Stanford Graphics Workbook

by

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Introduction

What is Stanford Graphics

Stanford Graphics is a Windows based Presentation package for creating 2D and 3D graphs and for analysing datasets. It has many excellent facilities for creating technical graphs for publication, that is, those required by scientists and engineers.

Using this Workbook

This workbook contains a number of examples which are designed to show some of the facilities available for creating graphs and for creating presentations and to help you navigate the menu system and the toolbars. It is not intended to be a replacement for the Stanford Graphics User Guide and so you are referred to that manual, if you require further details on a particular feature.

It is assumed that you are familiar with the use of Windows based packages; please consult a Windows manual if you do not know the meaning of the following terms:

windows
clicking
double clicking
dragging
menus
toolbars
file browsers

We also assume minimal knowledge of spreadsheets, i.e. that you have seen a spreadsheet before and know you can use the arrow keys or mouse to move around the spreadsheet. Our examples using spreadsheets should be fairly easy to follow but you can obtain more details from the Help pages or the Stanford Graphics manual.

Getting Help

When you select **Help** on the top menu, this makes available the online help. This has a **Command Glossary** which includes detailed descriptions of all the menu items in Stanford Graphics and a **How Do I** section which includes instructions for using all the different features of Stanford Graphics.

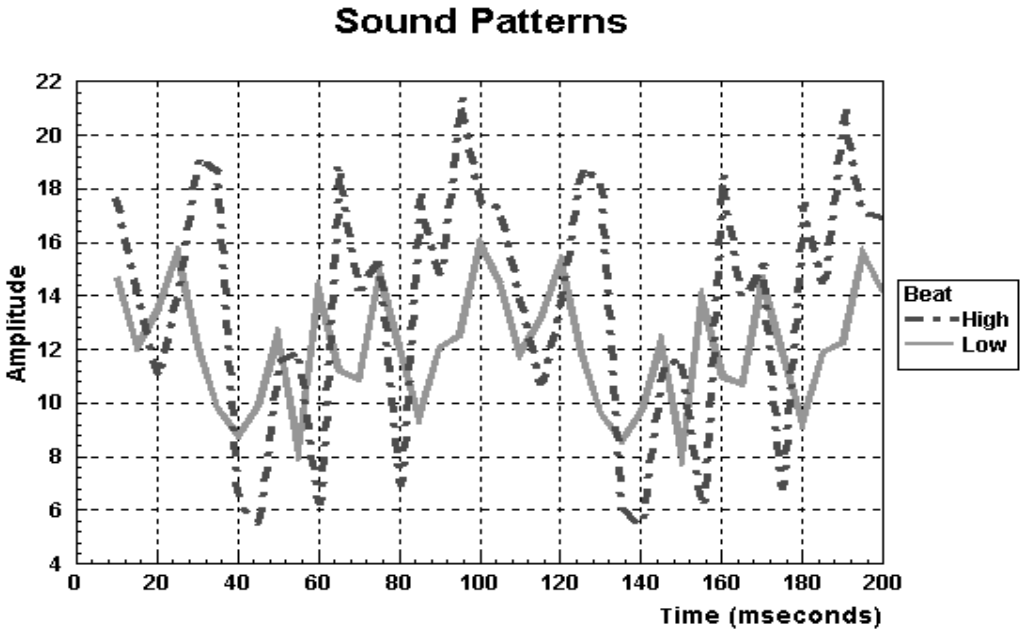
Checkpoint files

At various stages in the exercises, we ask you to check that you have obtained the picture on that page. If you have, then you can continue with the exercise. Otherwise, you have a choice; either use **File/Open** to load the checkpoint file which produces the relevant picture and then you can continue with the rest of the exercise OR you can return to the start of the exercise OR (presuming you are not at the first checkpoint of the exercise) you can load the file for the previous checkpoint and continue from that stage.

For details on where to find the checkpoint files for your system, please consult **Accessing checkpoint files** in Appendix 2.

Exercise 1 To draw a graph

You will be creating the graph shown below.

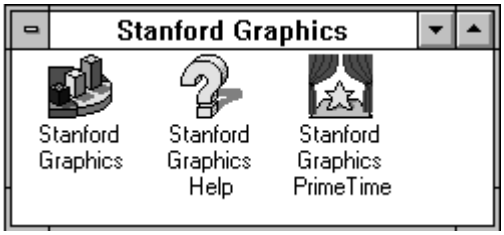


In this example, you will be doing the following: Full instructions are given below for each procedure.

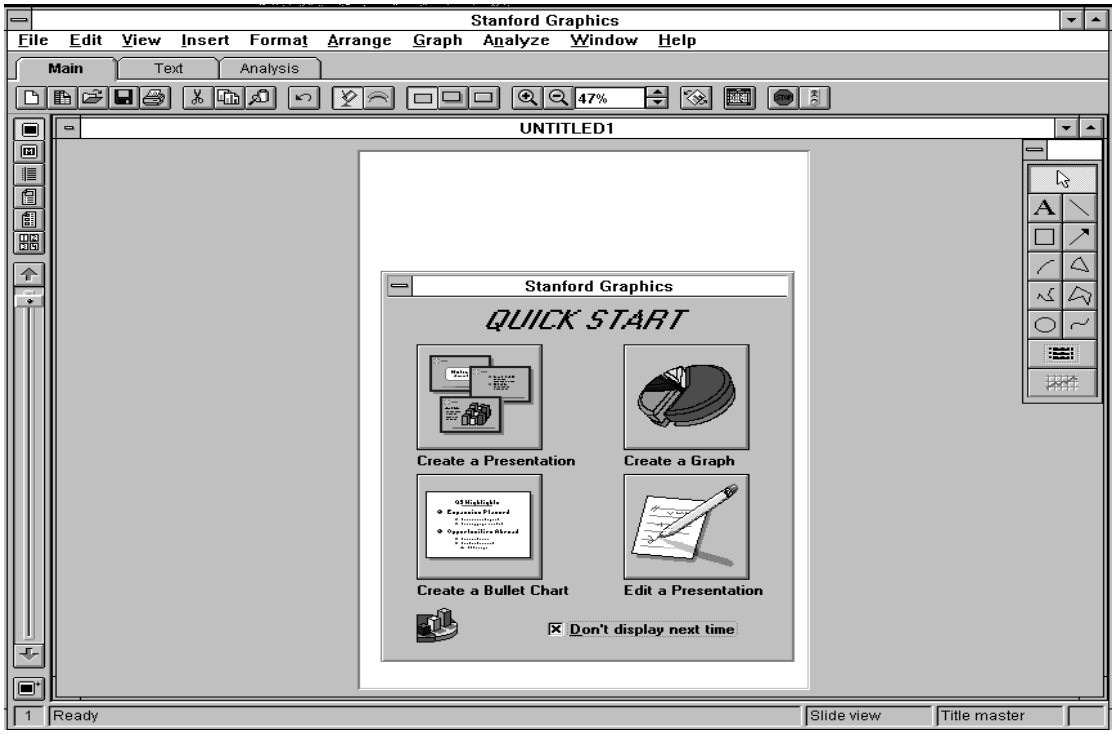
1 Starting Stanford Graphics
2 Changing the Printer
3 Importing data
4 Examining the spreadsheet
5 Choosing a graph type
6 Drawing a graph
7 Resizing a graph
8 Using the Range Highlighter
9 Adding a legend
10 Changing the legend labels
11 Changing the line styles
12 Adding axis titles
13 Changing the axis titles
14 Adding a title
15 Changing the title
16 Printing the graph
17 Saving the graph in a file
18 Exporting the picture
19 Leaving Stanford Graphics

There is an **Undo** facility available in Stanford Graphics. This allows you to reverse the effects of the last command. To perform this action, click on the Undo tool on the main toolbar or select the **Edit/Undo** menu item.

Starting Stanford Graphics



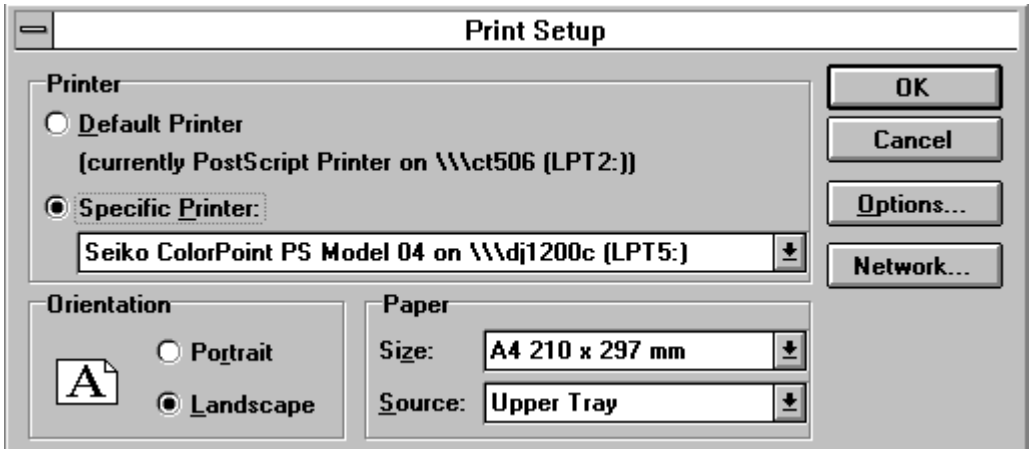
Read the section **Accessing Stanford Graphics locally** in Appendix 2	This should tell you how to get as far as the picture above. If there is no section in your workbook, please contact your local service staff
Double click the Stanford Graphics icon	To load the Stanford Graphics package. The Quick Start window appears.



Click **Don't display next time**	This window has tutorials in the use of Stanford Graphics. We are not using them in this workbook.
Close that window	If you want to have a look at the tutorials in future, you can find them by clicking **Help** then **Quick Start.** Then click one tutorial

Changing the printer

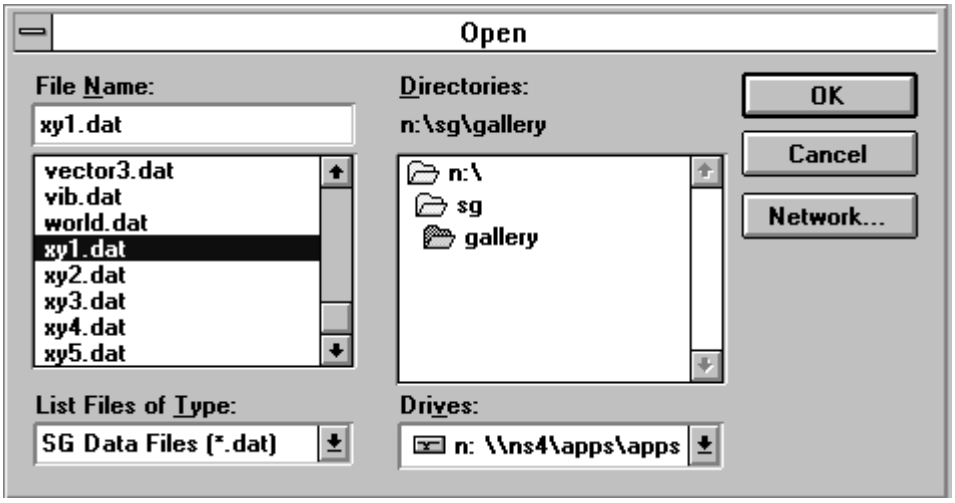
If Stanford Graphics is being run on a PC network at your site, you may have a choice of printers from which hardcopy may be obtained. Consult **Accessing local printers** in Appendix 2 of this workbook for more details.



Select **File/Print Setup**	A dialog box appears
Click on arrow in box under **Specific Printer**	A list of printers supported by Microsoft Windows at your site appears. Check that the orientation is landscape and that the paper size are what you require.
Select a colour printer	This becomes the current printer
Click the **Options** button	To check the printer options. Leave as it is but note the option to create an EPS file.
Click **OK** three times	To accept the options, the printer and then to confirm. The aspect of the slide should be landscape at the end of this process.

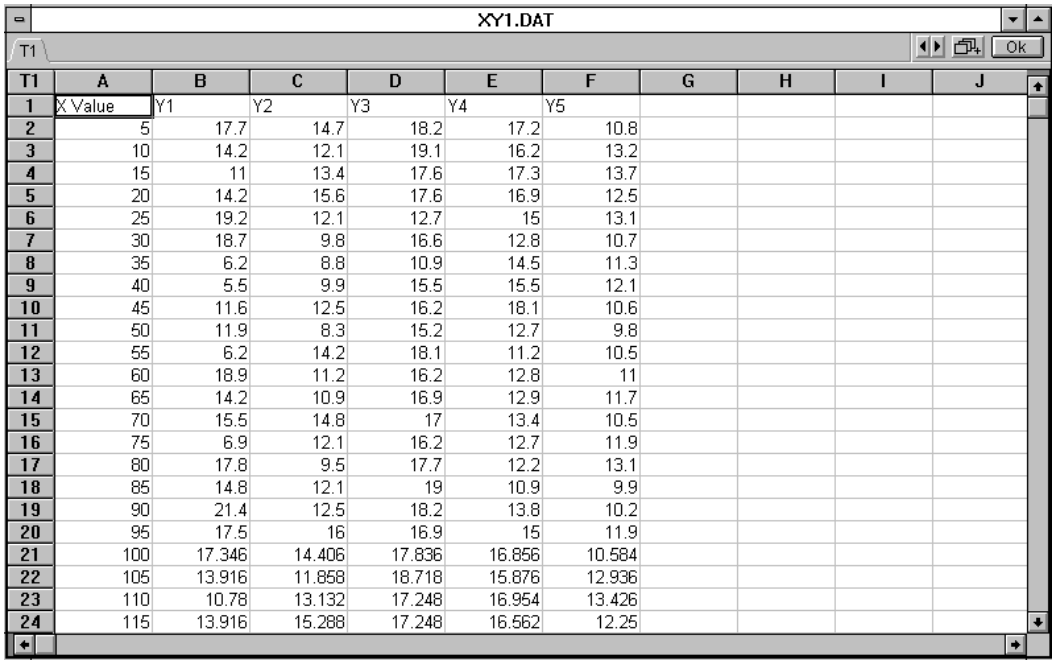
Importing data

In this step, a file of data is to be imported into a spreadsheet in Stanford Graphics. After the file is imported, you will see in later steps how it appears on the spreadsheet and then you will decide how to display the data.



Select **View/Spreadsheet**	A panel called Spreadsheet Resource appears; this allows the management of spreadsheets.
Click **Import**	which is on the Spreadsheet Resource Panel. A dialog box for file selection appears
Look at **Accessing locally the datasets and clipart files ...** in Appendix 2 and use the file browser to find the file **xy1.dat** and click it. Then click **OK**..	This is a sample data file that has been provided by Stanford Graphics and your local support team should have made it available. Note that this file was created by an ASCII text editor and contains columns of data separated by spaces.
Click **No** on the dialog box	No permanent link to the file is to be set up. This means even if you change the original data file, next time you open the saved graph, any data changes made to the original file do not appear in the spreadsheet so you would have to reimport the data. A new window containing data for X and Y1 to Y5 appears.

