

Task 3 — More about Charting in Excel 2003

The third task gives further details about charting (in Excel 2003). In particular some of the many ways in which the appearance of a chart can be improved are explained. On the downside, some limitations are noted too. *Note that Excel 2003 is not the most recent version of Excel 2003, and Excel 2007, the next version of Excel, has a significantly different user interface.*

Outline Requirements

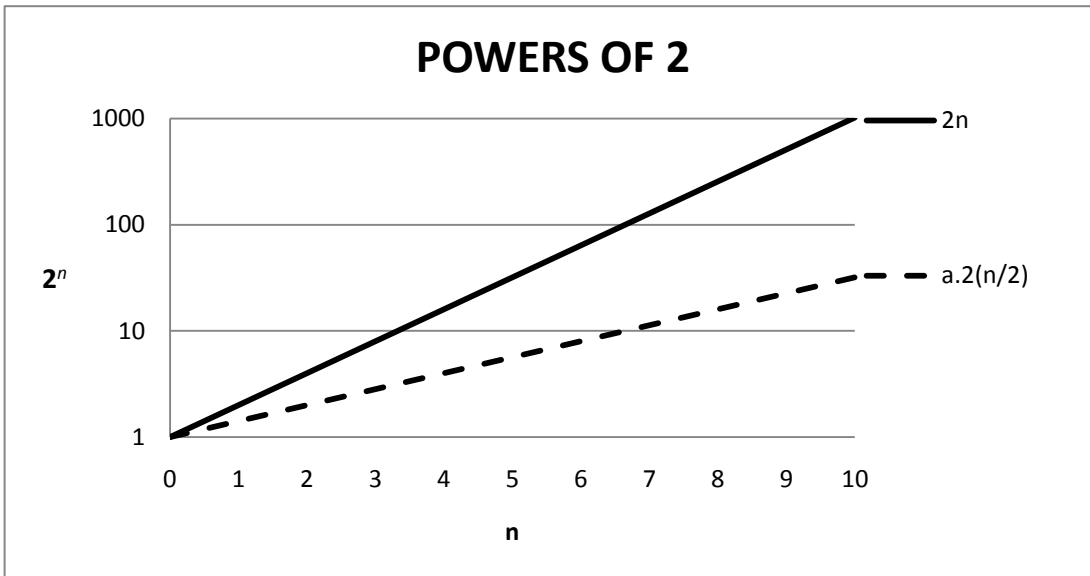
1. Log in to a PWF workstation.
2. Set up, in the Maths folder, an Excel file Powers.xls which contains a single worksheet with an embedded chart whose appearance is roughly as shown overleaf.
3. Use Edit | Fill ► Series... to set up the first two columns. [Page 3.3 *et seq.*]
4. Use Insert | Name ► Create... to associate the name **a** with the value 1. [Page 3.14]
5. Print the result and show the hard-copy to a demonstrator.
6. Work through problem 4: the Bacterial Growth problem.
7. Note the results of the experiments suggested at the end of problem 4.

Check-List

The demonstrator will have the following questions in mind when inspecting your work:

1. Are the four columns of information centred over the embedded chart?
2. Is the entire worksheet centred horizontally?
3. Are the headings right aligned?
4. Are the superscripts in the headings and in the chart as overleaf? [Pages 3.4 and 3.12]
5. Are there always two places shown after decimal points? [Page 3.12]
6. What formula gives rise to the value 1.00? [Page 3.14]
7. Have the tick marks been removed from both axes? [Page 3.8]
8. Does the chart contain two data series, one shown as a solid line and the other shown as a broken line? [Page 3.12 *et seq.*]
9. Do the two lines in the legend approximately align with the end points of the two data series? [Page 3.13]
10. Are the labels in the legend as overleaf (and so not very satisfactory!)? [Page 3.15]
11. What happens to the broken line when the value associated with **a** is changed from 1 to 4, then 10, then 32, then 100, then 0.1 in turn? [Page 3.15]
12. **Is there a footer showing your name and college?**

n	2^n	$a \cdot 2^{(n/2)}$	a
0	1	1.00	1
1	2	1.41	
2	4	2.00	
3	8	2.83	
4	16	4.00	
5	32	5.66	
6	64	8.00	
7	128	11.31	
8	256	16.00	
9	512	22.63	
10	1024	32.00	



Task 3 — More about Charting in Excel 2003

Synopsis: Series. Formatting and Editing Charts. Naming Cells. Chart Sheets.

