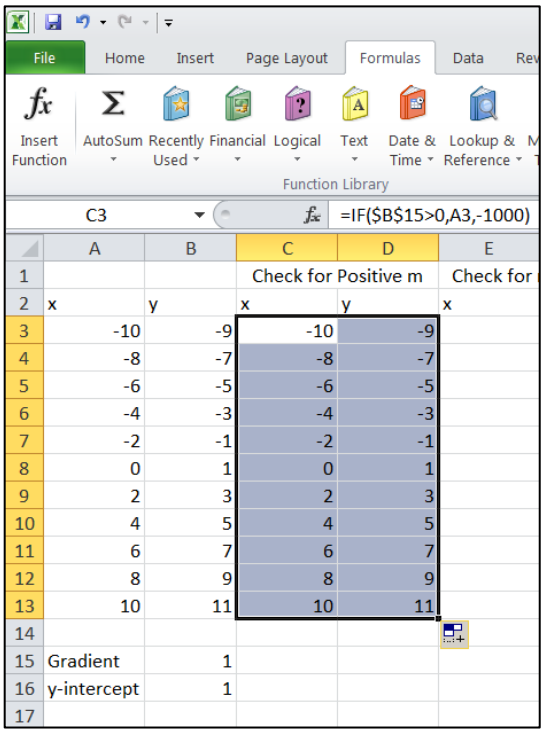
This means we have to use a conditional statement to determine the value of the gradient.

In cell C3 enter =IF(B15>0,A3,-1000). This means that if the value of the gradient is positive, the x-coordinate for that point will appear in the cell. If it is not positive then -1000 will appear in the cell. If we fix the scales on the axes of our graph we can make sure that the point will not be visible if it is equal to -1000.

Copy cell C3 and paste into cell D3. Copy cells C3 and D3 and paste into cells C4 to D13:



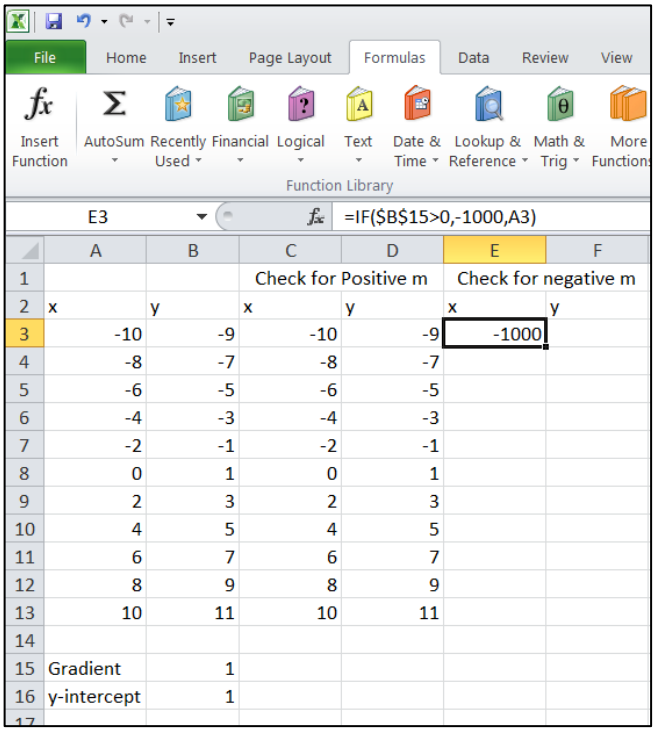
	A	B	C	D	E
1			Check for Positive m		Check for n
2	x	y	x	y	x
3	-10	-9	-10		
4	-8	-7			
5	-6	-5			
6	-4	-3			
7	-2	-1			
8	0	1			
9	2	3			
10	4	5			
11	6	7			
12	8	9			
13	10	11			
14					
15	Gradient	1			
16	y-intercept	1			
17					