Examining the Spreadsheet



XY1.DAT

T1 | Ok

T1	A	B	C	D	E	F	G	H	I	J
1	X Value	Y1	Y2	Y3	Y4	Y5				
2	5	17.7	14.7	18.2	17.2	10.8				
3	10	14.2	12.1	19.1	16.2	13.2				
4	15	11	13.4	17.6	17.3	13.7				
5	20	14.2	15.6	17.6	16.9	12.5				
6	25	19.2	12.1	12.7	15	13.1				
7	30	18.7	9.8	16.6	12.8	10.7				
8	35	6.2	8.8	10.9	14.5	11.3				
9	40	5.5	9.9	15.5	15.5	12.1				
10	45	11.6	12.5	16.2	18.1	10.6				
11	50	11.9	8.3	15.2	12.7	9.8				
12	55	6.2	14.2	18.1	11.2	10.5				
13	60	18.9	11.2	16.2	12.8	11				
14	65	14.2	10.9	16.9	12.9	11.7				
15	70	15.5	14.8	17	13.4	10.5				
16	75	6.9	12.1	16.2	12.7	11.9				
17	80	17.8	9.5	17.7	12.2	13.1				
18	85	14.8	12.1	19	10.9	9.9				
19	90	21.4	12.5	18.2	13.8	10.2				
20	95	17.5	16	16.9	15	11.9				
21	100	17.346	14.406	17.836	16.856	10.584				
22	105	13.916	11.858	18.718	15.876	12.936				
23	110	10.78	13.132	17.248	16.954	13.426				
24	115	13.916	15.288	17.248	16.562	12.25				

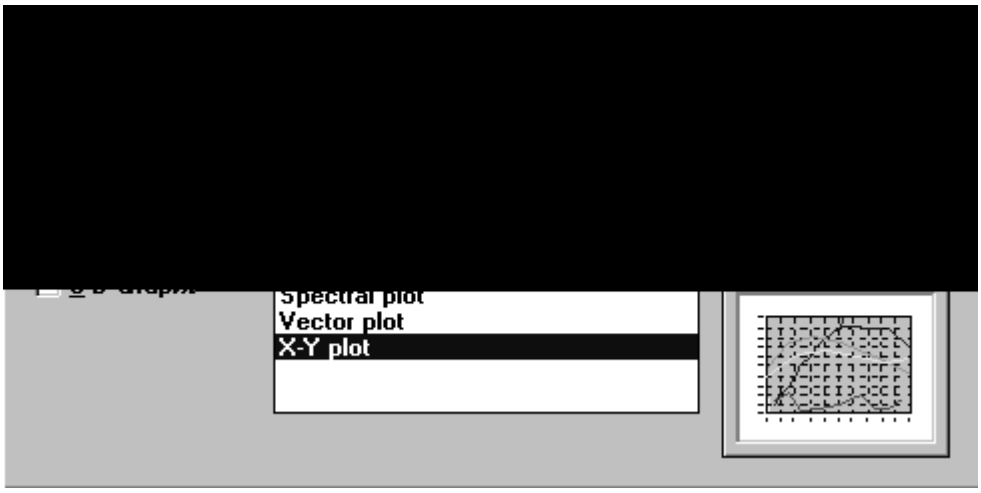
This is a spreadsheet. It consists of tables, each of which is a set of rows and columns. Values or labels can be put into the cells. Each cell has a unique address. For example, the address of the cell, which has a label XValue, is T1A1; i.e. the cell is in table 1, row 1, column A. You will be learning a little more about how to use spreadsheets in this exercise but in a later exercise, you will be considering spreadsheet functions in more detail.

Spreadsheets can hold data imported from a file of data or data can be directly typed on the spreadsheet. Sometimes, output spreadsheets are created as a result of a calculation. We shall meet some of these in this workbook.

When a spreadsheet is attached to a graph, a particular Range Highlighter, corresponding with the type of graph, appears with the spreadsheet. This allows you to define ranges of the spreadsheet as parts of the graph. There is no Range Highlighter yet since we have not specified what type of graph we wish to use .....

Choosing a graph type

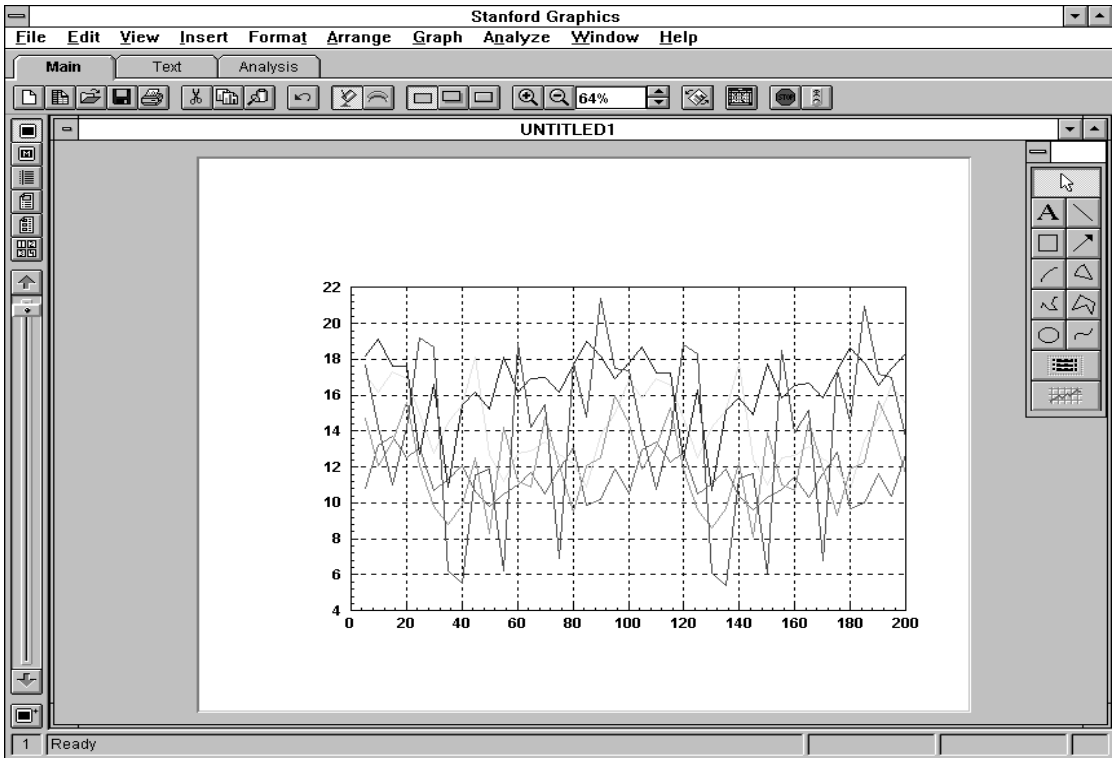
There are many ways of representing data and the Stanford Graphics User Guide has pictures of all the different ones available. (You can also use the Gallery button on the panel shown below to see the pictures). If you want more advice about the best way to represent your data, consult your local support team.



Select **Graph/Add Graph**	A dialog box comes up
Look at the box by **3D**	A 2D graph is to be drawn in this example so make sure there is no cross by the 3D box
Click **Technical**	A new list of graph types comes up
Click **X-Y plot** then **OK**	We want to draw line graphs where we have one independent variable plus several dependent variables. The Range Highlighter appears on the spreadsheet - you will be looking at this soon.

Drawing a graph

On the spreadsheet table, there are 6 columns. The Range Highlighter for the X-Y plot has appeared and this means it is now possible to draw an X-Y plot. By default, the Range Highlighter assumes that the first column holds the X values and all other columns are Y datasets.

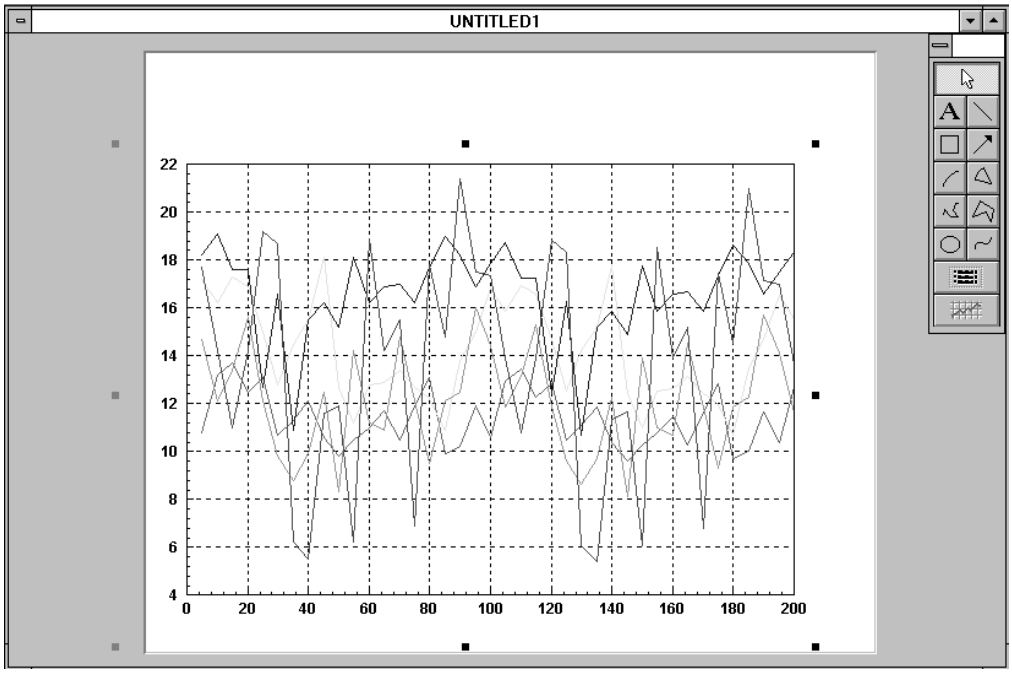


Click the small **OK** on top right of spreadsheet	A picture showing the graphs for the datasets Y1 to Y5 appears.

Checkpoint 1

If you have not obtained the picture above, then you can either load the file EX1CH1.SGX or you can start again from the beginning of the exercise

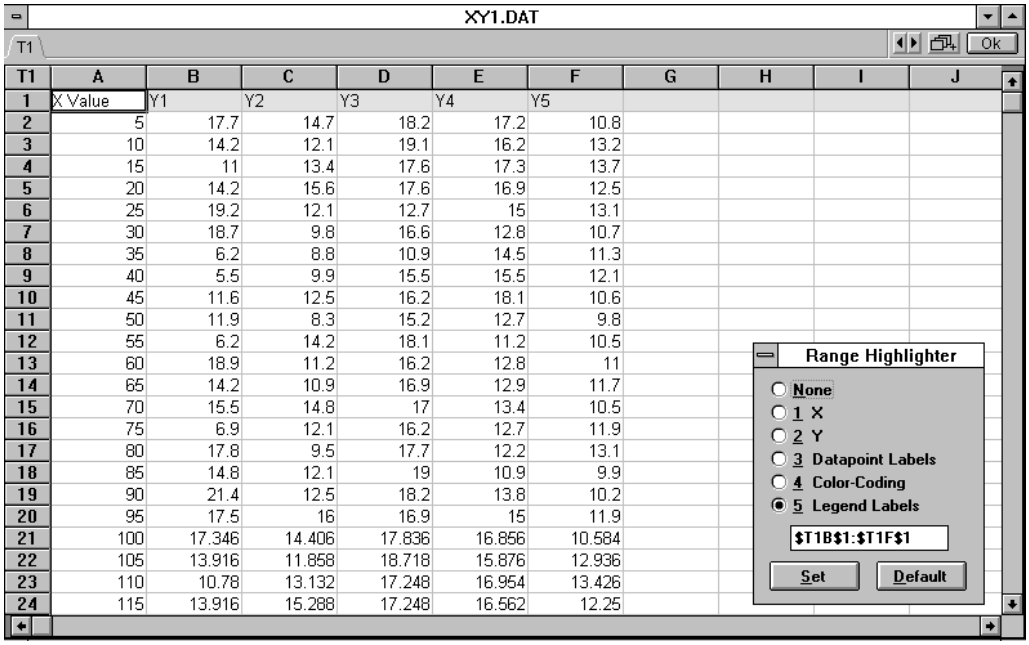
Resizing the graph



Make sure the graph is selected	If there are no handles (small black squares) around the whole graph, then click just above the top axis and the handles should appear.
Hold down the shift key and drag one of the corner handles. (If in difficulty, see local documentation for steps to take)	This scales the graph keeping the same aspect ratio. If the shift key is not held down, then the graph may be sized freely. In the above, the graph has been scaled up considerably, leaving little room for annotation.
Make sure graph is still selected	This is so that the correct spreadsheet will be automatically opened in the next exercise.

Using the Range Highlighter

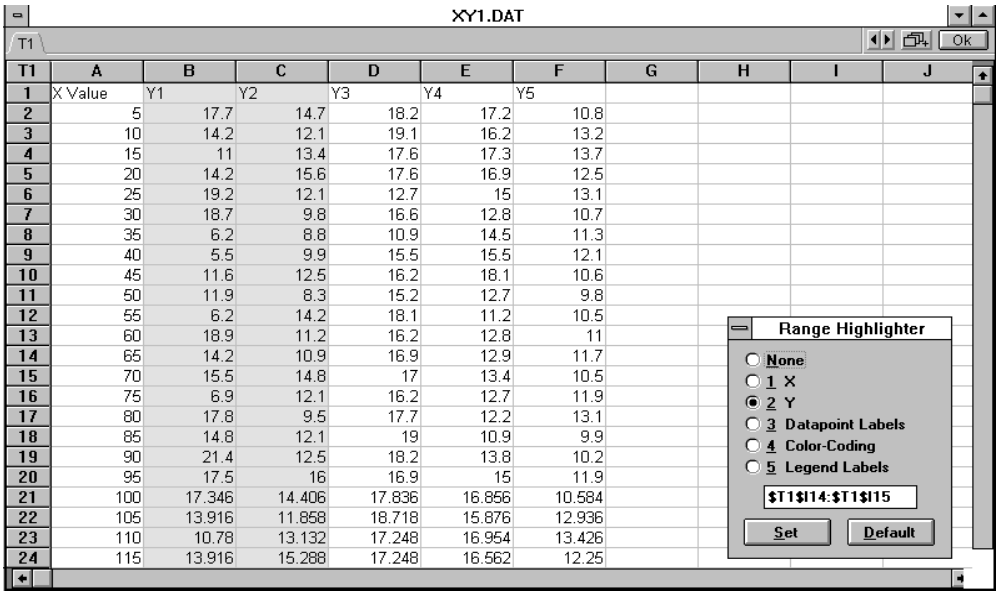
This part of the exercise is to show what the Range Highlighter chooses by default.



Select **View/Spreadsheet**	To return to the spreadsheet
If you are not returned to the spreadsheet but only to the Resource panel, then click **Display** to show the only spreadsheet	Notice the box at the bottom right called the Range Highlighter. This allows you to choose ranges from the spreadsheet for the graph and you will be learning how to do this on the next page.
Select the little circle by **X**	This is to see which current dataset is used for X values in the X-Y plot. The X dataset is highlighted.
Select the little circle by **Y**	All datasets Y1 to Y5 (and all columns to the right) are highlighted. These provide the Y values in the X-Y plot.
Select the little circle by **Legend Labels**	The column headers are highlighted

Using the Range Highlighter (continued)

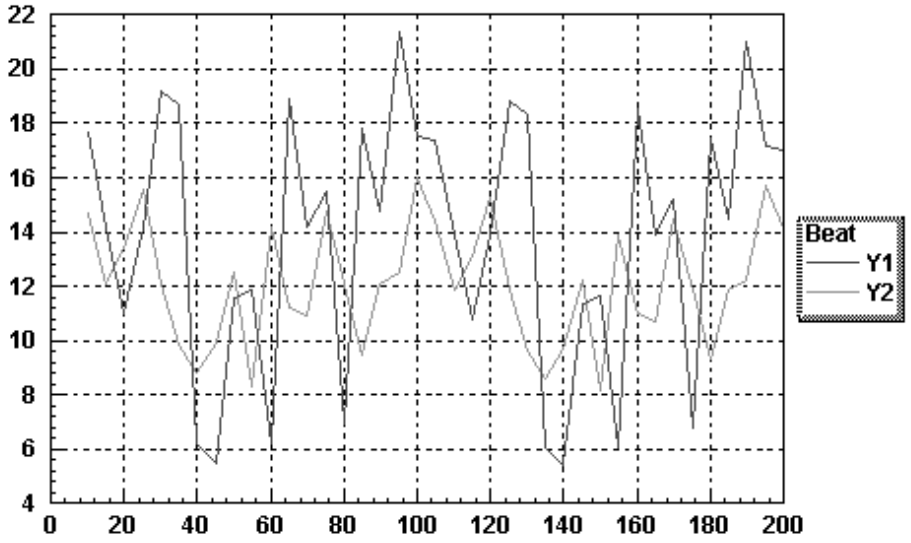
We have seen what values are chosen by default by the Range Highlighter. Now we want to change these.