Briefing

The version of Excel referred to in this document is Microsoft Excel 2003. *Note that Excel 2003 is not the most recent version of Excel 2003, and Excel 2007, the next version of Excel, has a significantly different user interface.* Task 2 touched on the charting facilities available in Excel 2003. Some more advanced facilities are introduced in this session.

Guided Practical Session

- Log in to a PWF.
- Close the Message-of-the-day window.
- Start Excel:

`start | Programs | Spreadsheets Maths and Statistics | MS Excel`

A Linear Series

The first illustration in this session shows a quick way of putting the values 1 to 10 into cells A1 to A10. Such a sequence is referred to by Excel as a *Series*. Since the values increase at a uniform rate, this is a *linear* series.

- Check that A1 is the active cell. Key in 1 and click the Enter box to confirm.
- Open Edit and choose Fill ► Series...

The Series dialogue box offers several options but it is simple to see what is required. The series is to be arranged in a column, it is linear and it increases by one at each step until it reaches a final value of 10. Some options are correct by default:

- Click the Columns option button under the heading Series in.
- Check that Linear is selected under Type by default.
- Check that the Step value is 1 by default.
- Click in the Stop value box and key in 10.
- Click OK. The values 1 to 10 should appear in the first *column*.

If the values appear in the first *row* you forgot to click the Columns option button.

A Growth Series

Go back a step before embarking on the second illustration:


- Open Edit and choose Undo Series. All but cell A1 should be cleared.
- Check that A1 is the active cell and has the value 1.
- Drag from cell A1 to cell A11 to select the first *eleven* cells in column A.
- Open Edit and choose Fill ► Series...
- Check that the Columns option is still selected and for this second illustration...

- Click the **Growth** option button under **Type**.
- Change the **Step** value to 2. Leave the **Stop** value blank.


With a linear series, a step value of 2 would mean that the values increased by 2 at each step as in 1,3,5,7,... With **Growth** selected the values are *multiplied* by 2 at each step as in 1,2,4,8,...

There are two ways of determining how far a series will run. You can *either* specify an explicit **Stop value** *or* you can select a range of cells to be filled before you embark on the **Fill ▶ Series...** command.

Given, this time, that the range A1:A11 has been selected, the doubling will continue until a value has been calculated for cell A11:


- Click **OK** and the series appears in the first 11 cells in column A. These values are powers of 2 running from 1 (2^0) to 1024 (2^{10}) so 2^n will be used as a heading...
- Click row label 1 to select the whole of row 1.
- With the pointer somewhere in this row, click the *right-hand* mouse button.
- From the pop-up menu choose **Insert**. A blank row appears at the top.
- Make A1 the active cell and key 2^n (we'll convert this to 2^n in a moment) into this cell. Click the Enter box to confirm and then click the **Align Right** button () to align 2^n with the values below it.

To turn 2^n into 2^n takes two steps: n is made italic and then made a superscript...

- Check that A1 is still the active cell and *in the Formula Bar* drag across the letter n only. This selects the letter n as can be seen by the highlighting (which extends to the right-hand end of the Formula Bar).
- With the n selected, open **Format** and choose **Cells...** Note the **Font style** heading in the **Format Cells** dialogue box.
- Click **Italic** in the list box under **Font style**.
- Click the **Superscript** checkbox under **Effects**.
- Click **OK** and then click the Enter box to complete the process. You should see something like 2^n in cell A1 (but the version in the Formula Bar is unchanged).
- Click the **Bold** button () to make the heading bold.

A Graph

The powers of two can be plotted on a graph. The **Chart Wizard** will be used:

- Select the range A1:A12 (include the heading).
- Click the **Chart Wizard** button () in the Standard Toolbar.
- The **Step 1** tab dialogue box is headed **Chart Type** and has two tabs. Ensure that the **Standard Types** tab is selected; click it if it is not.
- The **Standard Types** tab offers numerous **Chart types** with several **Chart sub-types** for each. Select **Line** (as the **Chart type**) and the fourth **Chart sub-type** should be selected

by default. This latter is described as **Line with markers** displayed at each data value.

- Click **Next>** to go on to **Step 2**.
- The **Step 2** tab dialogue box is headed **Chart Source Data** and has two tabs. Ensure that the **Data Range** tab is selected; click it if it is not.

The preview chart in **Step 2** shows a draft version of the chart. Below the preview chart there is a note that the range that you selected is **Sheet1!\$A\$1:\$A\$12\$** (the dollar-signs have no significance here). There is also confirmation that the **Series** is in a **Column**.

