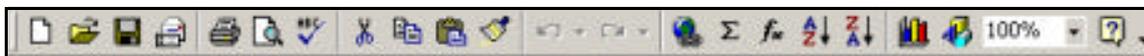


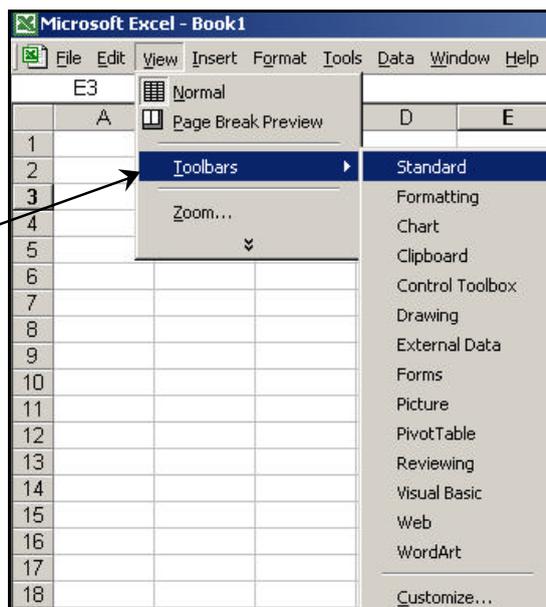
Graphs of Functions in Excel

This activity will show you how to draw graphs of algebraic functions in Excel.

- Open a new **Excel** workbook and look for the **Standard Toolbar**.



- If it is not there, left click on **View** then **Toolbars**, then **Standard** to make it appear.



- Now look for the **Chart Toolbar**.



- If it is not there, left click on **View** then **Toolbars**, then **Chart** to make it appear.



To draw the graph of $y = 3x - 2$ in Excel

- First you need to **draw up a table of values** for x and y .
Left click on **cell A1** and **type x** – the heading for column A.
Left click on **cell B1** and **type y** – the heading for column B.

x values

- To obtain whole numbers from 0 to 10 in column A:
Left click on **cell A2** and **enter the value 0**
Left click on **cell A3** and **enter the Excel formula $=A2+1$**
Excel will put the value 1 in cell A3 as shown.

| | A | B |
|---|---|---|
| 1 | x | y |
| 2 | 0 | |
| 3 | 1 | |
| 4 | | |

Now look for the little black ‘**fill down**’ square at the bottom of the right-hand side of cell A3.

‘fill down’ square

- Move the mouse until the cursor (cross) is on this square then **left click** and *at the same time* **drag the mouse** so that the cursor moves down column A.
Release the mouse button when you reach cell A12.

You should find that Excel enters values from 2 to 10 in cells A4 to A12.

Fill down copies the formula from A3 into the other cells, in each case increasing the cell reference by 1, so that each value entered is one more than the last.

y values

- Now enter the Excel formula $=3*A2-2$ in cell B2.

This tells Excel to multiply the value in cell A2 by 3 then subtract 2

Excel will work out the value of $3 \times 0 - 2$ and put the result (i.e. -2) in cell B2.

- Use **fill down** to copy the formula into **cells B3 to B12**.

The values and formulae in the cells will now be as shown here.

You can check the formulae if you wish by left clicking on each cell – the formula will appear in the box above the column headings.

| | A | B |
|----|----|----|
| 1 | x | y |
| 2 | 0 | -2 |
| 3 | 1 | 1 |
| 4 | 2 | 4 |
| 5 | 3 | 7 |
| 6 | 4 | 10 |
| 7 | 5 | 13 |
| 8 | 6 | 16 |
| 9 | 7 | 19 |
| 10 | 8 | 22 |
| 11 | 9 | 25 |
| 12 | 10 | 28 |