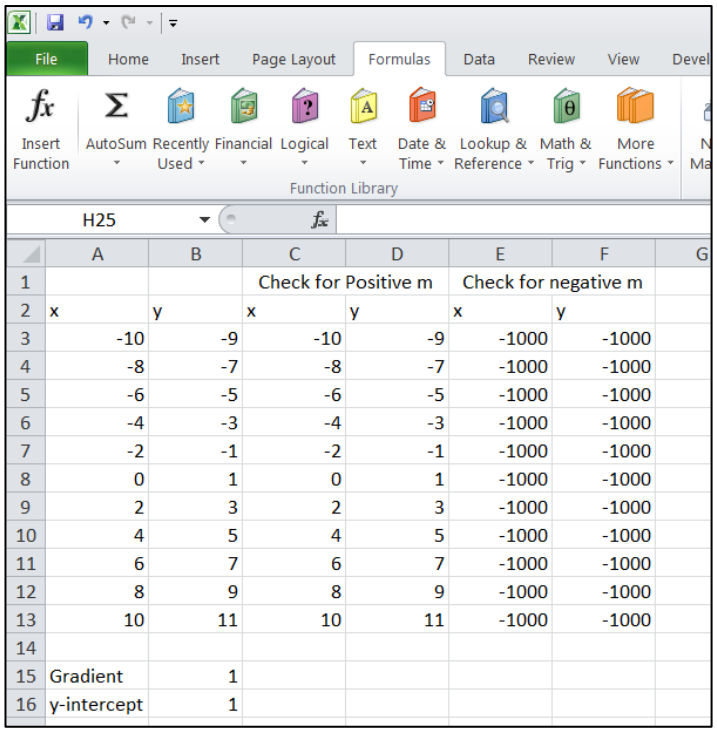
	A	B	C	D	E
1			Check for Positive m		Check for
2	x	y	x	y	x
3	-10	-9	-10	-9	
4	-8	-7	-8	-7	
5	-6	-5	-6	-5	
6	-4	-3	-4	-3	
7	-2	-1	-2	-1	
8	0	1	0	1	
9	2	3	2	3	
10	4	5	4	5	
11	6	7	6	7	
12	8	9	8	9	
13	10	11	10	11	
14					
15	Gradient	1			
16	y-intercept	1			
17					

In cell E3 enter =IF(B15>0,-1000,A3). This means that if the value of the gradient is positive, the value of -1000 will appear in the cell. If it is not positive then the x-coordinate for that point will appear in the cell.

Copy cell E3 and paste into cell F3. Copy cells E3 and F3 and paste into cells E4 to F13:

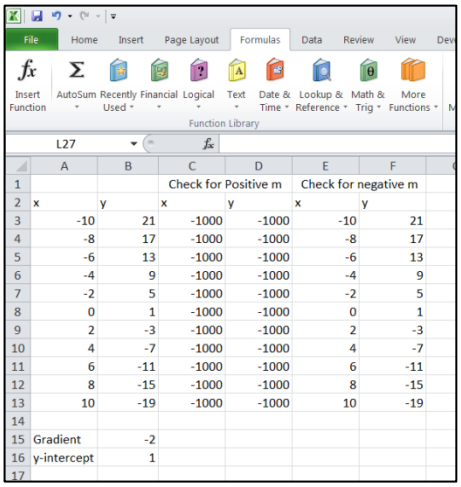


	A	B	C	D	E	F
1			Check for Positive m		Check for negative m	
2	x	y	x	y	x	y
3	-10	-9	-10	-9	-1000	
4	-8	-7	-8	-7		
5	-6	-5	-6	-5		
6	-4	-3	-4	-3		
7	-2	-1	-2	-1		
8	0	1	0	1		
9	2	3	2	3		
10	4	5	4	5		
11	6	7	6	7		
12	8	9	8	9		
13	10	11	10	11		
14						
15	Gradient	1				
16	y-intercept	1				



	A	B	C	D	E	F	G
1			Check for Positive m		Check for negative m		
2	x	y	x	y	x	y	
3	-10	-9	-10	-9	-1000	-1000	
4	-8	-7	-8	-7	-1000	-1000	
5	-6	-5	-6	-5	-1000	-1000	
6	-4	-3	-4	-3	-1000	-1000	
7	-2	-1	-2	-1	-1000	-1000	
8	0	1	0	1	-1000	-1000	
9	2	3	2	3	-1000	-1000	
10	4	5	4	5	-1000	-1000	
11	6	7	6	7	-1000	-1000	
12	8	9	8	9	-1000	-1000	
13	10	11	10	11	-1000	-1000	
14							
15	Gradient	1					
16	y-intercept	1					

Now, change the gradient to a negative value and the values in columns C, D, E and F should change.