The preview chart reveals a couple of problems:

1. The vertical scale has to accommodate values up to 1024 even though the majority of the values plotted are less than a tenth of this maximum. The left-hand half of the plot is not very useful. A logarithmic plot would be better and this alternative will be explored shortly.
2. The numbers against the horizontal axis are not very sensible. You should be able to read 1 to 11 (though 10 may be missing its second digit). Since the series runs from 2^0 to 2^{10} it would be better if the labels ran from 0 to 10.

The sensible way to proceed now is to go back one step and see whether there is a more suitable **Chart type**:

- Click **<Back** to go back to **Step 1**.
- Scroll down the list of **Chart types**. Unfortunately there is no sign of a logarithmic type.
- Select the **Custom Types** tab. There may be a short wait while these more specialised types are loaded. Scroll down the list of **Chart types** now and notice that **Logarithmic** is in the list.
- Select **Logarithmic**. A preview chart under the heading **Sample** shows a straight line plot which is what you should expect.
- Click **Next>** to go on to **Step 2**. The preview chart now looks better but there is still the problem with the numbers against the horizontal axis.
- Select the **Series** tab.

The **Series** tab gives a clue. The **Name** text box shows that the name of the chart has been taken from cell **Sheet1!\$A\$1** and the **Values** text box shows that the values have been taken from the range **Sheet1!\$A\$2:\$A\$12\$**. A third text box shows where the **Category (X)** axis labels have come from and this box is blank. This matter will be attended to later.

- Click **Next>** to go on to **Step 3**.
- The **Step 3** tab dialogue box is headed **Chart Options** and has six tabs. Ensure that the **Titles** tab is selected; click it if it is not.
- In the **Chart title** text box replace 2^n by **POWERS OF TWO**.
- Click in the **Category (X)** axis text box and key n into that box.
- Click in the **Value (Y)** axis text box and key 2^n (which will eventually be converted to $2''$) into that box. This probably appears sideways on the preview chart.

Next look at the other Chart Options tabs:

- Select the **Axes** tab. There are two checkboxes, one for the **Category (X) axis** and one for the **Value (Y) axis** and both checkboxes show a tick (✓).
- Click these two checkboxes in turn and notice that the numbers against the two axes on the preview chart are removed.
- Click these two checkboxes again and notice that the numbers against the two axes reappear which is what you want.
- Select the **Gridlines** tab. The *gridlines* on a chart take the form of horizontal or vertical lines which run the full width or height of the chart. The **Gridlines** tab probably indicates that there are no **Category (X) axis** gridlines but, on the **Value (Y) axis**, there are **Major** gridlines. Leave these checkboxes alone at this stage.
- Select the **Legend** tab. You can probably see the legend against the right-hand side of the preview chart. It includes a tiny 2^n (and not 2^n which would be better).
- Click the **Show legend** checkbox to deselect the legend.
- Select the **Data Labels** tab. There are probably no ticks in any of the checkboxes.
- Click the **Value** checkbox. Notice that each marked point on the plot shows the value associated with that point. Deselect the **Value** option.
- Click the **Category name** checkbox. Notice that each marked point on the plot shows the (ill-chosen) value on the x -axis. Deselect the **Category name** option. There seems no good reason this time for selecting any of the options.
- Select the **Data Table** tab and click the **Show data table** checkbox. A table appears below the x -axis showing the data in tabulated form.
- Click the **Show data table** checkbox again to deselect this feature.

Now move on to the last step:

- Click **Next>** to go on to **Step 4**.
- The **Step 4** dialogue box is headed **Chart Location** and has no tabs. Ensure that the chart will be placed **As object in: Sheet1** and click **Finish**. The completed chart appears.
- Use the drag handles on the chart border to make the chart exactly fill the region **D1:K15**.

This chart will be improved in several ways but first save the worksheet...

Saving the Worksheet

Remember that you can use the **Save** button with a new workbook because **Excel** will automatically behave as though the **Save As...** command had been given:

- Click the **Save** button on the Standard Toolbar. The list box in the **Save As** dialogue box shows your top-level folders including **Notes**.
- Double-click the **Notes** folder and check that the list box shows the folders contained in **Notes** including **Maths**.
- Double-click the **Maths** folder. It is likely that no files are shown in the list box because you probably have no **Excel** files in the **Math** folder yet.

- Click in the File name text box and overwrite whatever is in it with Powers and click Save. This saves the file, and Book1 in the Title bar changes to Powers.xls.

Chart Items — Terminology

The different parts of a chart are referred to as *chart items* and it is useful to rehearse some of the terminology before looking at a few of the many facilities for formatting and editing charts.