Values

| | A | B |
|----|----------|------------|
| 1 | x | y |
| 2 | 0 | $=3*A2-2$ |
| 3 | $=A2+1$ | $=3*A3-2$ |
| 4 | $=A3+1$ | $=3*A4-2$ |
| 5 | $=A4+1$ | $=3*A5-2$ |
| 6 | $=A5+1$ | $=3*A6-2$ |
| 7 | $=A6+1$ | $=3*A7-2$ |
| 8 | $=A7+1$ | $=3*A8-2$ |
| 9 | $=A8+1$ | $=3*A9-2$ |
| 10 | $=A9+1$ | $=3*A10-2$ |
| 11 | $=A10+1$ | $=3*A11-2$ |
| 12 | $=A11+1$ | $=3*A12-2$ |

Formulae



Now draw the graph as follows:

- Select the values in columns A and B by left clicking on cell A1 and then dragging the mouse until the cells are highlighted as shown.

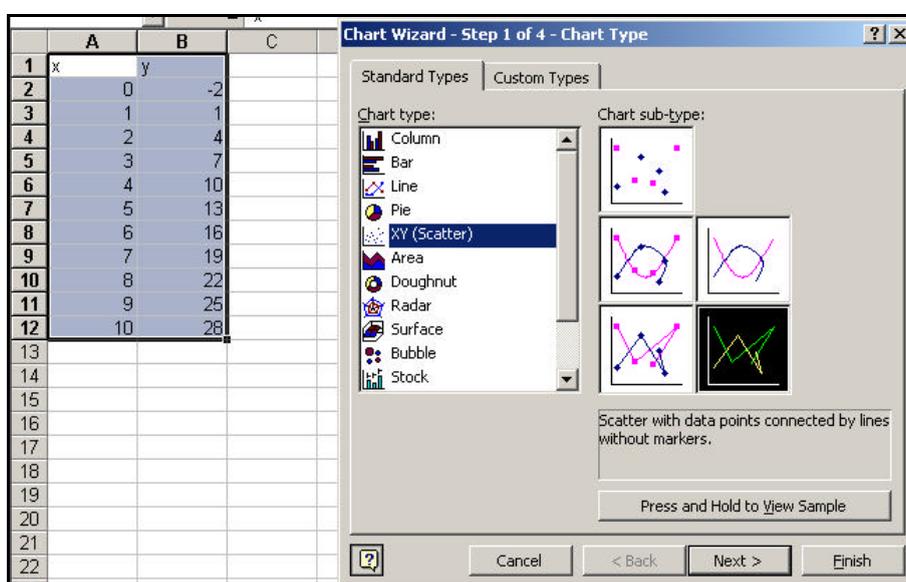
- Now left click on the **Chart Wizard**:



| | A | B |
|----|----|----|
| 1 | x | y |
| 2 | 0 | -2 |
| 3 | 1 | 1 |
| 4 | 2 | 4 |
| 5 | 3 | 7 |
| 6 | 4 | 10 |
| 7 | 5 | 13 |
| 8 | 6 | 16 |
| 9 | 7 | 19 |
| 10 | 8 | 22 |
| 11 | 9 | 25 |
| 12 | 10 | 28 |

The options for Step 1 of Chart Wizard will appear.

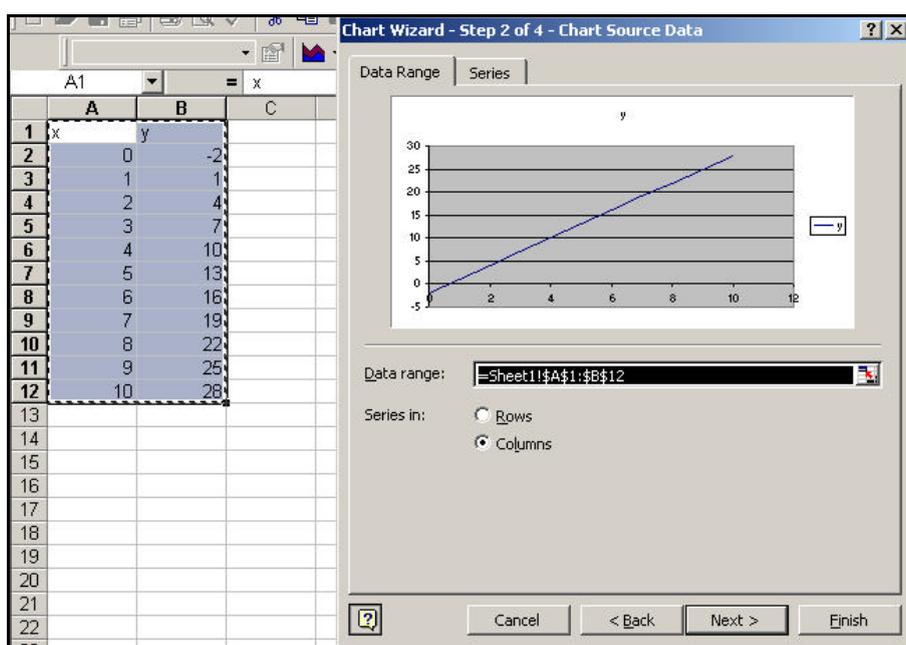
- Left click on **XY(Scatter)** and then the **last graph** to give a scatter graph 'with data points connected by lines without markers'.
- Then left click **Next**.