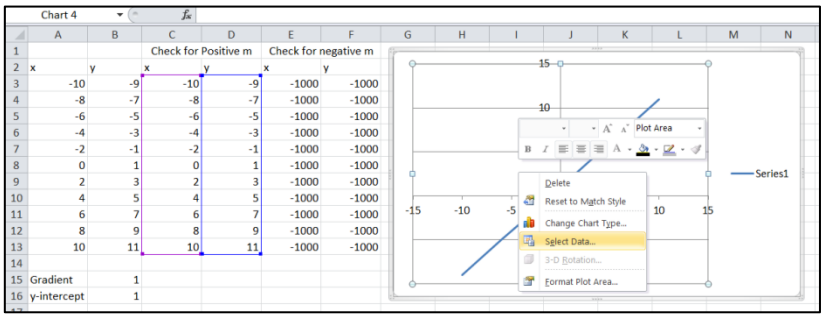
	A	B	C	D	E	F
1			Check for Positive m		Check for negative m	
2	x	y	x	y	x	y
3	-10	21	-1000	-1000	-10	21
4	-8	17	-1000	-1000	-8	17
5	-6	13	-1000	-1000	-6	13
6	-4	9	-1000	-1000	-4	9
7	-2	5	-1000	-1000	-2	5
8	0	1	-1000	-1000	0	1
9	2	-3	-1000	-1000	2	-3
10	4	-7	-1000	-1000	4	-7
11	6	-11	-1000	-1000	6	-11
12	8	-15	-1000	-1000	8	-15
13	10	-19	-1000	-1000	10	-19
14						
15	Gradient	-2				
16	y-intercept	1				

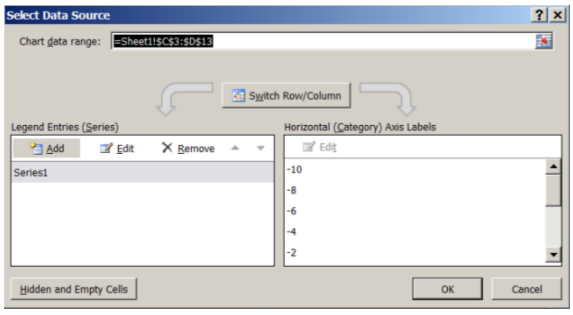
Change the gradient back to a positive value.

We now need to plot this data. Highlight cells C3 to D13 and click *Insert* > *Chart* > *Scatter with Straight Lines*.

Right click on the graph and click *Select Data*…

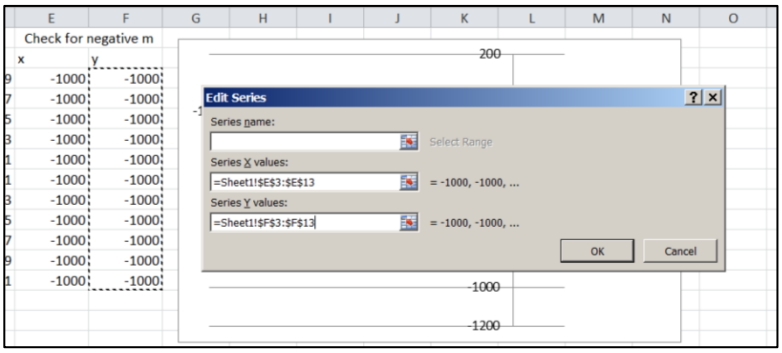
From the *Select Data* menu click *Add*.