The three most important chart items are the two axes and the line of the plot. The horizontal axis is variously referred to as the *Category (X) axis* or the *x-axis* and the vertical axis is variously referred to as the *Value (Y) axis* or the *y-axis*. The line is formally called a *data series* and note that this has a *marker* (a diamond-shaped blob) at each point.

The two axes form the left-hand and lower boundaries of the *Plot Area*, the central region of the chart. The Plot Area lies within the *Chart Area* which is delimited by the outermost boundary of the chart.

Each axis has an *Axis Title* (n and 2n at the moment) and the *Chart Title* is at the top. Both axes also carry *labels* (the values 1 to 11 and 1 to 10000).

The *x-axis* has obvious *tick marks*, little lines which dangle down from the axis near the labels. The *y-axis* also has tick marks which stick out to the left of the axis but, as noted earlier, it also has gridlines which run across the full width of the Plot Area. The *major* gridlines are associated with the labels 10, 100 and so on. It is possible to have *minor* gridlines too which indicate sub-divisions.

A chart can also have a legend but this item was deselected earlier.

- Move the pointer to the various items in the chart and notice that, after a one-second wait, an advisory notice appears close to the pointer. The notice usually indicates what the item is. When you point at a marker on the data series the notice even gives the value at that point.
- Next, (single-)click on the various items in the chart. In most cases this action selects the item and it is highlighted in some obvious way. Try selecting the main title, the *x-axis* and the data series in turn.
- Click in the Chart Area, anywhere just inside the surrounding border. When the Chart Area is selected, the selection is indicated by the appearance of the eight drag handles that were present when the chart first appeared.
- Notice the Chart menu in the Menu bar. Click an arbitrary cell *outside* the chart. This deselects the chart (all evidence of selection disappears) and the Chart menu is replaced by the Data menu.

The Chart Menu

If you wish to revise a decision made when using the Chart Wizard the Chart menu is the one to use. This exists only if the chart is selected:

- Click somewhere *inside* the chart. This selects some item of the chart and the Chart menu takes over from the Data menu in the Menu bar.
- Open Chart and notice that the first four entries exactly correspond to the four steps in the Chart Wizard:
 1. Chart Type...

2. Source Data...
3. Chart Options...
4. Location...

Suppose you wish you had opted for vertical gridlines as well as horizontal gridlines:

- Open **Chart** and choose **Chart Options...** This opens the **Chart Options** tab dialogue box.
- Select the **Gridlines** tab and arrange for both **Major gridlines** checkboxes to have ticks in them and both **Minor gridlines** checkboxes to be clear. The preview chart displays the vertical gridlines.
- Click the *lower* **Minor gridlines** checkbox and notice how the new gridlines act as subdivisions appropriate to a semi-log plot.
- Click the *lower* **Minor gridlines** checkbox again to clear the sub-divisions.
- Click **OK**. This closes the dialogue and the real chart appears with its new gridlines.

By using other tabs in the **Chart Options** dialogue box one can change other decisions made earlier. For example one can bring back the legend or add data labels to the markers.

A more significant use of the **Chart** menu will be to attend to the problem of the labels on the *x*-axis which currently run from 1 to 11 but should run from 0 to 10. This problem will be kept pending for another couple of pages.

Formatting a Chart — The Format Menu and Double-Clicking

The **Chart** menu is for revisiting old ground. It is possible to make additional refinements to a chart using the **Format** menu. In general terms, one selects some chart item which one wants to adjust and then opens the **Format** menu. This menu will know which item has been selected.

As an illustration, consider the vertical axis. It seems silly to have tick marks as well as gridlines and it would be as well to remove them. It also seems silly to extend the axis as far as 10000 when the maximum value (1024) is only a little above 1000. The **Format** menu can be used as follows:

- First, select the **Value (Y) axis** by clicking one of its labels (for example, click 100). [One could also select the axis by clicking a tick mark or the axis itself.] Notice that a blob appears at each end of the axis to indicate selection.
- Open **Format** and notice that the first entry is **Selected Axis...** Choose that command to open the **Format Axis** tab dialogue box which has five tabs.
- Ensure that the **Patterns** tab is selected; click it if it is not. One of several sets of options boxes specifies that the **Major tick marks** are **Outside** the axis. Change from **Outside** to **None**. This will clear the tick marks.
- Next, select the **Scale** tab. The information in this tab includes a ticked checkbox which indicates that a **Logarithmic scale** is being used for this axis. Note also that the **Maximum** is 10000.
- Click in the **Maximum** box and change the value to 1000. Click **OK**. This closes the tab dialogue box and the real chart appears with the tick marks removed from the vertical axis and the maximum value is now 1000.