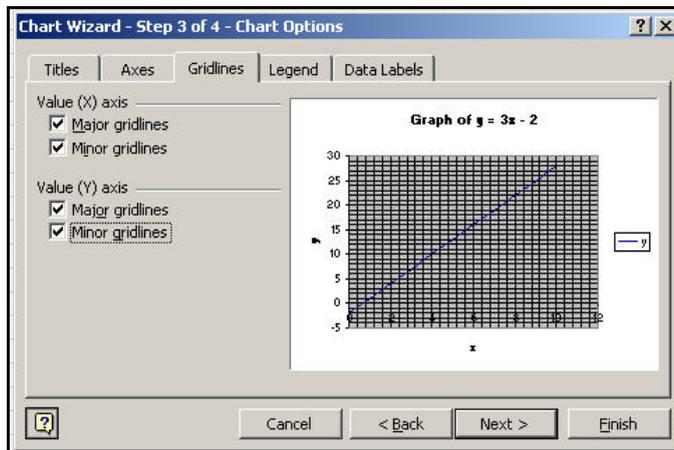
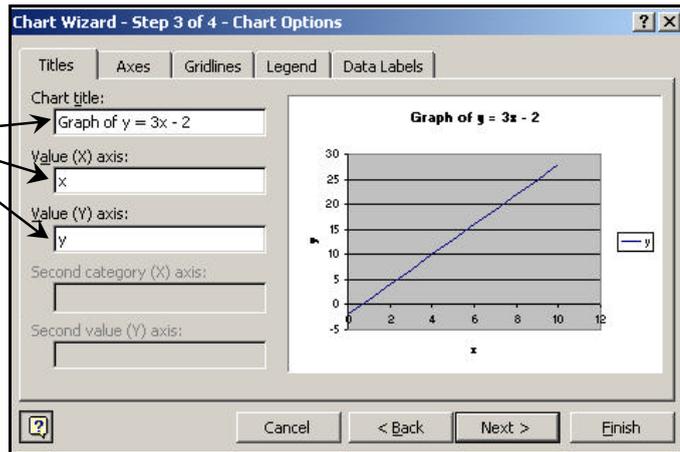
This will take you to Step 2.

This shows the Data range i.e. the references of the cells that are being used and that the series is arranged in columns.

- Left click **Next** to take you to Step 3.