Click in spreadsheet on **B** and then click **C** holding down the shift key	Both columns should be in black. We want to just plot 2 datasets. If you don't hold down the shift key, only the dataset clicked last would be highlighted.
Select the little circle by **Y**	in the Range Highlighter box
Click on **Set**	You should check that you have the correct datasets before doing the next step, by clicking on a blank cell in the spreadsheet. The columns B and C should be highlighted.
Click the cell Y1 and then click Y2 holding down the shift key	and then set the legend labels in the Range Highlighter box.This means that if a legend is added to the graph, there will be 2 entries, labelled Y1 and Y2.
Click **OK**	on top right and return to the graph

Adding a legend

Remember that the legend labels have been set to Y1 and Y2 on the Range Highlighter in the last step of this exercise ...



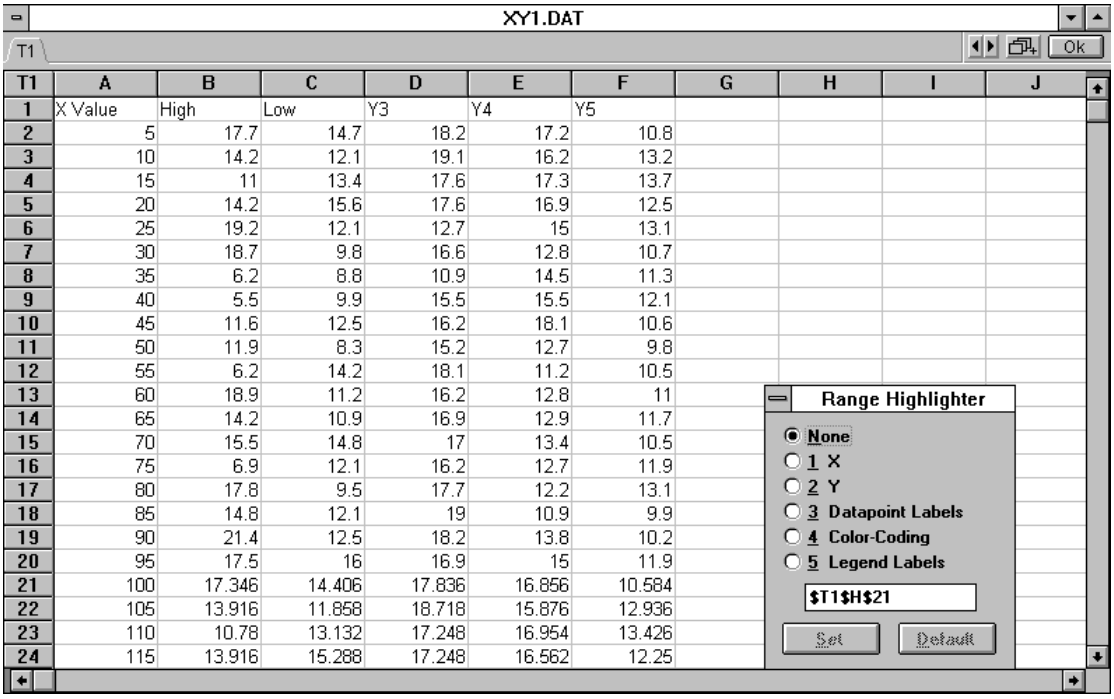
Select the graph and then select **Graph/Add Legend**	If there are no handles round the graph, this menu item will be dimmed.
Type **Beat** (or **Throb** or whatever you want!)	for a title to the legend box. You may need to click the empty title box before typing
Click **OK**	The legend is added. Ensure that the legend is selected and then try moving this to a more suitable place by clicking on the border and dragging.

Checkpoint 2

If you have not obtained a picture similar to the above, then either load the file EX1CH2.SGX and start from the next page or load the file EX1CH1.SGX and retrace your steps since Checkpoint 1.

Changing the legend labels

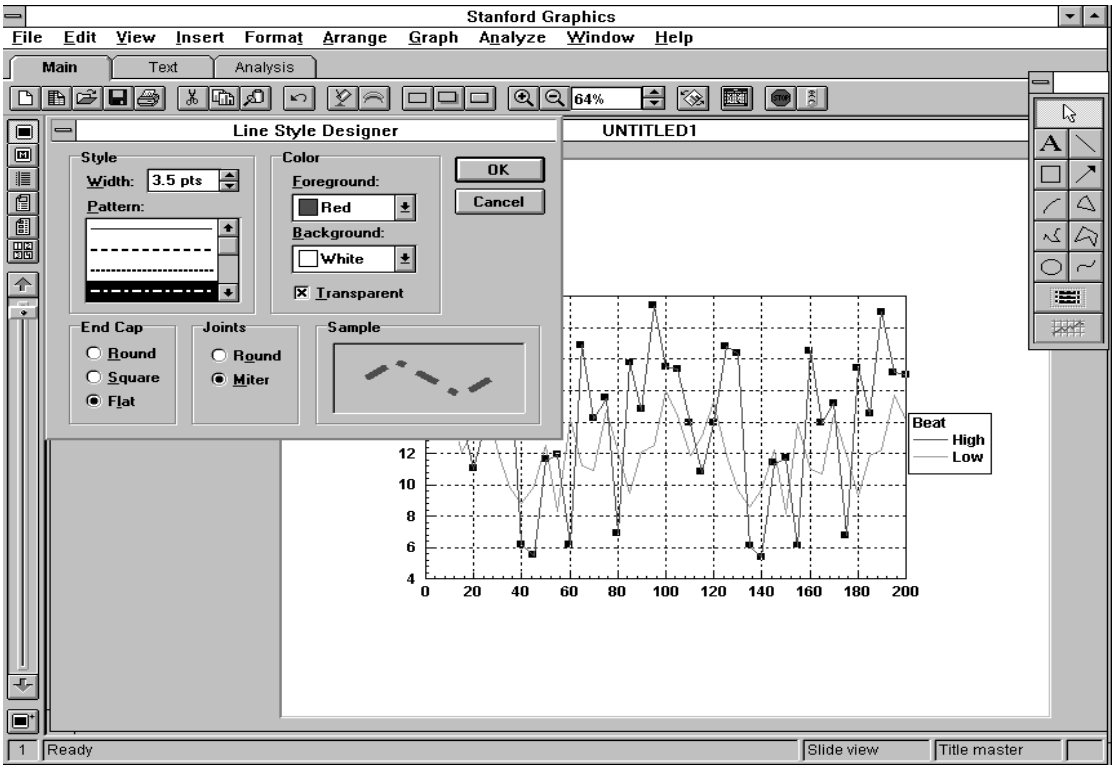
To change the legend labels, they have to be updated on the spreadsheet so ..



T1	A	B	C	D	E	F	G	H	I	J
1	X Value	High	Low	Y3	Y4	Y5				
2	5	17.7	14.7	18.2	17.2	10.8				
3	10	14.2	12.1	19.1	16.2	13.2				
4	15	11	13.4	17.6	17.3	13.7				
5	20	14.2	15.6	17.6	16.9	12.5				
6	25	19.2	12.1	12.7	15	13.1				
7	30	18.7	9.8	16.6	12.8	10.7				
8	35	6.2	8.8	10.9	14.5	11.3				
9	40	5.5	9.9	15.5	15.5	12.1				
10	45	11.6	12.5	16.2	18.1	10.6				
11	50	11.9	8.3	15.2	12.7	9.8				
12	55	6.2	14.2	18.1	11.2	10.5				
13	60	18.9	11.2	16.2	12.8	11				
14	65	14.2	10.9	16.9	12.9	11.7				
15	70	15.5	14.8	17	13.4	10.5				
16	75	6.9	12.1	16.2	12.7	11.9				
17	80	17.8	9.5	17.7	12.2	13.1				
18	85	14.8	12.1	19	10.9	9.9				
19	90	21.4	12.5	18.2	13.8	10.2				
20	95	17.5	16	16.9	15	11.9				
21	100	17.346	14.406	17.836	16.856	10.584				
22	105	13.916	11.858	18.718	15.876	12.936				
23	110	10.78	13.132	17.248	16.954	13.426				
24	115	13.916	15.288	17.248	16.562	12.25				

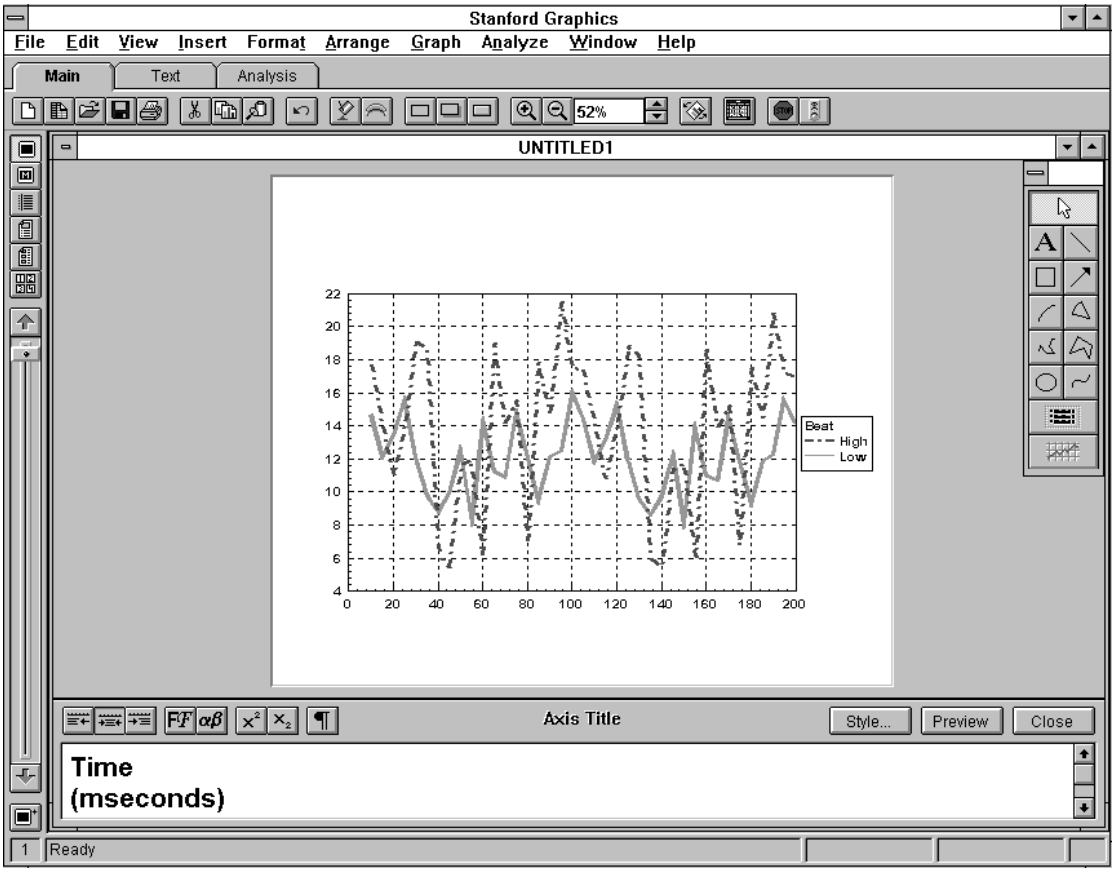
Select **View/Spreadsheet**	to return to the spreadsheet. Sometimes the Spreadsheet Resource Panel comes up, depending on whether the graph has been selected or not.
If the SRP has come up, click on **Display**	having made sure that the correct spreadsheet is selected
Click on **Y1** and change it to **High**	to give a more meaningful label!
Click on **Y2** and change it to **Low**	for another meaningful label. To register the Low label, you should click on a blank cell on the spreadsheet. There is no need to reset the Range Highlighter
Click **OK**	to return to the graph. Notice that the legend labels have changed.

Changing the line styles



Click one of the lines in the graph	There should be handles on the line
Select **Format/Line Style**	A dialog box appears
Select a suitable width and pattern for the line	This will help to distinguish it from the other if there is access only to a monochrome printer
Check that the joints and endpoints appear as wished	as shown in the sample picture
Click **OK**	To return to the graph. Repeat for the other line but choose a different linestyle.

Adding axis titles

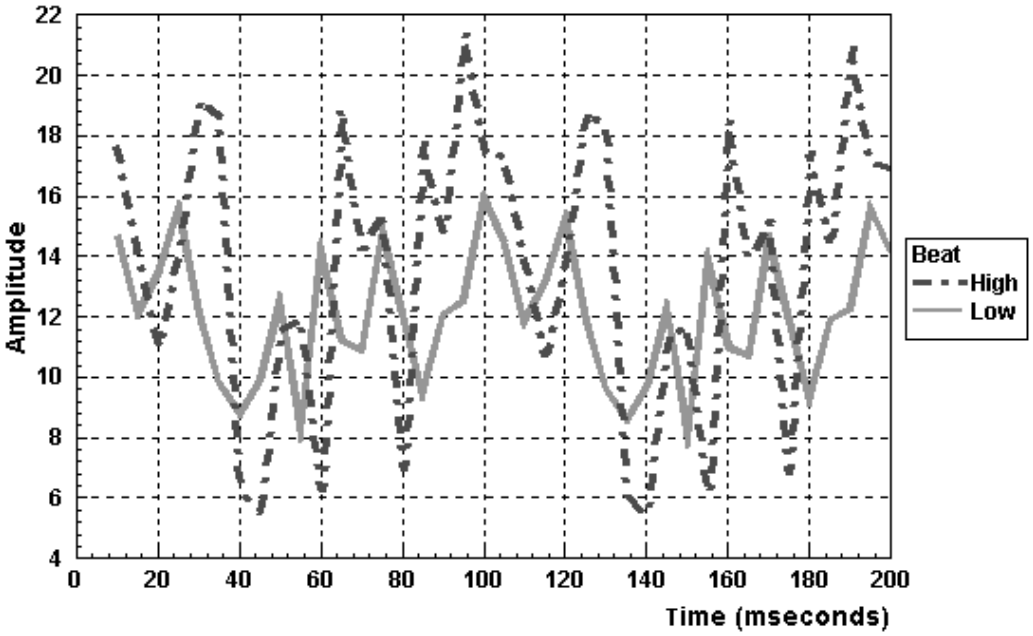


Checkpoint 3

If you have not obtained a picture similar to the one above, then either load the file EX1CH3.SGX and start here or load the file EX1CH2.SGX and retrace your steps from Checkpoint 2.

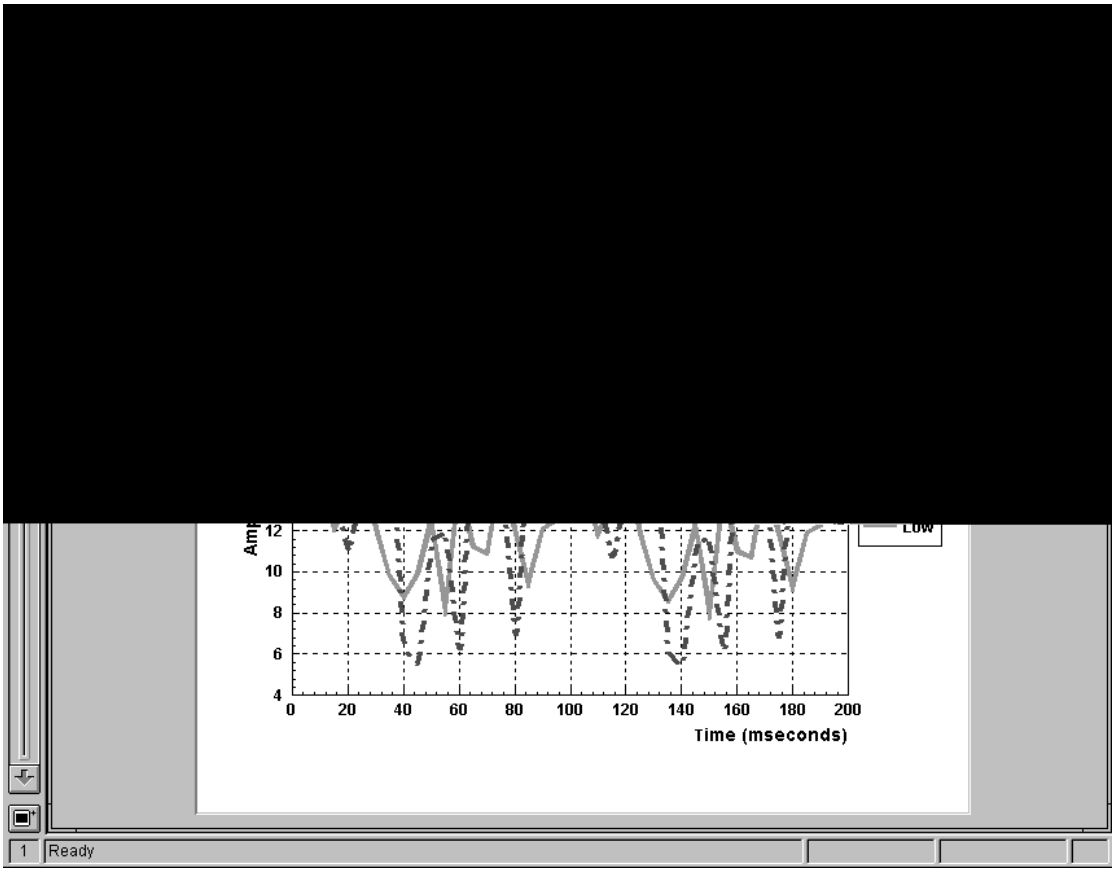
Click on the X axis	Some axis items will have handles round them
Select **Graph/Add Axis Title**	A box appears at the bottom of the screen for input of the title.
Type **Time**, press Return then type **(mseconds)**	So the title can appear on two lines
Select **Close** on top right of axis title box	The axis title should appear on the graph but you may need to reduce the size of the graph or to shift it upwards to see the title.