The next step is to remove the tick marks from the horizontal axis. One could go through the same procedure of selecting the axis, opening **Format** and then choosing **Selected Axis...** but there is a quicker way:

- First, select the **Category (X) axis** by clicking one of its labels. Again, a blob appears at each end of the axis to indicate selection.
- Next, *double-click* the label. This action takes you straight to the **Format Axis** tab dialogue box. It was unnecessary to do the single-click to select but that action is recommended so you can verify that you are formatting the right item.
- Almost certainly the **Scale** tab is selected since this was the last tab used on the vertical axis. The **Scale** tab has a rather different appearance now because the horizontal axis is linear rather than logarithmic. Leave the entries in this tab alone.
- Select the **Patterns** tab. Clear the **Major tick marks** as before. Click **OK**.

The tick marks are removed from the horizontal axis of the real chart. The labels **1** to **11** still need changing but the **Format Axis** dialogue box is not the place to make such a change.

Formatting a Chart — Changes to a Data Series

The next step is to format the data series to remove the markers:

- Click somewhere on the line of the plot between two markers. This *selects the data series*. Notice that large blobs appear on all the markers to highlight the selection.
- Open **Format** and choose **Selected Data Series...** to open the **Format Data Series** tab dialogue box which has six tabs.
- Immediately click **Cancel** to close the box. Open it again the quicker way...
- Click somewhere outside the chart and then *double-click* somewhere on the line of the plot. This opens the **Format Data Series** tab dialogue box in a single step.
- Ensure that the **Patterns** tab is selected; click it if it is not. Under the **Line** heading, the **Automatic** option has been selected by default. This gives a solid coloured line.
- Click the  next to the **Style** box. This opens a drop-down list box which shows various styles of line. You could select long dashes or short dashes and so on. The default solid line seems a good choice so click the  next to the **Style** box again to get rid of the drop-down list box.
- Click the  next to the **Color** box. This opens a drop-down palette of colours.
- Click the black square in the palette. This will change the colour of the line.

Notice that by specifying a colour, the **Automatic** option is deselected and the **Custom** option is selected instead.

Under the **Marker** heading, the **Automatic** option has likewise been selected by default. This gives the diamond-shaped markers which are not needed, so...

- Click the **None** option then...
- Click **OK**. This closes the dialogue box. The markers appear still to be present but this is an illusion. What you see is a highlighting effect to show that the data series is still selected.

Changing the Chart Type to XY (Scatter)

The labels on the *x*-axis currently run from 1 to 11 rather than from 0 to 10. No information has been supplied in the worksheet to specify what the labels ought to be and Excel simply noted that there were eleven values and naïvely used 1 to 11 for the labels.

The difficulty stems from choosing a Line chart in Step 1 of the Chart Wizard. The proper choice would have been to use an XY (Scatter) chart, in which one set of values is plotted against another and both sets of values are specified explicitly:

- Open Chart and choose Chart Type...
- Select XY (Scatter).
- Select the fourth Chart sub-type Scatter with data points connected by lines.
- Click OK.

Two consequences of this change are that the tick marks reappear and the markers reappear on the data series. These features are still unwanted and a little revision is in order:

- Remove the tick marks from both axes. Note that a quick way of doing this is to remove the tick marks from one axis, then select the other axis and press the F4-key (the repeat-last-action key).
- Assuming the markers have reappeared on the data series remove them too.

The labels on the *x*-axis now run from 0 to 12. Excel still doesn't know what the values should be and the Source Data dialogue box will give a clue as to what is happening:

- Open Chart and choose Source Data...
- Click the Series tab in the Source Data dialogue box.

The text boxes record the way the Chart Wizard interpreted your original selection on the worksheet.

The Name of the data series is taken from the first cell A1. The *full address* of this cell includes the sheet name which is Sheet1. This name is separated from the *cell identifier* by an exclamation mark. The full address of the first cell is therefore Sheet1!\$A\$1.

The values which constitute the data series, the Y Values, are in a range whose full address is Sheet1!\$A\$2:\$A\$12.

On the other hand, the X Values box is waiting for an appropriate range and this means making a temporary excursion:

- Click Cancel to close the dialogue box.
- Select cell A1. This is outside the chart so the Chart menu is replaced by the Data menu.
- Open Insert and choose Columns. A new blank column appears on the left. The data series and the chart move to the right.
- Make A2 the active cell. Key 0 into cell A2.
- Click the Enter box to confirm.
- Open Edit and choose Fill ▶ Series...
- Select the Columns option. Leave the Type as Linear and leave the Step value as 1.