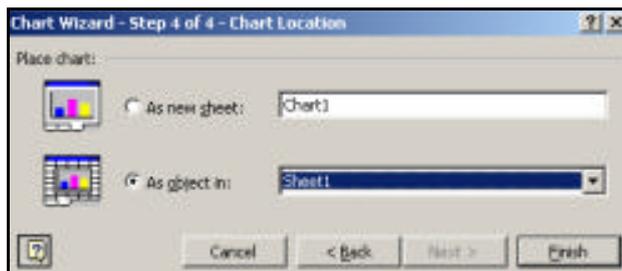
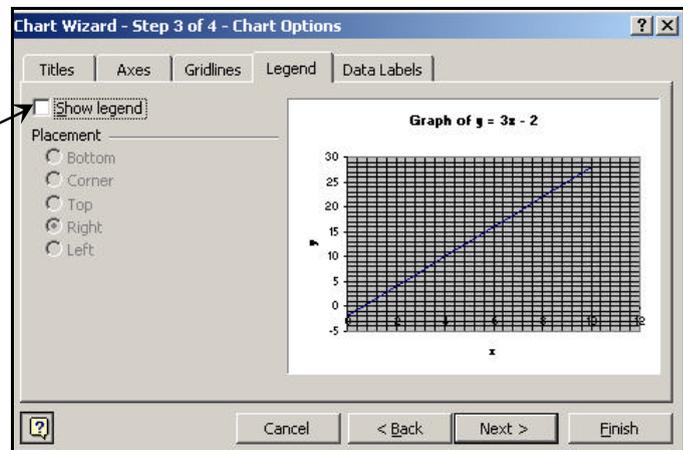
- Enter the title and labels for your graph as shown.
- Then left click on **Gridlines** at the top.



- Left click on any of the **gridline** boxes that are not already ticked. Ticks will appear and gridlines will be added to the graph as shown.
- Then left click on **Legend**.

A legend (or key) is useful when a graph has more than one line, but in this case it is not needed.

- Left click on the **Show legend** box and the tick and the legend will disappear.
- Then left click on **Next**.



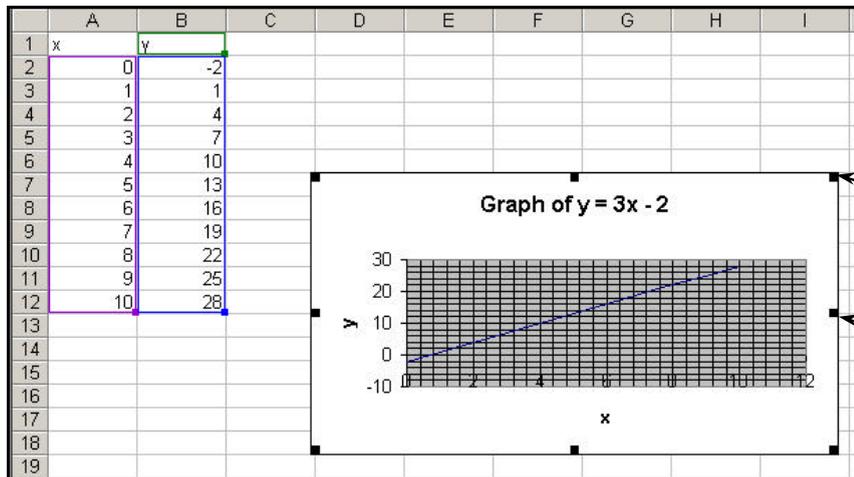
In Step 4 you are given the choice of having the graph drawn as an object on the same sheet as the table or on a new sheet by itself.

- Choose the second option as shown, then left click **Finish**.



Your graph will appear, but its appearance may leave a lot to be desired!

- Before starting to improve it, **Save your spreadsheet**, giving it an appropriate name. *Remember to save the spreadsheet periodically whilst you work on it.*



To alter the size and shape of the graph, use the handles.

- Use the **corner handles** to enlarge the graph.
- Use the **side handles** to change its shape.

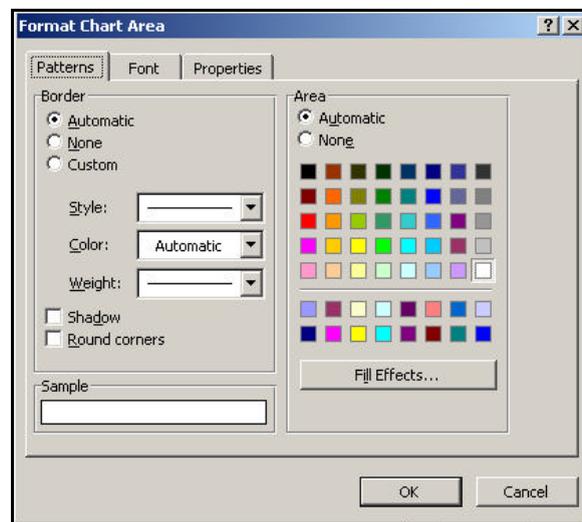
Many other features of the graph can also be improved. There is more than one way of obtaining the menus for doing this.