Changing the axis titles



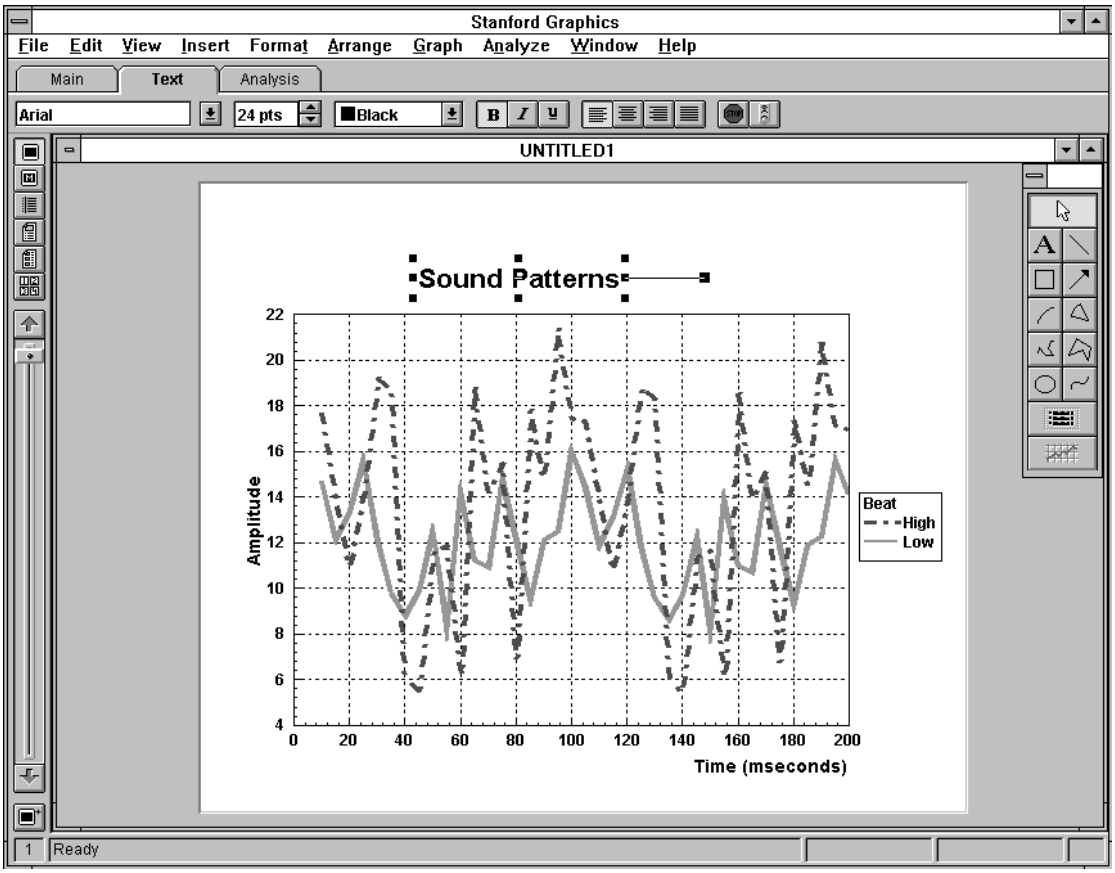
Double click the axis title	We want to change the title and its formatting
Remove the carriage return by moving to the start of the second line and pressing the backspace key	So the title will be on one line
Try changing font, justification etc	Using the buttons above the title in the box.
Select **Close**	When happy with the title
Add a title to the y axis	Call it **Amplitude**

Adding a title



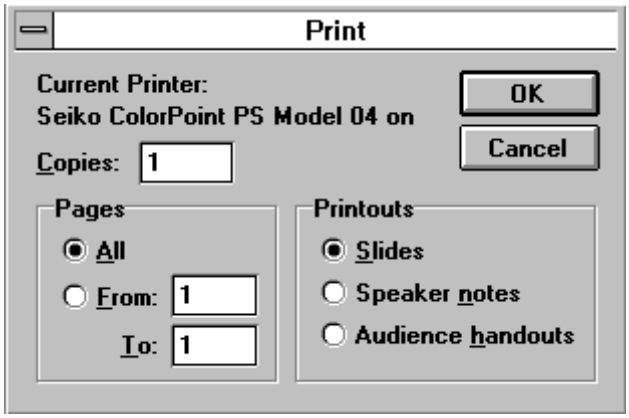
Select the big **A** on one of the toolbars	This is to add text where you like to the picture
Click a suitable location for the title	Somewhere above the graph
Type **Sound Patterns**	The title appears.

Changing the title



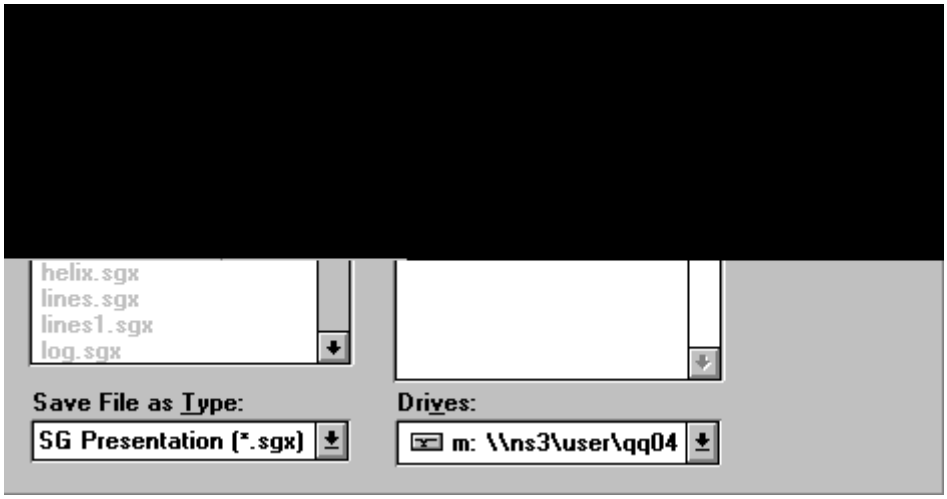
Click **Text** (one of the index cards near the top)	It is now up to you to change the position, font, size, colour etc. You will need to select the text by clicking on it..
Choose the font and size first	Then change the text position.

Printing the graph



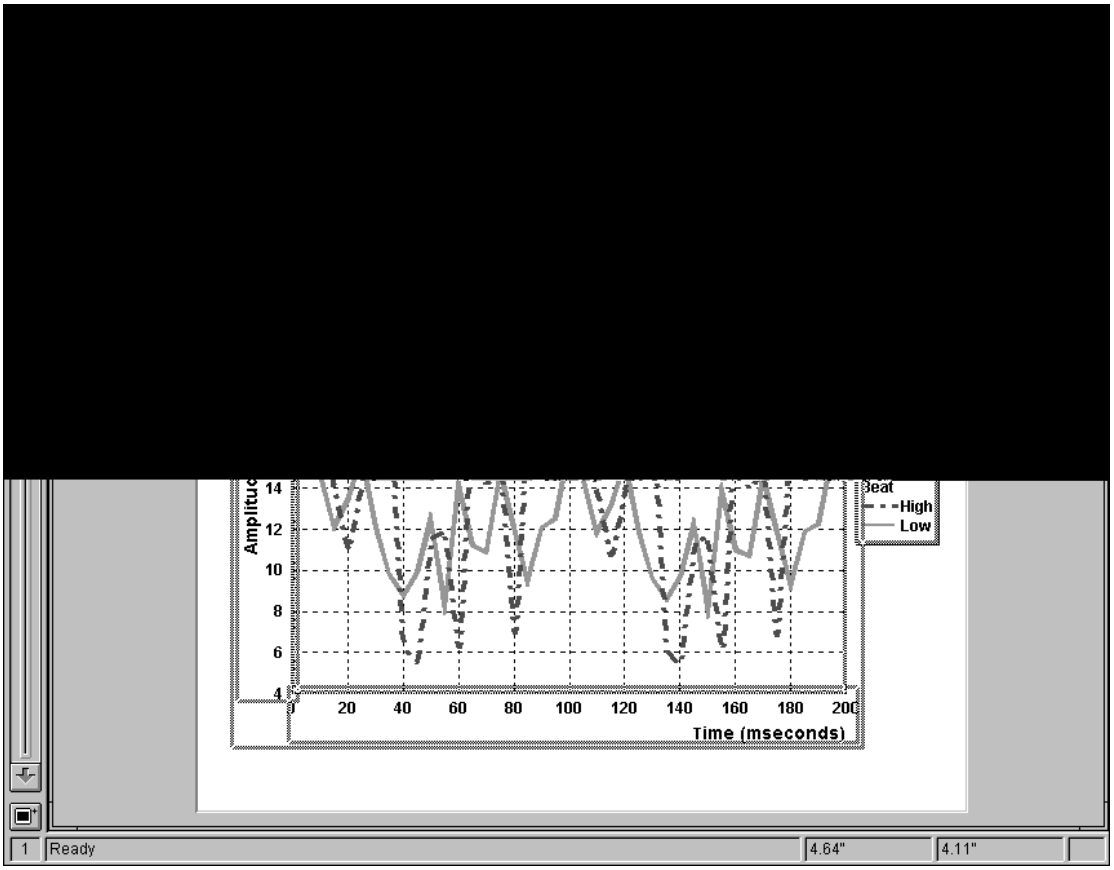
Select **File/Print**	A dialog box appears. You can choose to print all the pictures or you can be more selective. In this case, you have only one picture.
Click **OK**	Make sure that **Copies** is set to 1 and that **Slides** (not notes nor handouts) will be printed

Saving a graph in a file



Select **File/Save**	A dialog box appears
Save the presentation as **lines.sgx** in directory which is owned by you.	Make sure that SGX presentation is selected for the type of file. You can use **File/Open** to retrieve this file at a later date into Stanford Graphics and then do further work on the presentation.

Exporting the picture



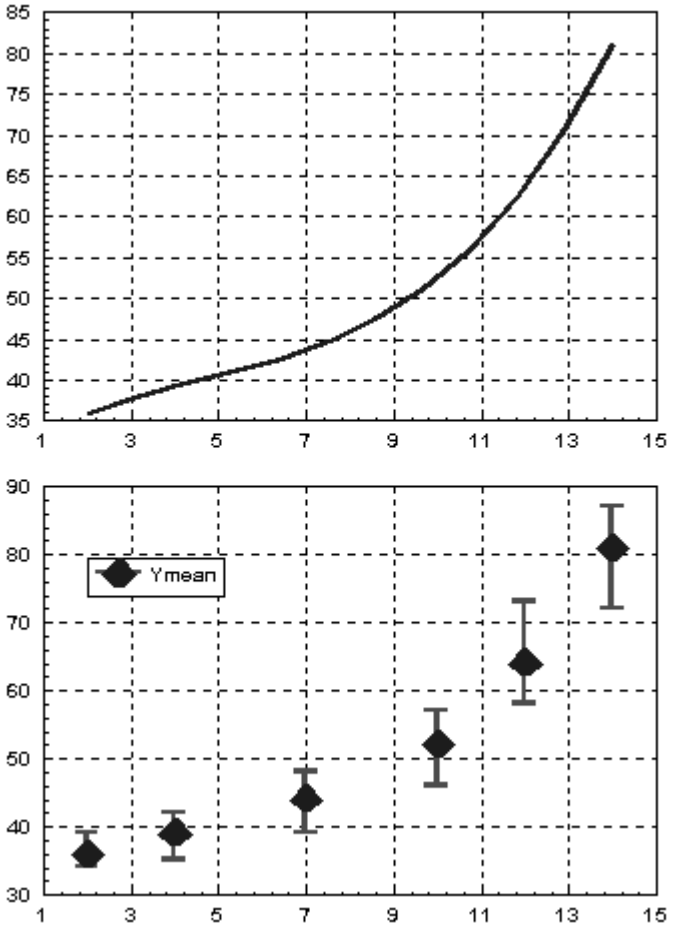
Select the whole picture	To do this, click in the top left and drag a box round the whole picture. You should have everything highlighted.
Select **File/Export Picture**	A dialog box appears
Save the presentation as **lines.wmf**	Make sure that Windows Metafile is selected for the type of file You can import this picture into other Windows packages such as MS Word

Leaving Stanford Graphics

Select **File/Close**	To close the old presentation. If you want to leave Stanford Graphics, then select **File/Exit**. Otherwise, you can select **File/New** to start a new presentation or **File/Open** to open an old presentation. You will be prompted what to do for all of the subsequent exercises.

Exercise 2 To draw an error bar chart

Error bar plots are used to show the possible uncertainties associated with X values or Y values or with both.

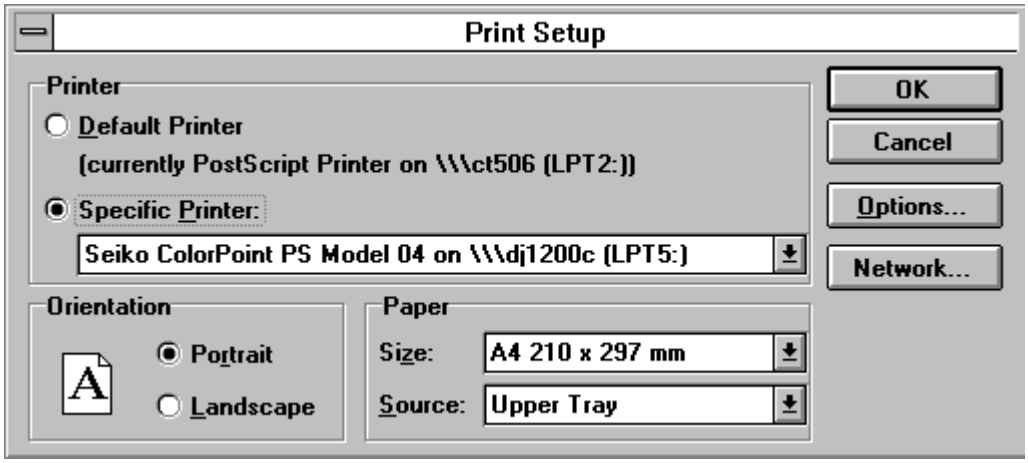


In this example, you will be doing the following. Full instructions are given below for each procedure:

1. Changing the printer set up
2. Choosing a graph type
3. Adding data to a spreadsheet
4. Resetting the Range Highlighter
5. Adding a curve and envelope
6. Changing the error bar symbols
7. Changing the axis limits
8. Adding a legend
9. Adding another graph to the same page
10. Using the guides and snap grids to align the graphs
11. Trying the curve fitting routines

Changing the printer set up

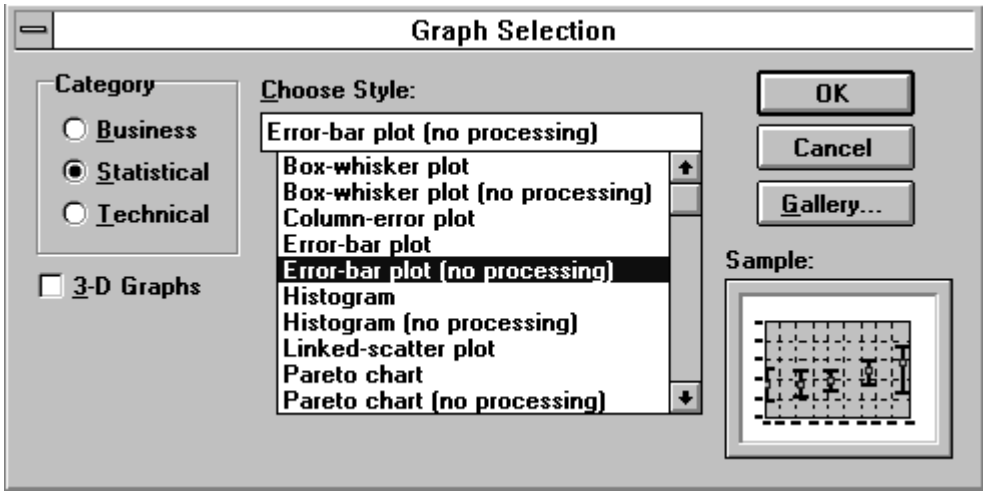
It is assumed that you have a new presentation on the screen. If you have exited from Stanford Graphics, then restart the package. If you have saved the last example but have not left the package, then select **File/New** and, if another dialog box appears, ask for a **New Presentation**.