- Set the Stop value to 10.
- Click OK.

This should put the values 0 to 10 in cells A2 to A12. Check this.

- Make A1 the active cell. Key in n and click the Enter box to confirm.
- Right-align this n and make it bold and italic.

This has incorporated into the worksheet the values which are suitable labels for the x -axis. You can now pay attention to the chart again:

- Click anywhere in the chart. Note that the Chart menu takes over from the Data menu once more.
- Open Chart and choose Source Data...
- Click in the X Values box and be prepared for an unusual window which appears when you drag out a region of the worksheet...
- Check that the insertion point is in the X Values box then, in the worksheet, drag from cell A2 to cell A12 to select the values 0 to 10 which are required as labels for the x -axis. A curious window with a single text box indicates how the dragging process is proceeding. When the mouse button is released the range Sheet1!\$A\$2:\$A\$12 should appear in the X Values box.
- Click OK.

The data series now runs through the point (0,1) and the labels are appropriate: it is now more obvious that 2^6 has the value 64. Next, shorten the axis:

- Double-click a label on the Category (X) axis to open the Format Axis tab dialogue box.
- Select the Scale tab.
- Change the Maximum to 10 and change the Major unit to 1.
- Click OK. At last the x -axis labels are as required.

Formatting a Chart — Changes to Titles

- Click, in turn, the n , the $2n$ and the POWERS OF TWO titles. Whenever titles are selected in this way a border appears highlighting the item.
- With POWERS OF TWO selected, drag across the word TWO from left to right. This highlights the word. Key in 2 so the chart title changes to POWERS OF 2.
- Double-click $2n$ to open the Format Axis Title tab dialogue box.
- Select the Font tab and change the Size to 11 points.
- Select the Alignment tab. Under the Orientation heading, the orientation is indicated in Degrees. Set the orientation to 0 Degrees.
- Click OK. The $2n$ axis title should now be horizontal.
- With $2n$ still selected, drag across the n to highlight that letter.
- Open Format and choose Selected Axis Title...

- Select *Italic* in the list box under **Font style** and click the **Superscript** checkbox under **Effects**. Click **OK**. The axis title should now look more like 2^n .
- Change the other axis title from n to n .

Formatting a Chart — Changes to the Plot Area

- Click somewhere in the Plot Area but not too close to the line on the plot or to a gridline or to an axis. This selects the Plot Area. Several handles appear which you could use to change the size and shape of the Plot Area.
- Double-click somewhere in the Plot Area to open the **Format Plot Area** dialogue box.

The **Format Plot Area** dialogue box is simple. Under the **Border** heading you can see that the **Custom** option has been selected by default. This is a grey line. You haven't seen it because it is covered by the two axes and the topmost and rightmost gridlines:

- Select the **None** option under the **Border** heading.
- Ensure that the **None** option is selected under the **Area** heading too. There is no need for a fancy background.
- Click **OK**. The chart now has a clean and uncluttered appearance.

Editing a Chart — Incorporating a new Data Series

The alterations which have been made so far are described as *formatting* actions in the **Excel** documentation. They are to be contrasted with *editing* actions which include adding new points to a data series or adding a new data series to a chart.

To add a second data series to the chart, a new series must be entered into the worksheet:

- Click cell **C2** and thereby make **C2** the active cell.
- Key in the formula `=SQRT(B2)` and click the **Enter** box to confirm.
- Check that **C2** is still the active cell complete with its emphasised border indicating selection. Notice the little black square at the bottom right-hand corner of the border. This is the *Fill handle*.
- Point to the **Fill handle** and notice that the pointer changes to a **+-sign**.
- Drag the **Fill handle** downwards to cell **C12** and release the mouse button. This is the standard short-cut way of filling and is known as *AutoFill*.

Each cell in the **C** column takes on the square root of the value of its neighbour in the **B** column. The default **Format Category** is **General** and the result is a mixture of whole numbers and numbers taken to several decimal places. This looks messy:

- Check that the range **C2:C12** is still selected, open **Format** and choose **Cells...**
- Select the **Number** tab and select **Number** as the **Format Category**. Check that the number of **Decimal places** is shown as **2**.
- Click **OK**. The values in the **C** column look much tidier.
- Make **C1** the active cell and key $2^{(n/2)}$ into the cell and click the **Enter** box to confirm.
- Make this entry look as much like $2^{(n/2)}$ as you can (only the n is italic). Right-align the entry and make it bold.