One way is simply to **double left click on the feature you wish to change.**

- **Left double click on the Chart Area** – this is the white part of the graph.

This menu will appear. It allows you to change the appearance of the border and background of the graph as well as the font (i.e the text) and other properties.

- **Experiment** with these if you wish, then left click **OK**.



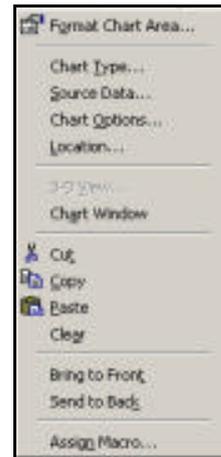
If you don't like the changes you have made, left click on the **Undo** button.



Another way to obtain the **Format menu** for a feature is to **right click on the feature**. This method lets you format the feature and do other things as well.

- **Right click on the Chart Area** of the chart.

This menu will appear. Selecting **Format Chart Area** would give the menu for formatting the chart area again. Selecting **Chart Type**, **Source Data**, **Chart Options** or **Location** takes you back to one of the Chart Wizard Steps you followed when setting up the graph.



- **Experiment** with these now if you wish.

Now try this **third way of changing things**:

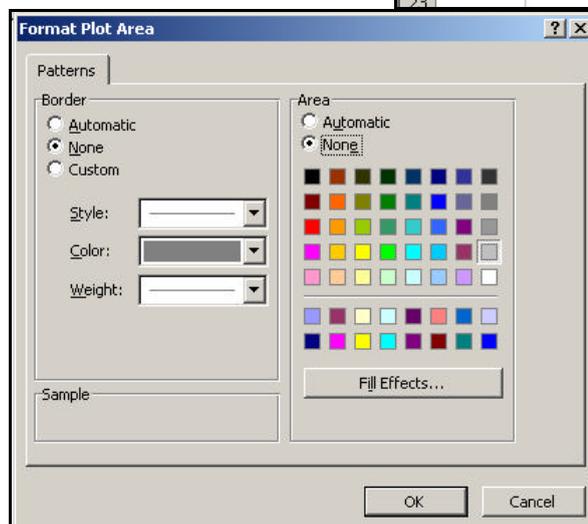
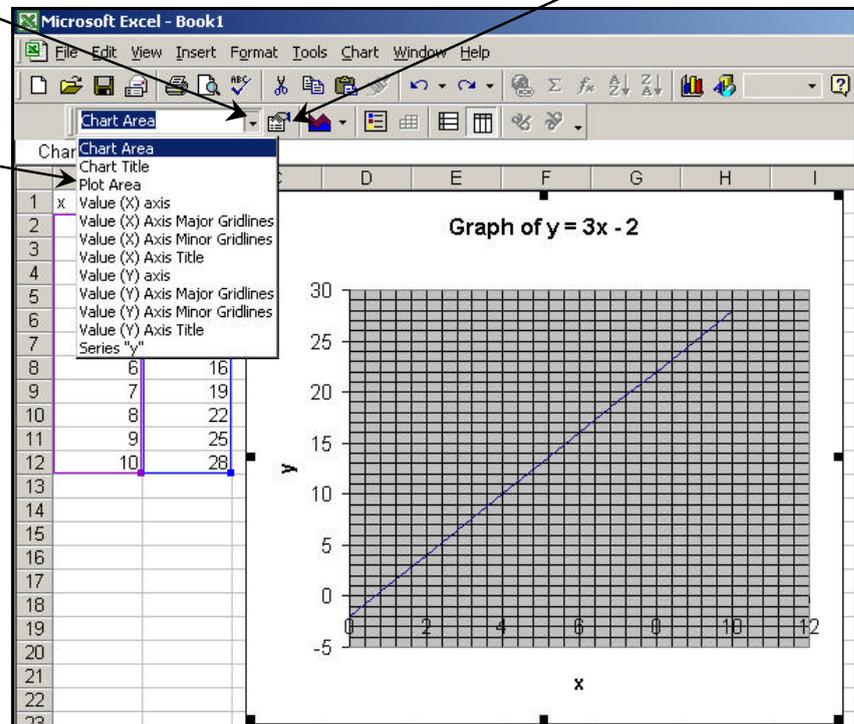
Left click the **arrow** next to 'Chart Area' on the **Chart toolbar**.