Select **File/Print Setup**	and choose the same colour printer but ...
Switch to **Portrait**	We want to do two plots on same page
Click **OK** twice	to leave the Print Setup box and to confirm printer choices

Choosing a graph type

In this example, we know we want to plot an error bar chart so we start with the selection of a graph type.



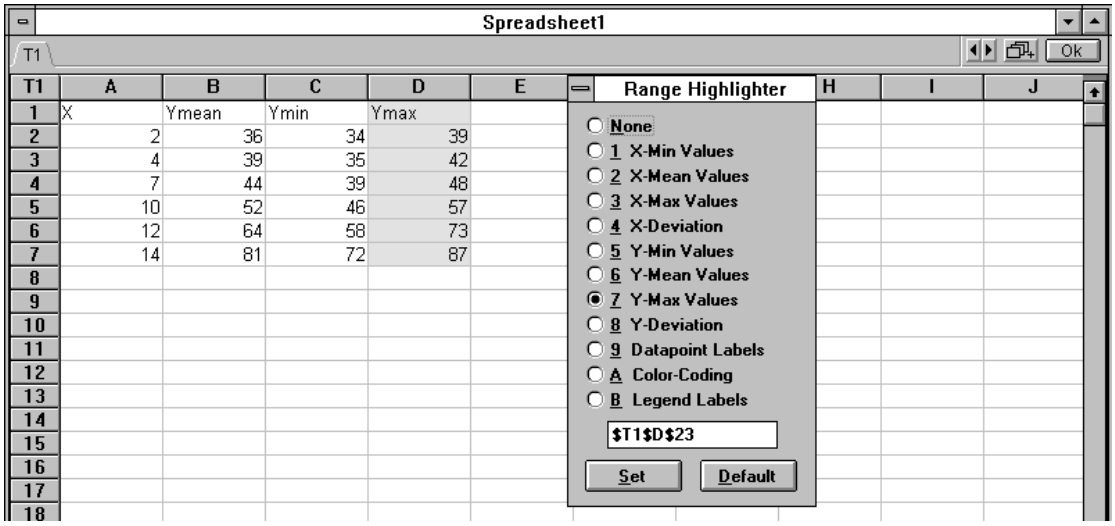
Select **Graph/Add Graph**	A dialog box comes up
Look at the box by **3D**	Make sure there is no cross by the 3D box since a 2D plot is to drawn
Click **Statistical**	A new list of graph types appears
Click **Error bar plot (no processing)** then **OK**	The 'no processing' option means that you have to specify in the Range Highlighter which columns of data belong to which variables, instead of having this done automatically by Stanford Graphics. The spreadsheet resource panel appears and it should be empty.

Adding data to a spreadsheet

Select **New**	A clean spreadsheet appears. You are going to type the data in the spreadsheet
Click in the cell **T1A4**	The cell becomes emphasised
Click in the cell **T1A1**	This becomes emphasised again; this is the current cell.
Type **X**	for a column header
Type the rest of the data	which is shown above, using the arrow keys to move around the cells.

Resetting the Range Highlighter

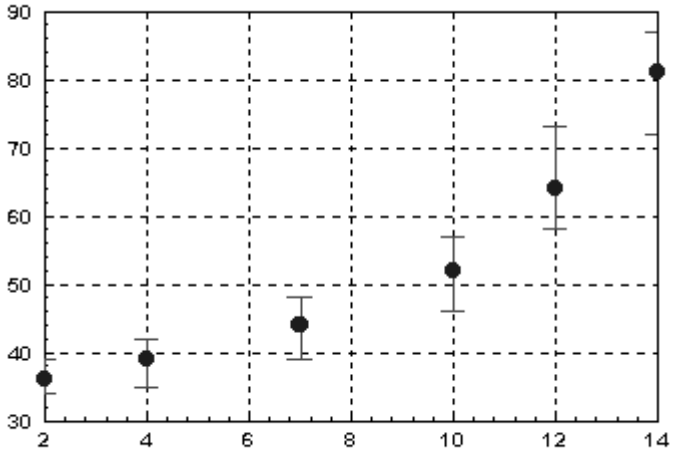
As already mentioned, the type of graph determines the form of Range Highlighter. The items here are specifically for an Error Bar chart. Notice that you do not have to set all the items.



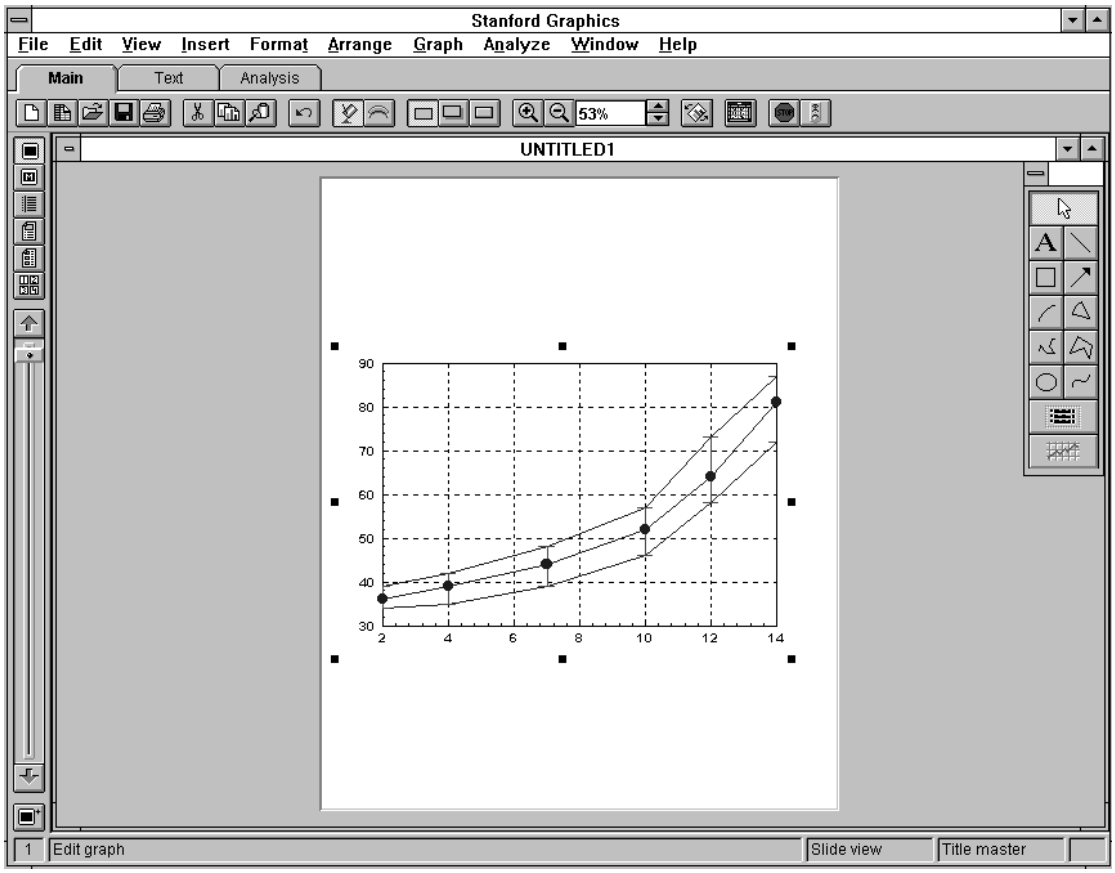
Click Column **A**	and set to X-Mean Values
Click Column **B**	and set to Y-Mean Values.
Click Column **C**	and set to Y-Min Values
Click Column **D**	and set to Y-Max Values
Click cell **T1B1** (Ymean)	and set the Legend Label
Select **OK**	to return to the graph

Checkpoint 1

If you have not obtained the picture below, then either start from scratch or load the file EX2CH1.SGX and start from here.

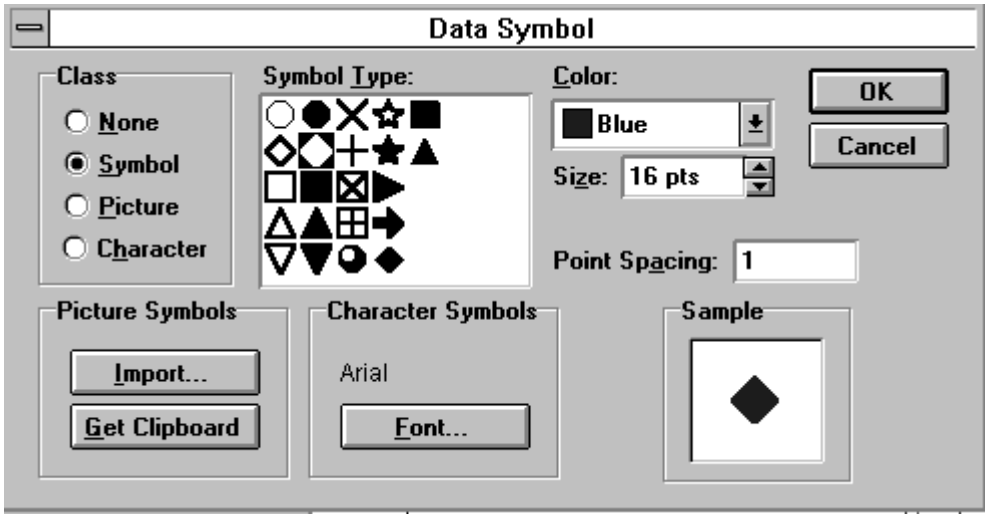


Adding a curve and envelope



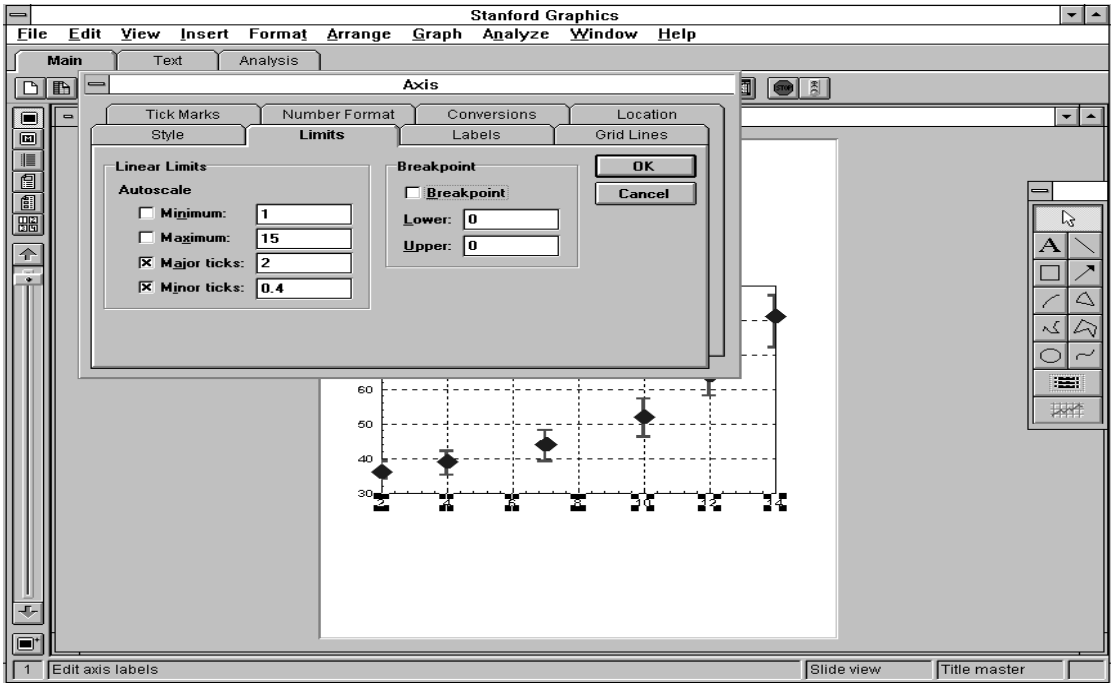
Make sure the graph is selected	If there are no handles around the whole graph, then click just above the top axis and the handles should appear
Select **Format/Style**	A dialog box appears
Click **Show envelope** and **Show curve**	A little cross should appear in the boxes by these items
Click **OK**	to see the results as shown above. Decide yourself whether you wish to keep the curve and envelope switched on

Changing the error bar symbols



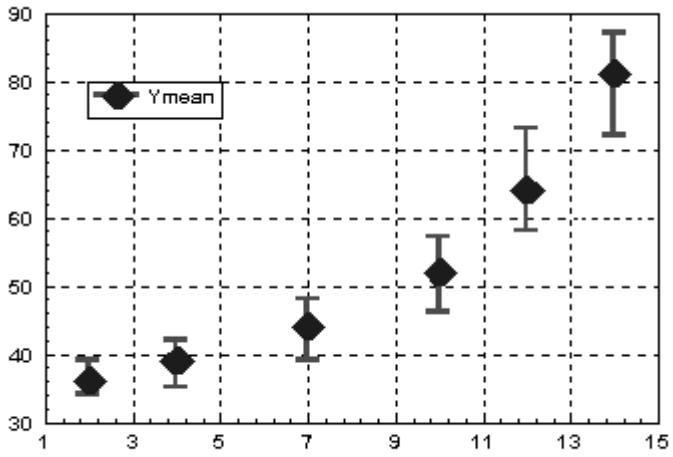
Click on the data symbols on the graph to select them	All the symbols should have handles
Select **Format/Curve Symbols**	The dialog box as shown above appears
Click on a different symbol and choose **OK**	to return to the graph. You could also change the colour and size of the symbols and the line weights of the error bars (use **Format/LineStyle**)

Changing the axis limits



Select the X axis	Handles should appear on all the axis labels
Select **Format/Style**	A dialog menu appears with index cards. It is worth going through all the index cards to see the range of axis facilities
Choose the **Limits** index card	This allows the range and intervals along the axis to be reset
Change the limits of the X axis to **1** and **15** instead of 2 and 14	The error bars will stand out better, particularly those at x = 2 and x = 14
Click **OK**	to return to the graph

Adding a legend

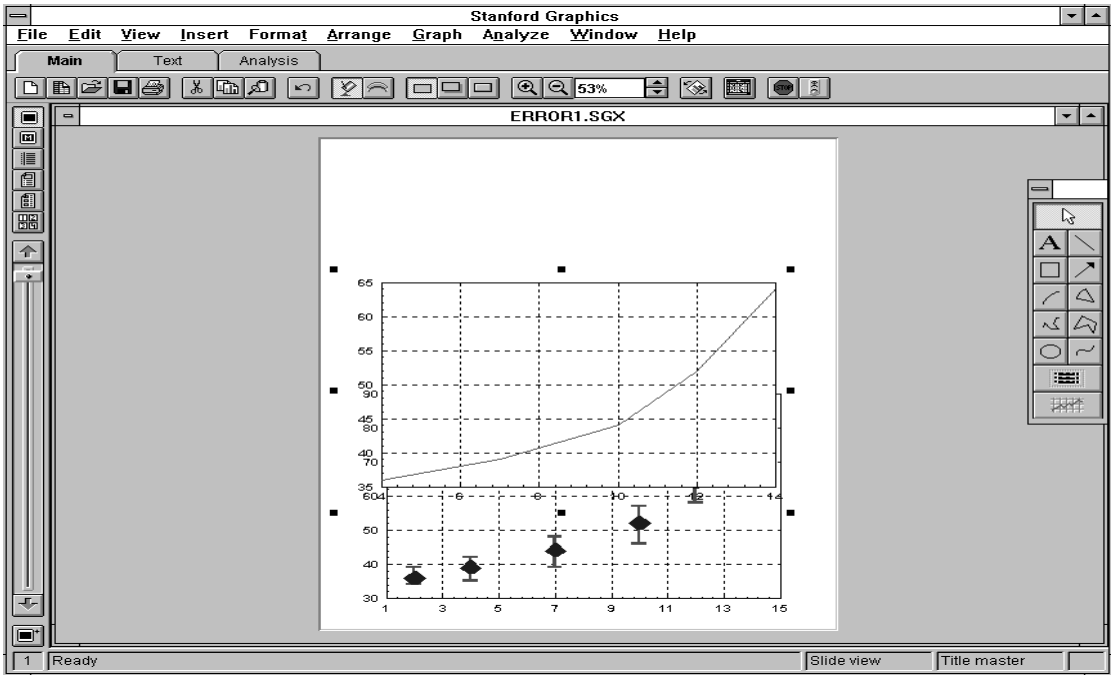


Adding the legend is left as an exercise. You should save the graph before moving to the next part of the exercise.