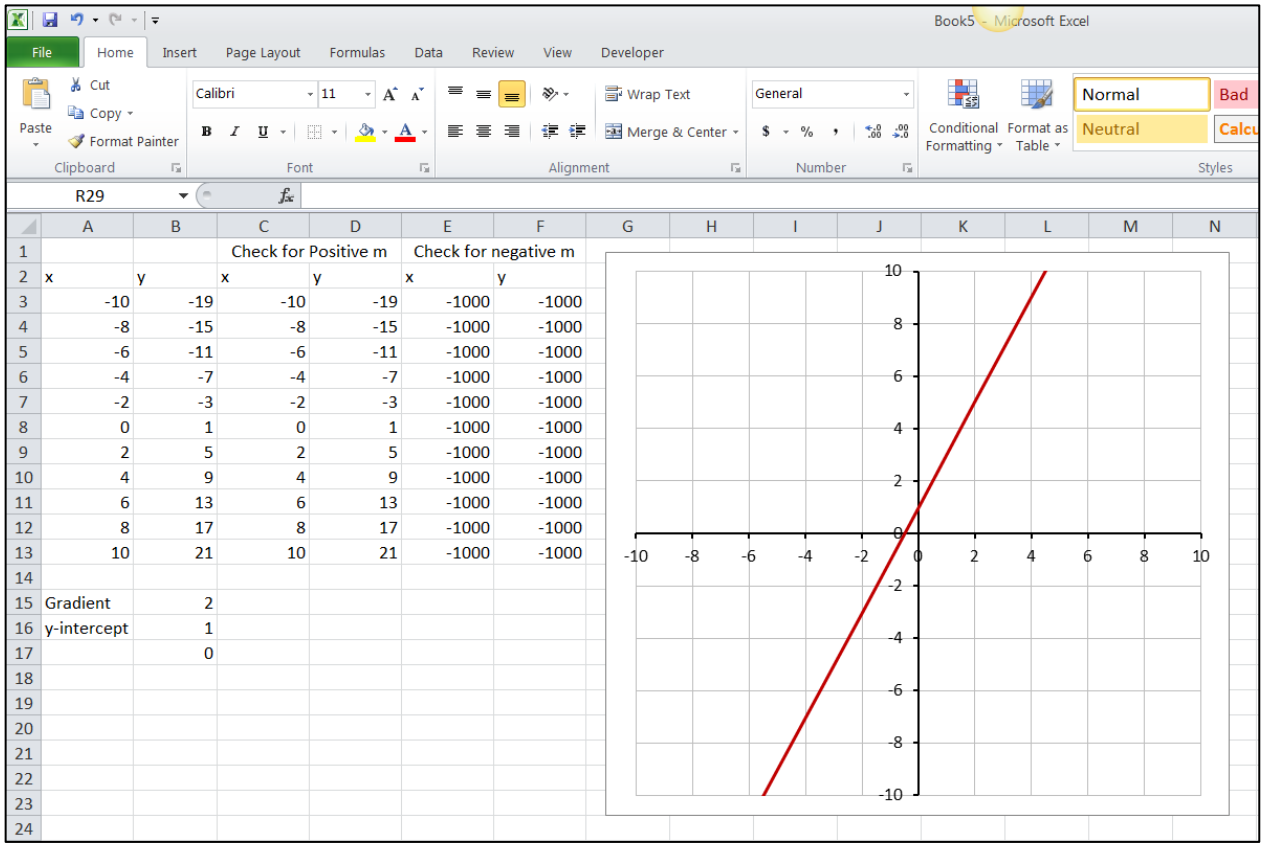


Place the cursor in the *Series X Values* box and then highlight cells E3 to E13.

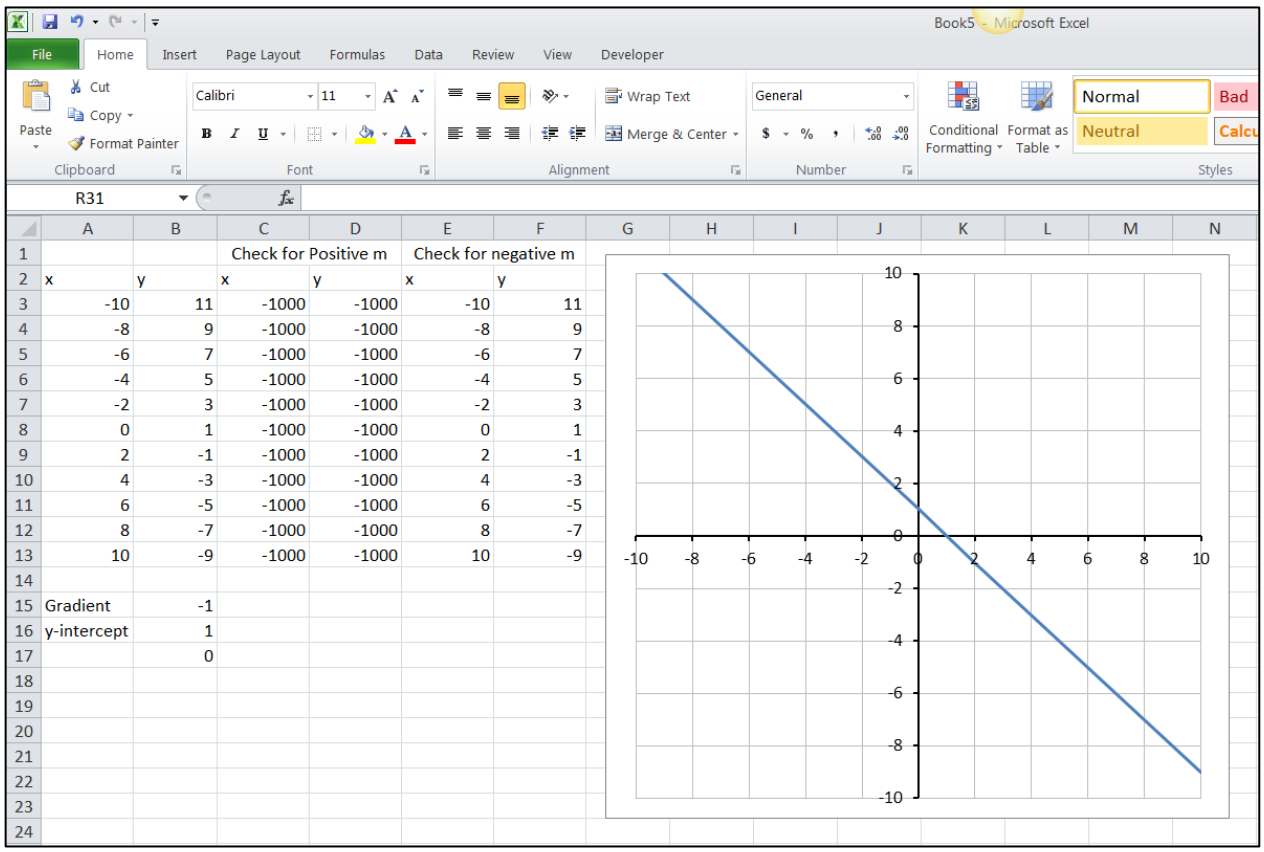
Place the cursor in the *Series Y Values* box, delete the existing contents, and then highlight cells F3 to F13.