Format button

This gives a list of things you can change.

- Left click on **Plot Area** and then on the **Format button**.

The menu shown below should appear.



- Left click on both **None** boxes and then **OK**.

This will remove the grey colour from the plot area on the graph.

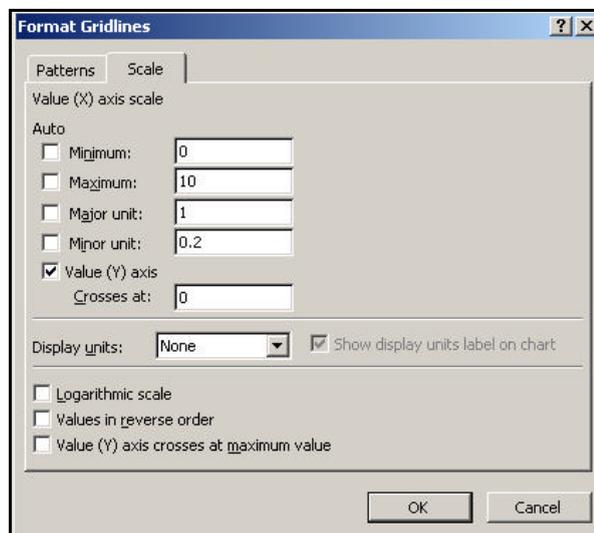
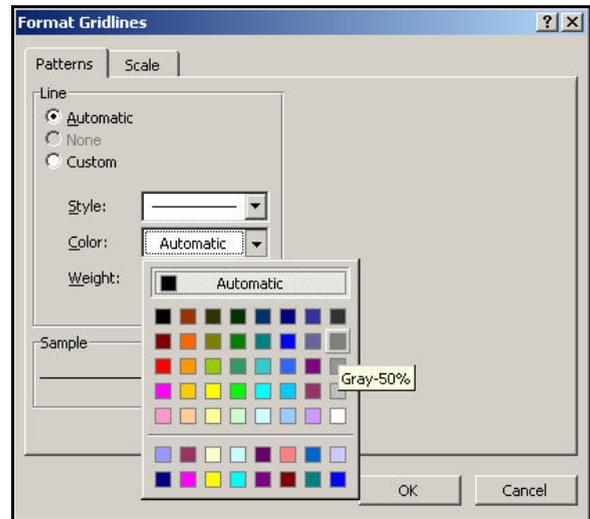


You can **alter the scale and appearance of the axes and gridlines** in a number of ways.

- On the **Chart toolbar** select **Value (X) Axis Minor Gridlines** then left click the **Format** button.
- In the **Patterns** menu set **Colour** to a mid-shade of grey, rather than Automatic (black).

This will make the minor gridlines less obvious than the major gridlines.

(Another way of doing this is use different Weights for the major and minor gridlines.)



- In the **Scale** menu enter the following values:

| | | |
|------------|-----|---------------------------|
| Minimum | 0 | N.B. If a value is |
| Maximum | 10 | already there, just |
| Major Unit | 1 | click the Auto box |
| Minor Unit | 0.2 | to remove the tick. |

When you enter values the ticks in the Auto boxes will disappear. This means Excel will keep the scale you want and not change the scale automatically if you change the size of the graph.

- Left click **OK**.