Checkpoint 2

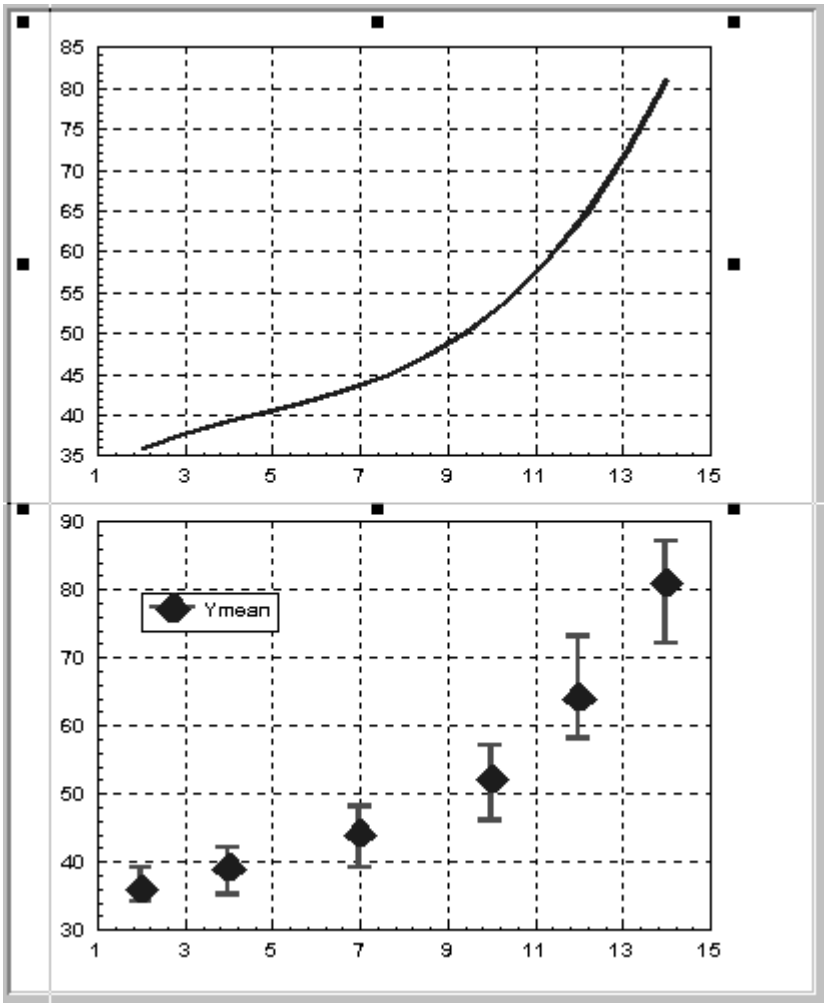
If you have not obtained a picture similar to the one above, then either load the file EX2CH2.SGX and start here or you could load the file EX2CH1.SGX and retrace the steps from Checkpoint 1.

Adding another graph to the same page



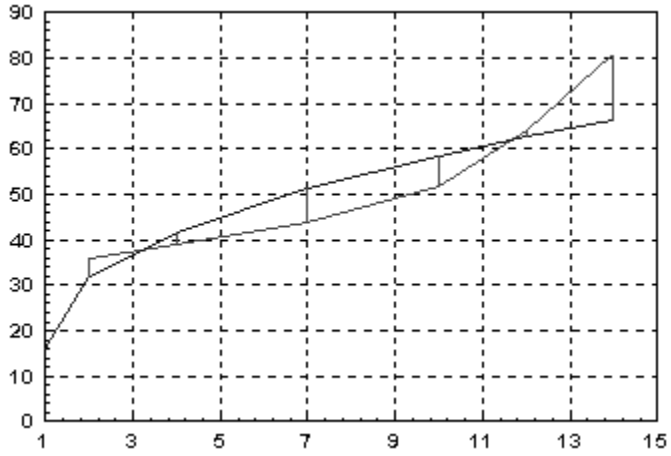
Select the graph and move down the page	Make sure the whole graph is selected
Select **Graph/Add Graph**	You are about to create a line graph plotting Ymean against Xmean
Select **Technical/X-Y plot** then **OK**	Make sure that the 3D option is switched off
Click **Display**	on the Spreadsheet Resource Panel
Click Column **A**	and set to the X Values
Click Column **B**	and set to the Y Values
Click **Ymean**	and set to the Legend Label
Click **OK**	to return to the graph

Using the guides and snap grids to align the graphs

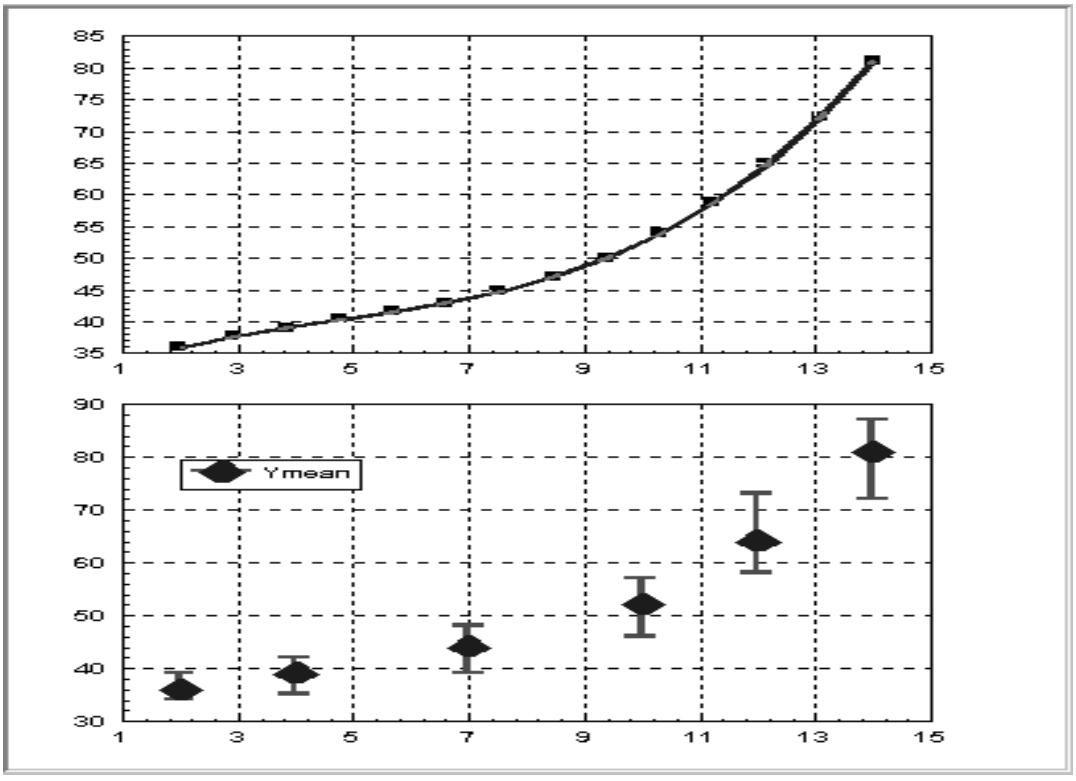


Select **Arrange/Show Guides** and **Arrange/Snap to Grid**	A tick should appear by both of these items. Rulers appear on the graph; these can be moved around. When Snap to Grid has been selected, any objects moved around will be snapped to points on a grid.
Move the vertical ruler to the left	This will allow vertical alignment of the left axes of both graphs
Select the graphs one by one	and move them so that they are aligned. Another way of doing this is to use the **Arrange/Size** menu item
Select X axis of top graph	and change the limits to 1 and 15

Trying the curve fitting routines

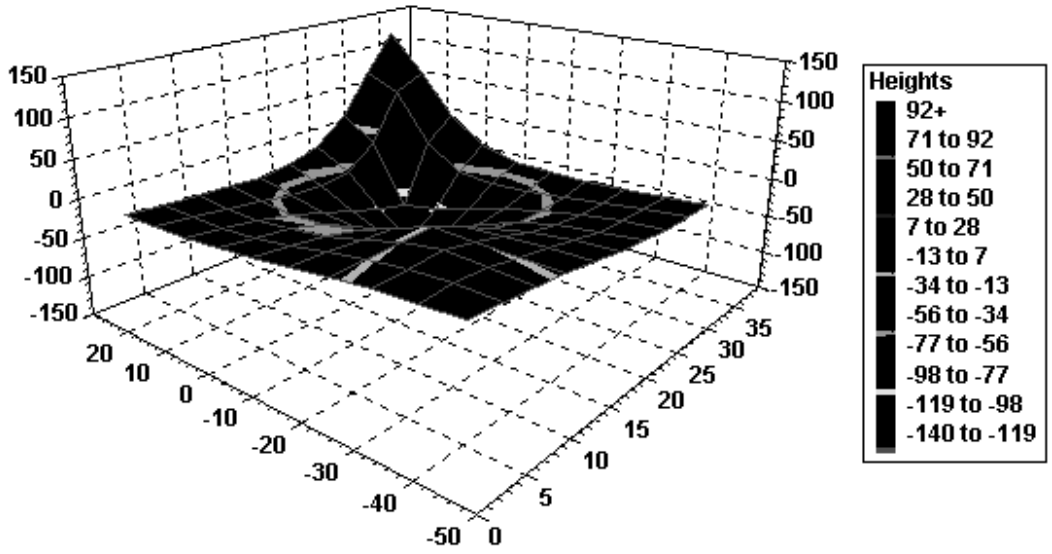


Select the curve	Handles should appear at all the points
Select **Analyze/Geometric Fit** then **OK**	This is one of the possible curve fits. You should get a picture similar to the one above
Select **Analyze/Polynomial Fit** then **OK**	You could change the order to 3, switching off sample input and changing the sample number to 14 from 7. This provides a good fit as can be seen from the picture below. Save the graphs.



Exercise 3 To draw a 3D surface plot

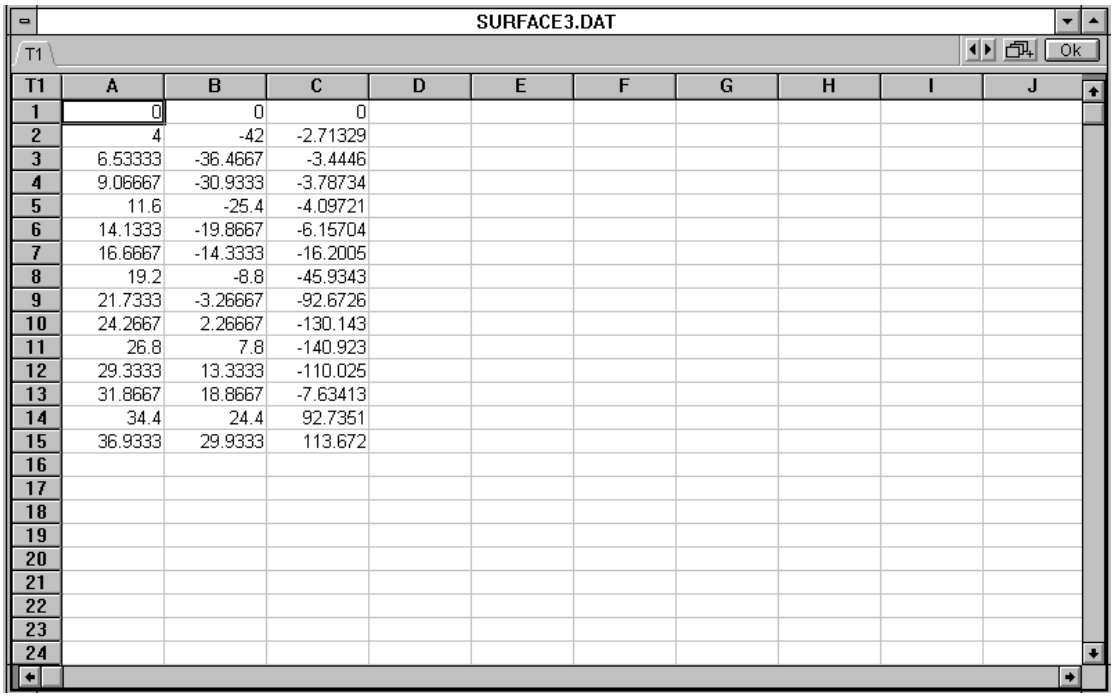
The 3D surface plot option in Stanford Graphics allows a surface mesh to be drawn, provided that there is a regular grid of x,y,z values. In addition, if a set of triplets is available, Stanford Graphics has an option to process this data and produce the surface plot.



In this example, you will be doing the following set of actions. Full instructions will be given.