One way to incorporate a new data series into a chart is known as *drag and drop* (however, **note that you cannot use this technique to add a new data series to a chart in Excel 2007**):

- Select the range C1:C12 (include the heading).
- Move the pointer to somewhere on the border of the selected range so that it takes the form of a broad arrow (keep clear of the fill handle).
- Drag the border to somewhere in the chart (it doesn't matter where) and release the mouse button (this is the drop action). At the drop, a second data series appears on the chart.

The second data series is probably coloured and has markers. Some further formatting is needed...

Formatting a Chart — Changing the Legend

- Check that the chart is selected. The Chart menu should be on the Menu bar.
- Open Chart and choose Chart Options... to open the Chart Options tab dialogue box.
- Select the Legend tab and click the Show Legend checkbox.
- Click OK. The legend, which was discarded at Step 3 of the Chart Wizard has now been brought back. It provides a (somewhat unsatisfactory) key to distinguish the two data series.
- Click anywhere inside the legend's border to select the legend. Eight handles should appear. By dragging the handles you can change the size and shape of the legend border. By clicking inside the legend area away from a handle and then dragging, you can reposition the legend...
- Stretch the border vertically and reposition the legend so that the two components are roughly in line with the rightmost extremities of the two data series.
- Open Format and choose Selected Legend...
- Select the Patterns tab in the Format Legend tab dialogue box.
- Select the None option under the Border heading.
- Click OK. The legend's border disappears but the handles remain to indicate that the legend is still selected.
- Click outside the chart. This action is preparatory to the next illustration but it has the side effect of deselecting the legend so the handles disappear.

Formatting a Chart — Changes to the new Data Series

The next step will be to format the new data series to make it a broken black line and to remove its markers:

- Double-click somewhere on the line of the new plot between two markers to open the Format Data Series tab dialogue box. Check that the Patterns tab is still selected.
- Change the Style of the line to a simple broken line and change the colour to black.
- Change the Marker option to None. Click OK.

It is possible that the legend doesn't quite fit into the space available and $2(n/2)$ (which is erroneous anyway) is split over two lines. Whether or not this is the case, give the legend more space...

- Click in the legend so that the eight handles appear. Drag the handle in the middle of the left-hand side leftwards to make the legend wider. Crash into the chart itself, concluding the drag halfway between the 9 and 10 gridlines.
- Click in the Plot Area of the chart to select it. Drag the handle in the middle of the right-hand side to the left to make the chart less wide. The axis labels may turn (or may already have turned) sideways. If this is the case...
- Double-click a label on the axis to open the Format Axis tab dialogue box.
- Select the Alignment tab and ensure that the Orientation is 0 Degrees.
- Click OK. Click outside the chart.

Naming Cells

The values in the C column are the square roots of the values in the B column. Suppose you want these new values to be a factor of 4 larger.

You could simply adjust the formula in cell C2 to $=4*\text{SQRT}(B2)$ and drag the fill handle downwards to update the other cells in the C column.



If you then wish to experiment with other factors, the process of updating cell C2 and dragging becomes slightly tedious. It is better to set aside some specific cell for the factor and just change the contents of this one cell between experiments:

- Make D2 the active cell and key 4 into this cell. Click the Enter box to confirm. It seems sensible to give a heading to this factor...
- Make D1 the active cell. Key in a (one character). Click the Enter box to confirm.
- Right-align this a and make it bold.

The obvious next steps are to adjust the formula in cell C2 to $=\text{\$D\$2}*\text{SQRT}(B2)$ and then drag downwards. Remember the use of dollar-signs to indicate an absolute address? The first \$ isn't strictly needed but it does no harm.

To anyone used to ordinary mathematics, it would be much better if one could write the formula simply as $=a*\text{SQRT}(B2)$ and use a as the required reference to the value 4. There is a facility for doing just that:

- Drag downwards from D1 to D2 so as to select the cell containing the name a and the cell containing the value 4.
- Open Insert and choose Name ► Create... The Create Names dialogue box has the Top row checkbox set. This indicates that the name a in the top row of the current selection will be taken as a name which can be used in formulae. Click OK.
- Make C14 the active cell and try a simple experiment...
- Key in the formula $=a+2$ and click the Enter box to confirm. The value 6 is duly calculated for the cell.
- Open Edit and choose Undo Typing to remove the 6.