The contents of these two boxes should now look like the screenshot on the right.
Click *Okay* twice and your graph will be updated. However, you will need to fix the range of your axes to see it clearly. Once you have fixed your axes, and formatted your graph to make it more attractive you should have something similar to the following. Note that you may need to change the colour of your lines to meet the requirements of this example. You can do this by right-clicking on your lines and selecting *Format Data Series*... and changing the line colour.



	A	B	C	D	E	F
1			Check for Positive m		Check for negative m	
2	x	y	x	y	x	y
3	-10	-19	-10	-19	-1000	-1000
4	-8	-15	-8	-15	-1000	-1000
5	-6	-11	-6	-11	-1000	-1000
6	-4	-7	-4	-7	-1000	-1000
7	-2	-3	-2	-3	-1000	-1000
8	0	1	0	1	-1000	-1000
9	2	5	2	5	-1000	-1000
10	4	9	4	9	-1000	-1000
11	6	13	6	13	-1000	-1000
12	8	17	8	17	-1000	-1000
13	10	21	10	21	-1000	-1000
14						
15	Gradient	2				
16	y-intercept	1				
17		0				
18						
19						
20						
21						
22						
23						
24						



	A	B	C	D	E	F
1			Check for Positive m		Check for negative m	
2	x	y	x	y	x	y
3	-10	11	-1000	-1000	-10	11
4	-8	9	-1000	-1000	-8	9
5	-6	7	-1000	-1000	-6	7
6	-4	5	-1000	-1000	-4	5
7	-2	3	-1000	-1000	-2	3
8	0	1	-1000	-1000	0	1
9	2	-1	-1000	-1000	2	-1
10	4	-3	-1000	-1000	4	-3
11	6	-5	-1000	-1000	6	-5
12	8	-7	-1000	-1000	8	-7
13	10	-9	-1000	-1000	10	-9
14						
15	Gradient	-1				
16	y-intercept	1				
17		0				
18						
19						
20						
21						
22						
23						
24						

Task 6

Plot 50 horizontal lines of length 1. The position of each line should be randomly determined (set suitable boundaries so they are reasonably close together. Lines which start in the first quadrant should be red, lines which start in the second quadrant should be green, lines which start in the third quadrant should be blue and lines which start in the fourth quadrant should be orange.

Hints

- The IF function can test multiple conditions by combining it with AND. For example

  =IF(AND(A1<19,A1>12),3,7)

  will display the value of 3 if A1 is between 12 and 19, and the value of 7 otherwise.

- The RANDBETWEEN function only accepts non-negative integers. If you need decimals you need to divide the random number by something. If you need negative numbers you need to subtract something from the random number.

- To plot separate line segments, leave a space between each set of coordinates