1. Importing 3D data into a spreadsheet
2. Selecting a graph type
3. Checking the spreadsheet
4. Changing the viewpoint
5. Changing the colour map scheme
6. Changing the legend annotation
7. Regridding the data
8. Changing the weights used in the interpolation

Importing 3D data into a spreadsheet



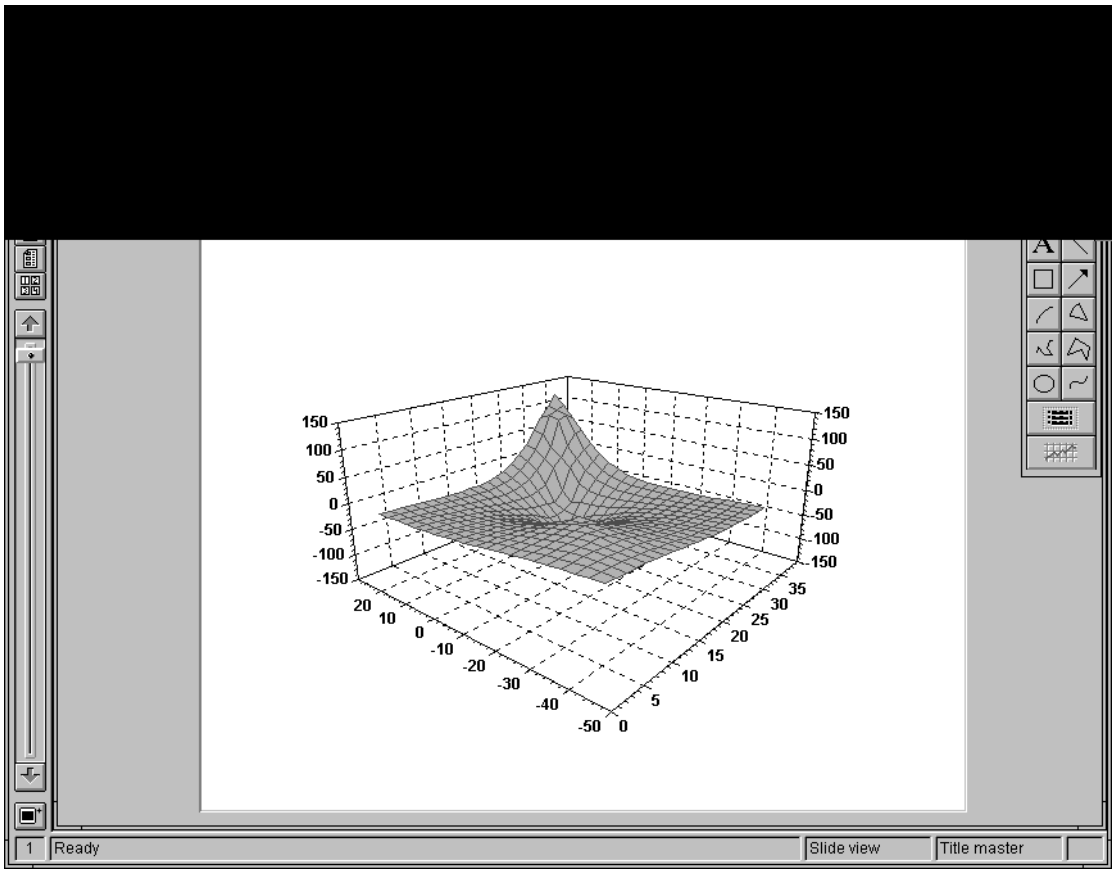
SURFACE3.DAT

T1 | Ok

T1	A	B	C	D	E	F	G	H	I	J
1	0	0	0							
2	4	-42	-2.71329							
3	6.53333	-36.4667	-3.4446							
4	9.06667	-30.9333	-3.78734							
5	11.6	-25.4	-4.09721							
6	14.1333	-19.8667	-6.15704							
7	16.6667	-14.3333	-16.2005							
8	19.2	-8.8	-45.9343							
9	21.7333	-3.26667	-92.6726							
10	24.2667	2.26667	-130.143							
11	26.8	7.8	-140.923							
12	29.3333	13.3333	-110.025							
13	31.8667	18.8667	-7.63413							
14	34.4	24.4	92.7351							
15	36.9333	29.9333	113.672							
16										
17										
18										
19										
20										
21										
22										
23										
24										

Start up and set **Landscape** orientation for the printer	Have a look at previous exercises if you cannot remember how to do this
Select **View/Spreadsheet**	to go to the Spreadsheet Resource Panel
Select **Import**	and find the file **surface3.dat**. This file is also a sample file provided by Stanford Graphics - see the section **Local Setup of Stanford Graphics** for details on accessing this file. Notice there is no Range Highlighter - this only appears if a graph type has been selected
Click **No**	for maintaining the link to the data file

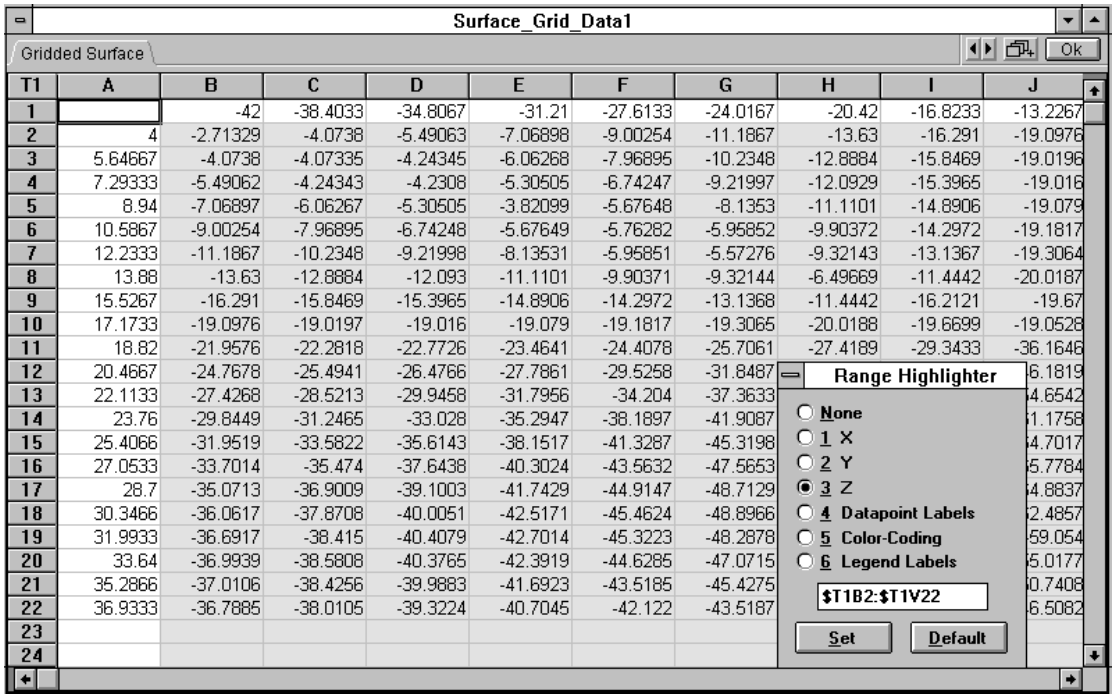
Selecting a graph type



Select **Graph/Add Graph**	A dialog box appears
Click box by **3D**	This time we want a 3D plot
Select **Technical/Surface plot from triplets** then **OK**	The data is processed automatically, provided that X, Y and Z columns are in Columns A, B and C. There is no Range Highlighter for the input data
Select **OK**	at the top right of the spreadsheet. The 3D plot appears. A new spreadsheet is created which shows Z values for the points on a regular X-Y grid. These points are created by interpolation from the original X, Y and Z points.

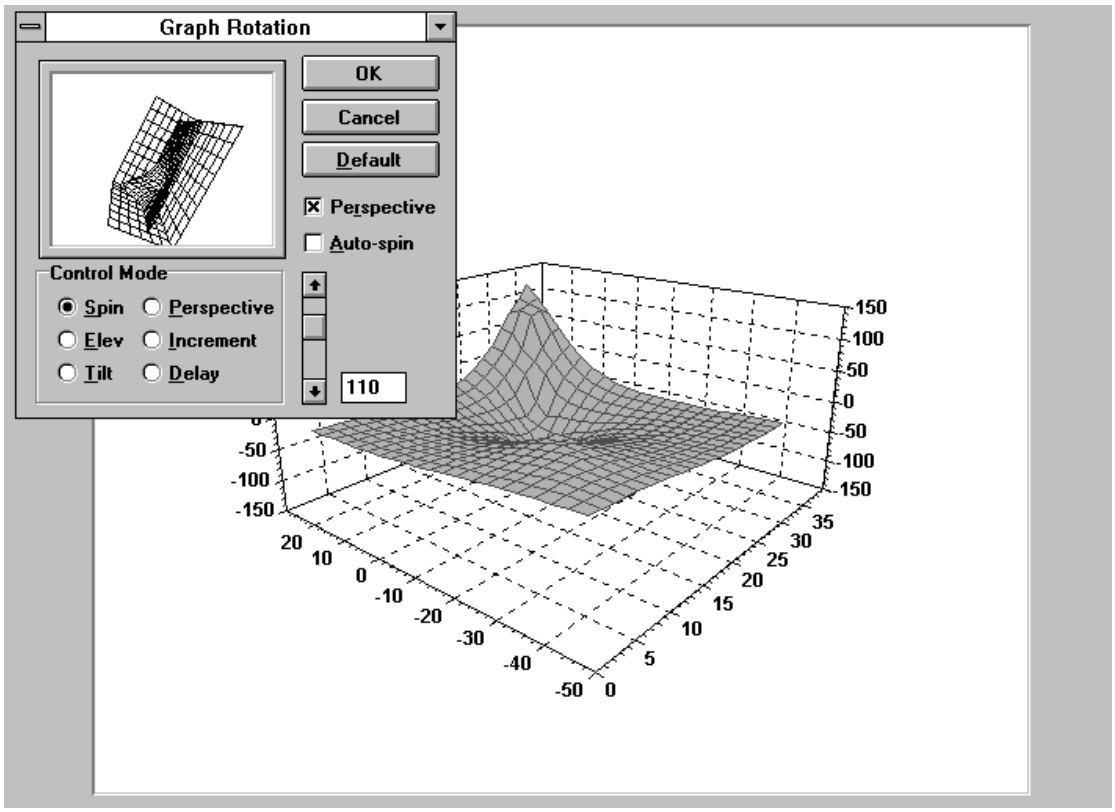
Checkpoint 1
If you have not obtained the picture above, then either load the file EX3CH1.SGX and start from this point or start from the beginning again

Checking the spreadsheet



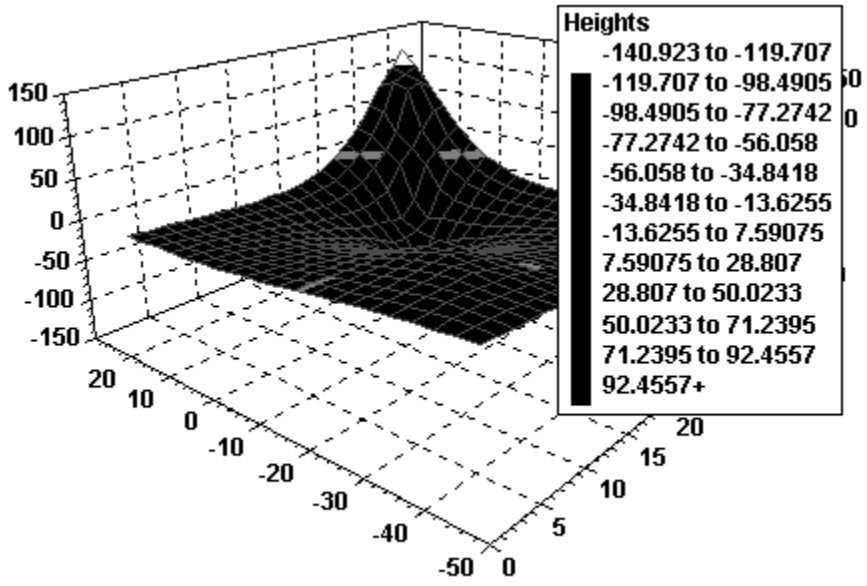
Select **View/Spreadsheet**	having made sure that the graph is selected
Click **Output Data** then **OK**	A large matrix of values appears
Click **Z** on the Range Highlighter	and most of the matrix is highlighted as shown above. These are the interpolated Z values. Have a look at where the X and Y values are and then return to the graph. Do not change anything on the Range Highlighter

Changing the viewpoint



Select the graph	and make sure there are handles round the whole graph
Select **Edit/Rotate Graph**	A new dialog box appears - this contains dials for the spin, elevation and tilt which are the angles around the z axis, from the z axis and around the x axis.
Experiment with the values for spin etc by moving the vertical scroll bar next to the Control Mode and finally select **Default**	to return to the original view. The default values for spin,elev and tilt are 50, 290 and 0 (in degrees)

Changing the colour map scheme

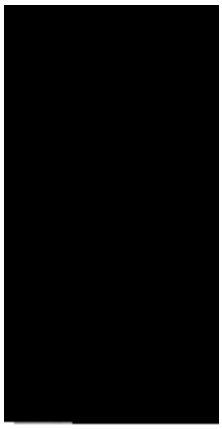


Select **Format/Style**	keeping the graph selected
Switch to a **Colormap** scheme and click **OK**	A colour scale is set up to show the different heights
Select **Graph/Add Legend**	to create a legend - give a title of **Heights**

Checkpoint 2

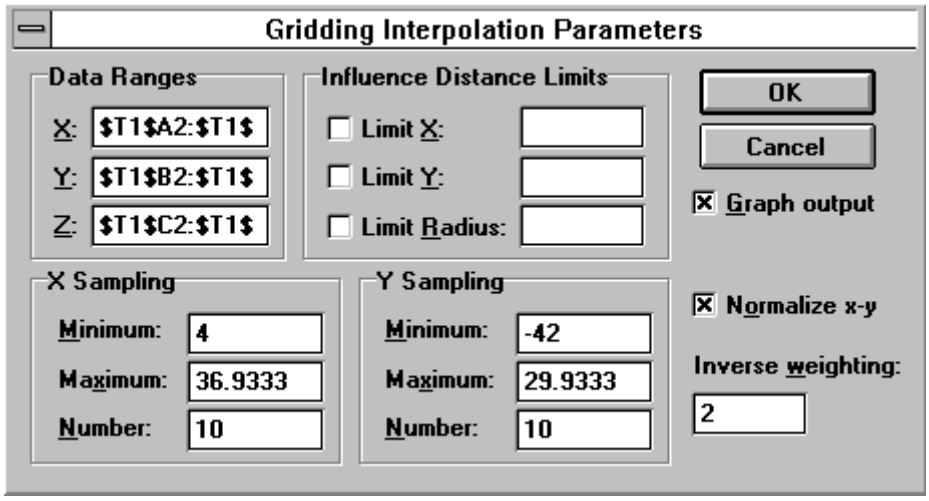
If you have not obtained a picture similar to the one above, then either load the file EX3CH2.SGX and start from here or load the file EX3CH1.SGX and retrace your steps from that checkpoint.

Changing the legend annotation



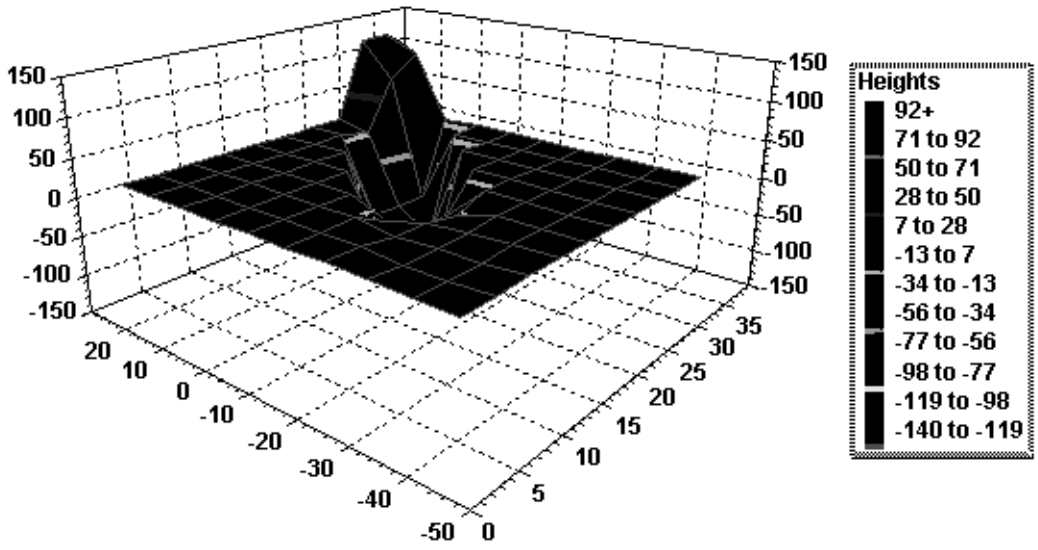
Select the legend	If this is difficult, then move the graph first to the left
Select **Format/Numbers**	Stanford Graphics has a multitude of formats to choose from. Number formats are described in more detail in the Stanford Graphics User Guide.
Choose **#,##0** and click **OK**	This means that numbers lose their decimal places and decimal points
Move the legend and graph apart	so you can see everything

Regridding the data



Click on the surface	and there should be many handles visible
Select **Analyze/Grid Surface**	A dialog menu appears - this allows various parameters connected with the interpolation process to be changed.
Change the number of samples for both X and Y from 21 to **10**. Click **OK**	This means a smaller grid is to be generated. You could have a look at the resultant spreadsheet to check the size of the resultant matrix

Changing the weights used in the interpolation



Repeat the **Analyze/Grid Surface** command	keeping the surface still selected
Change the value of **Inverse Weighting** from 2 to **1.** Click **OK**	What do you think is happening here? Try changing it to 4 as well.
Click the box by **Limit radius,** set it to **5** and click **OK**	Why do so many points have zero values?
Save the graph and close	as usual

Exercise 4 To draw the curve of a 3D function

Start a new presentation. If you have left Stanford Graphics altogether, then restart; otherwise, click **File/New** to begin a new presentation.