- Check that C14 is still the active cell. As usual C14 is noted in the Name Box (to the left of the Formula Bar). To the right of the C14 in the Name Box there is a  button...
- Click the  and notice the single entry a in the drop-down list box. If you had created several names, they would all be here too.
- Click this a and observe that cell D2 becomes the active cell (not cell D1 which has a in it). Further, the Name Box doesn't record this cell as D2 but as the name a.
- Make C2 the active cell. Modify the formula to =a*SQRT(B2) and click the Enter box to confirm. The value in C2 changes from 1.00 to 4.00 and this change is reflected in the chart.
- Drag the fill handle of C2 downwards to cell C12. The formulae in the other cells are duly updated and the associated data series on the chart changes too.
- Experiment with different values in D2; try 10, 32, 100 and 0.1 and notice the changes both to the values in the C column and to the chart.
- Check that you understand just why the second plot on the chart changes as it does as the value of a is changed.

The heading in cell C1 needs editing. Start by *double*-clicking it:

- Double-click cell C1. This not only makes C1 the active cell but it also causes the flashing insertion point to appear in the cell itself.
- Click in front of the 2 to ensure that the insertion point is to the left of the leading 2 in cell C1 and key in a. (the dot separates the a from the 2 and implies multiplication).
- Click the Enter box to confirm. The change to the heading affects the legend in the chart though this latter still isn't right!
- Change the value in D2 to 1. You then get the values which you originally had for the second data series.

You should by now be able to make most of the adjustments to a worksheet and to a chart that you are likely to want to make. Unfortunately, there seems to be no way of changing $2n$ into 2^n and $a.2(n/2)$ into $a.2^{(n/2)}$ in the legend. The best you can do is to change the headings of columns B and C to something like 2^n and $a.2^{(n/2)}$.

Printing the Worksheet

Preview and print the worksheet:

- Ensure that the chart is *not* selected. Click a cell in the worksheet if it is.
- Open File and choose Print Preview. The appearance is not very satisfactory. As with Flat.xls it would be better to move the chart below the tabulated values and move these values to the right. Click Close and make the appropriate changes to the worksheet, especially to the position of the chart.
- Use the Page Setup command to centre the entire worksheet horizontally and to add the footer which incorporates your name and college. Preview again.
- When all is well, print the worksheet with the embedded chart.
- Clear the message window and collect the printed worksheet from the printer.

- If the previewer is open, click **Close**. Then click **Save** and finally go **File | Close** to close the workbook.

Powers of Two Concluded

This example has introduced a number of formatting and editing features. It also reflects real life in the way that a chart is commonly built up in stages with a certain amount of back-tracking and changing of mind on the way.

With the benefit of hindsight, the end product could have been set up more speedily. In outline, the first step should have been to set up both the n and 2^n columns and then, on entry to the **Chart Wizard**, select **XY (Scatter)** as the **Chart type** rather than get into the mess that resulted from using **Line** as the **Chart type**.

The requirement for a semi-log plot should have been ignored until a complete draft chart had been completed. At that stage, the y -axis could have been selected and then formatted by putting a tick in the **Logarithmic scale** checkbox in the **Scale** tab.

Leaving Excel

- Open **File** and choose **Exit**. A message window advises that you have made some changes and asks whether you want to save these changes. Click **Yes** which saves the recent changes and you then exit from **Excel**.

The workbook is now saved in the file **Powers.xls** and you leave **Excel**.

Logging off

- As at the end of every session, it is important to log off in the approved way:

start | **Log Off**

After a short wait, the screen returns to its idle state presenting the invitation to press:

Ctrl+Alt+Delete to Login

Summary

Here are some of the more important features which were referred to Session 6.

Workbook	A collection of worksheets and chart sheets in a single file.
Chart sheet	A sheet in a workbook occupied by a chart alone.
Series	A sequence of values in which there is some simple relationship between one value and the next.
Data Series	A data series (on a chart) is a sequence of markers which might be joined by a line.
Marker	A blob of some simple geometric shape on a chart indicating a point on a data series.
Legend	A key indicating which markers apply to which data series on a chart.
Plot Area	The area of a chart where a graph (typically) is plotted.
Axis	A horizontal or vertical line on a graph, usually calibrated in such a way that the coordinates of a point on the graph can be specified.

Tick mark	Calibration line on an axis.
Gridline	Tick mark which runs right across a chart.
Chart Title	Text providing a caption to a chart.
Axis Title	Text providing a caption to an axis.
Axis label	Text associated with a tick mark or gridline.
Chart item	Generic term for the components of a chart.
Editing	Adding a new point to a data series or adding a new data series to a chart or simply changing one or more points.
Formatting	Changing the appearance of a chart, usually by making changes to one or more chart items.