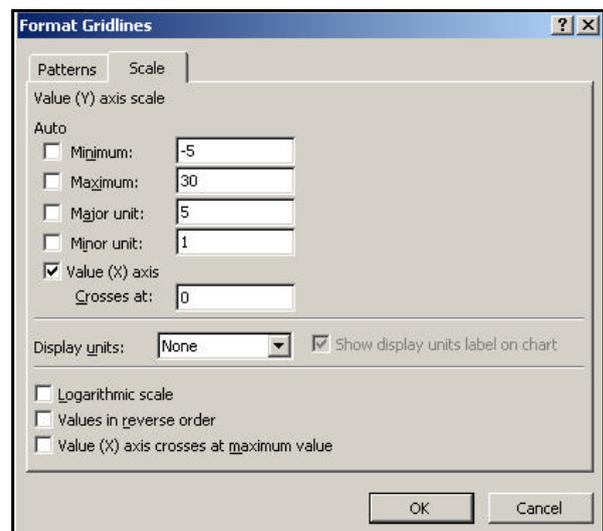
- Now select **Value (Y) Axis Minor Gridlines** on the **Chart toolbar** and left click the **Format** button.

- In the patterns menu set the **Colour** to the same shade of grey that you used earlier.

- In the **Scale** menu enter the values shown:

| | | |
|------------|-----|---|
| Minimum | - 5 | This will give a y-axis from - 5 to 30 with major gridlines at intervals of 5 units and minor gridlines at intervals of 1 unit. |
| Maximum | 30 | |
| Major Unit | 5 | |
| Minor Unit | 1 | |

- Then left click **OK**.



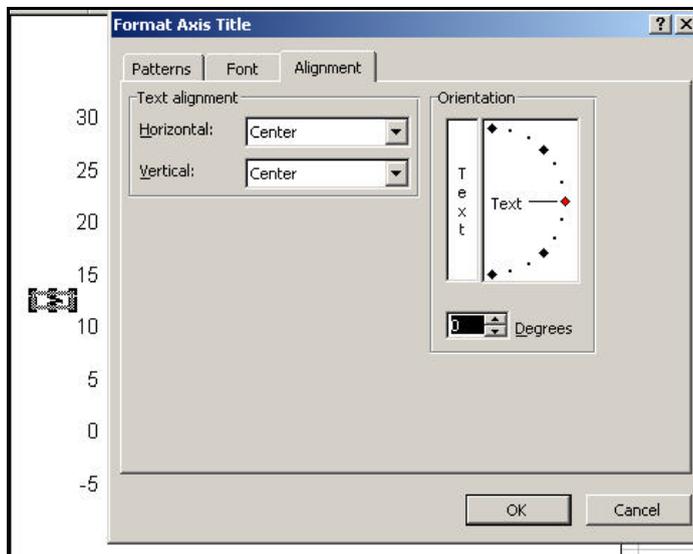
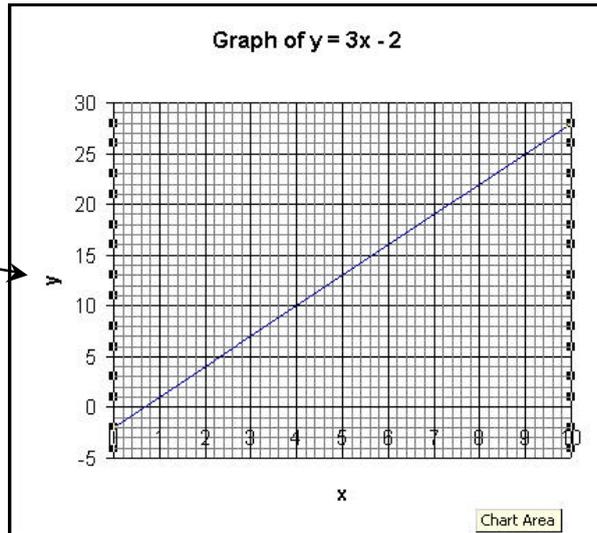
Your graph should now look like this.

The y axis minor gridlines are selected because they have just been changed.

Note that the label on the y axis looks odd.

To change the orientation:

- Left double click on the y axis title to obtain the **Format Axis Title** menu.



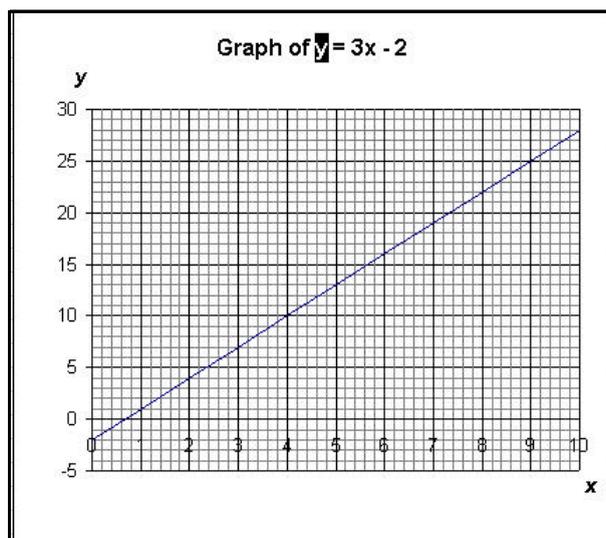
- Then left click on **Alignment**.
- Use the mouse to move the **red marker** at the end of the Text alignment line until it lies in a horizontal position. (Alternatively you could type 0 in the Degrees box.)
- Left click **OK**.

The y should now be the right way up.

- Use the mouse to **move the labels** to the ends of the axes if you wish, as shown here.

To make the letters in the titles and labels italic:

- Highlight a letter, then left click the Italic button on the Formatting Toolbar (if this is in view) or **right click on the letter**, then select **Format Chart Title** and choose the Bold Italic option from the menu.



- **Experiment** with ways of changing the appearance of your graph.
- **Draw graphs of other functions.** Some suggestions are given below.



Use Excel to draw graphs of the following functions.

In the **first three** use a scatter graph 'with data points connected by lines without markers' – the **last Scatter Graph option**.

In the **others** choose a scatter graph 'with data points connected by smoothed lines without markers' – the **3rd Scatter Graph option**.

| Function | x values | Value in A2 | Excel formulae for: | | Fill down to |
|------------------------|-----------|-------------|---------------------|---------|--------------|
| | | | A3 | B2 | |
| $y = 5x$ | 0 to 10 | 0 | =A2+1 | =5*A2 | A12 and B12 |
| $y = \frac{1}{2}x + 3$ | 0 to 10 | 0 | =A2+1 | =A2/2+3 | A12 and B12 |
| $y = 5 - 2x$ | 0 to 5 | 0 | =A2+1 | =5-2*A2 | A7 and B7 |
| $y = x^2$ | -4 to 4 | -4 | =A2+0.5 | =A2^2 | A18 and B18 |
| $y = 3x^2$ | -4 to 4 | -4 | =A2+0.5 | =3*A2^2 | A18 and B18 |
| $y = x^2 + 3$ | -4 to 4 | -4 | =A2+0.5 | =A2^2+3 | A18 and B18 |
| $y = \frac{1}{x}$ | 0.2 to 5 | 0.2 | =A2+0.2 | =1/A2 | A26 and B26 |
| $y = \frac{2}{x}$ | 0.2 to 10 | 0.2 | =A2+0.2 | =2/A2 | A51 and B51 |

Experiment with other functions if you have time.



Teacher Notes

Unit Intermediate Level, *Using algebra, functions and graphs*
Intermediate Level, *Making connections in mathematics*
Advanced Level, *Working with algebraic and graphical techniques*

Skills used in this activity:

- drawing graphs of functions in Excel

Preparation

Students need to have some basic knowledge of computer terminology and the use of computers (eg how to use the mouse and menus in Excel).

Notes on Activity

This activity can be used at the start of the course to introduce graph plotting in Excel. The functions listed on page 9 can be altered or extended as you wish.

Suggested follow-up activities are listed below:

Using algebra, functions and graphs – Spreadsheet Graphs (in Skills Activities)

Making connections in mathematics – Linear Graphs (in Skills Activities)

Working with algebraic and graphical techniques – Interactive Graphs (in Starters)