There is what is called a Formula Visualiser in Stanford Graphics which allows you to input your own equations for 2D and 3D curves and surfaces.

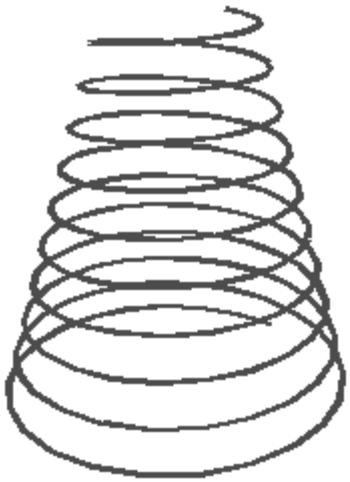
This exercise is to draw a tapered helix. The parametric equations for the helix are as follows:-

x = cos(t) * (a - (a - b) * t / 360 / n)
y = sin(t) * (a - (a - b) * t / 360 / n)
z = c * t / 360 / n

where

a is the radius at the bottom
b is the radius at the top
c is the height
n is the number of turns

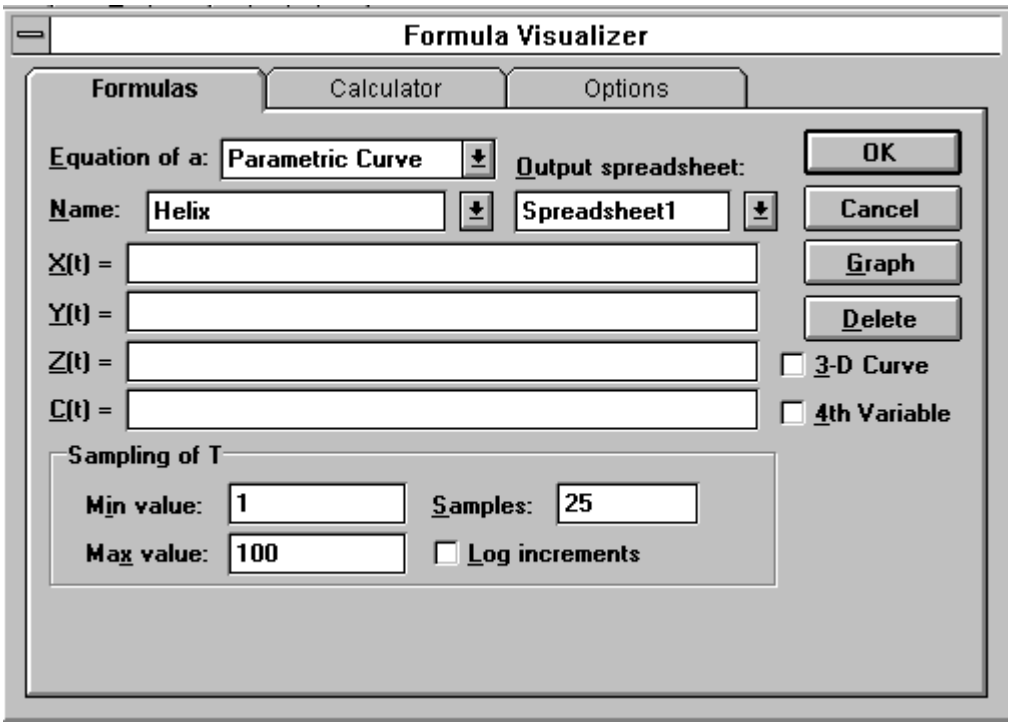
For the picture here, a = 100 and b = 40 and c = 360. The minimum and maximum values for t are to be set at 0 and 3600 (10 times 360). We should try to make sure that the number of sample points is reasonably large, say about 240 (or 24 for each twist)



In this exercise, you will be proceeding through the following list of actions:

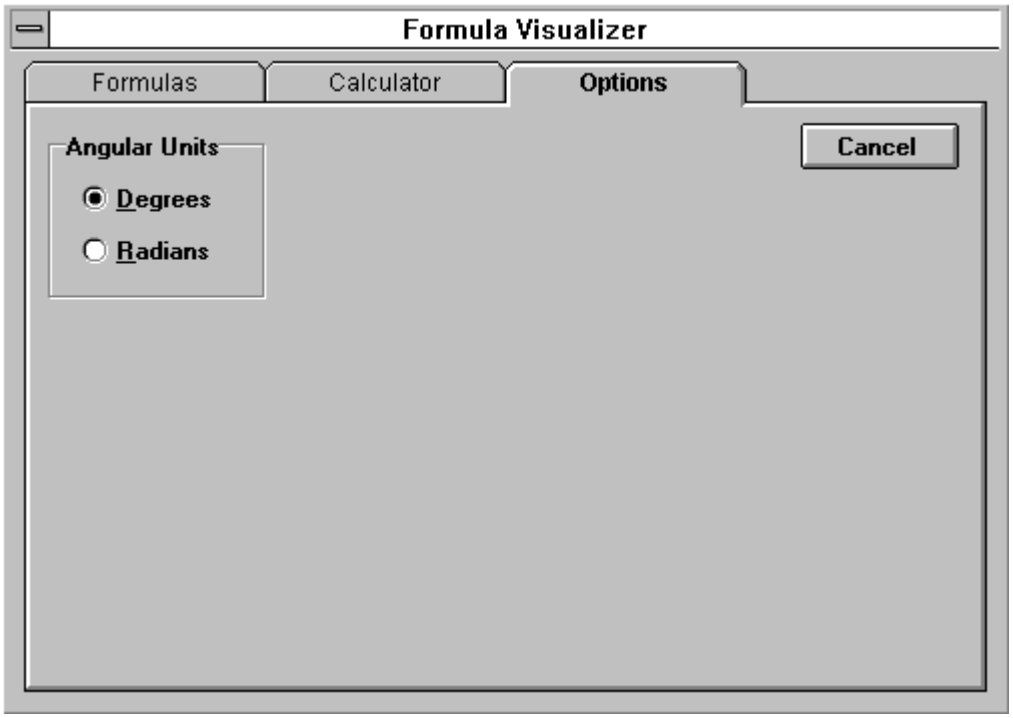
1. Opening the Formula Visualiser
2. Selecting the parametric curve options
3. Typing the parametric equations for x, y, and z
4. Setting limits for the parameter
5. Drawing the curve
6. Altering the equations

Opening the Formula Visualiser



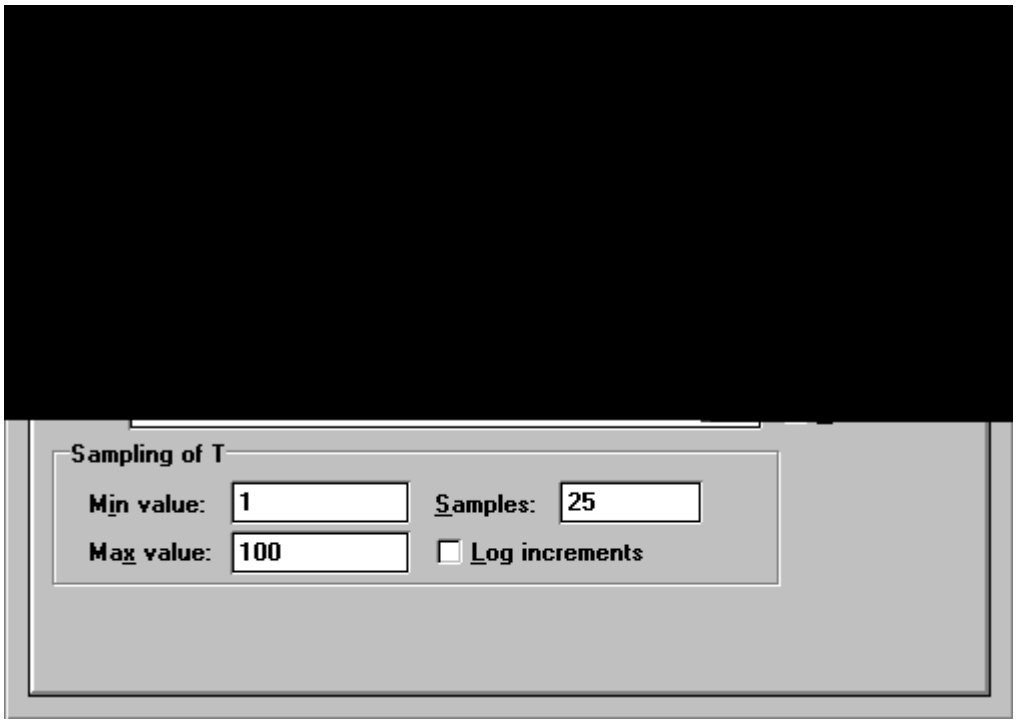
Select **Anaylze/Formula Visualiser**	A dialog box appears
Click on the scroll box by **Equation of a:** and select **Parametric Curve**	The dialog box changes form to show X(t), Y(t) and Z(t) where t is the parameter of the curve
Type **Helix** for the name	You can create any number of curves and surfaces. They are given names so you can select which formula is to be current

Selecting the parametric curve options



Click on the **Options** index card	A new panel comes up
Click the **Degrees** box	so that it is marked like the panel above
Return to the **Formulas** index card	ready to type the parametric equations

Typing the parametric equations for x,y and z

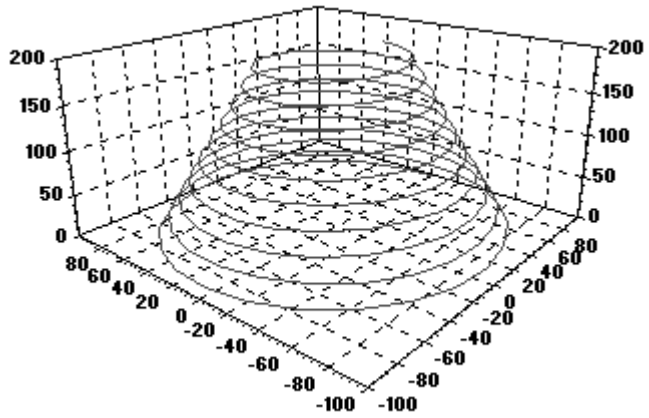


Click in box by X(t)	and type the equation for X(t) as above
Click in box by Y(t)	and type the equation for Y(t)
Click in box by Z(t)	and type the equation for Z(t). Do **NOT** click OK or press Enter

Setting limits for the parameter

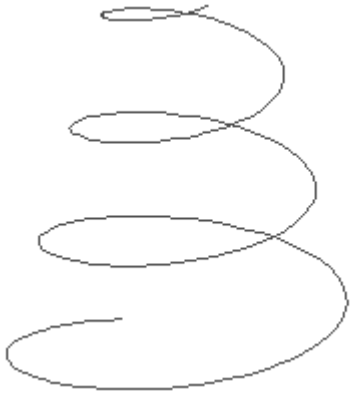
Click in box by **Min value**	and set to the value of 0
Click in box by **Max value**	and set to 3600
Click in box by **Samples**	and set to 240. Again, do **NOT** click OK or press Enter

Drawing the curve



Choose **Graph**	The above plot should appear. If you had selected OK instead of Graph, you would see the spreadsheet instead of the above plot.
Select any one of the axes	You want to remove all traces of the axes
Select **Format /Style**	As an exercise, use the Style, Tickmarks, Labels and Gridlines index cards to remove the axis. Repeat for the other two axes

Altering the equations

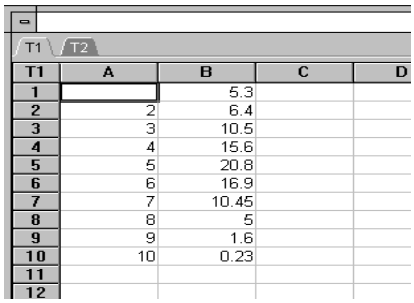


Select **Analyze/Formula Visualiser**	to change the equations
Click the scroll box by Name and pick **Helix**	The parametric equations reappear
As an exercise, try changing the equations so that there are 3.5 turns	You could also try rotating the graph to get a better view and switching off perspective viewing.
Save the graph and close	

Exercise 5 To become familiar with the spreadsheet facilities

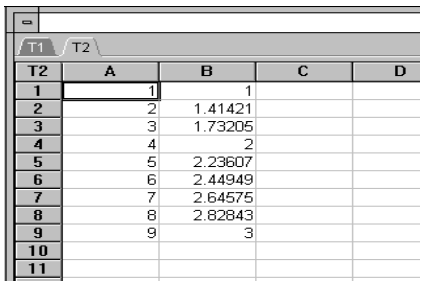
Introduction to spreadsheets

All data in Stanford Graphics is held in one or more spreadsheets. In general a spreadsheet consists of a set of tables containing a set of rows and columns. In the diagram shown below a spreadsheet containing two tables, T1 and T2, are shown. T1 is currently visible.



T1	A	B	C	D
1		5.3		
2	2	6.4		
3	3	10.5		
4	4	15.6		
5	5	20.8		
6	6	16.9		
7	7	10.45		
8	8	5		
9	9	1.6		
10	10	0.23		
11				
12				

Clicking on the tab T2 reveals the contents of table T2 as shown below.



T2	A	B	C	D
1	1	1		
2	2	1.41421		
3	3	1.73205		
4	4	2		
5	5	2.23607		
6	6	2.44949		
7	7	2.64575		
8	8	2.82843		
9	9	3		
10				
11				

A graph is created by first specifying the type of graph required and then specifying the data which is to be graphed using a Range Highlighter. The Range Highlighter links the data in a spreadsheet to the variables required to make up the required graph. The format of the Range Highlighter is determined by the type of graph selected. It acts as a link between the data in the spreadsheet and the data representation on a graph.

The above example, which shows the Range Highlighter for an X-Y Plot, shows that the cells A1 to A5 in the first column of the active table, which is T1, in the active spreadsheet have been specified as the X-values for the

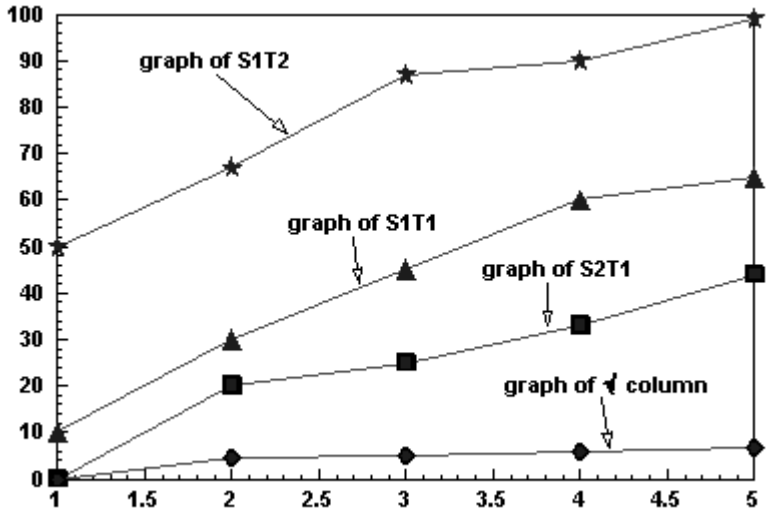
graph. Ranges can be selected by typing into the Range Highlighter dialogue box or by selecting (and dragging) over cells in the spreadsheet.

It is possible to use data in any part of any table in any spreadsheet to create a graph. Different parts of the same graph can contain curves defined by data in different tables in different spreadsheets.

The following example will illustrate the above points and also provide a brief introduction to the use of spreadsheets. For a full explanation of spreadsheets, see the Stanford Graphics User Guide.

Example

In this example we shall create two spreadsheets, one containing two tables and the other only one. The data in the second spreadsheet will be partly created from the data in the first. This will serve to illustrate briefly some of the spreadsheet capabilities available. We will then use the data in the different spreadsheets to create the graphs shown below. The labelling of the curves is not included in the instructions. Labelling using the text features is covered elsewhere in this workbook.



In this example, you will be doing the following. Full instructions are given below for each procedure.

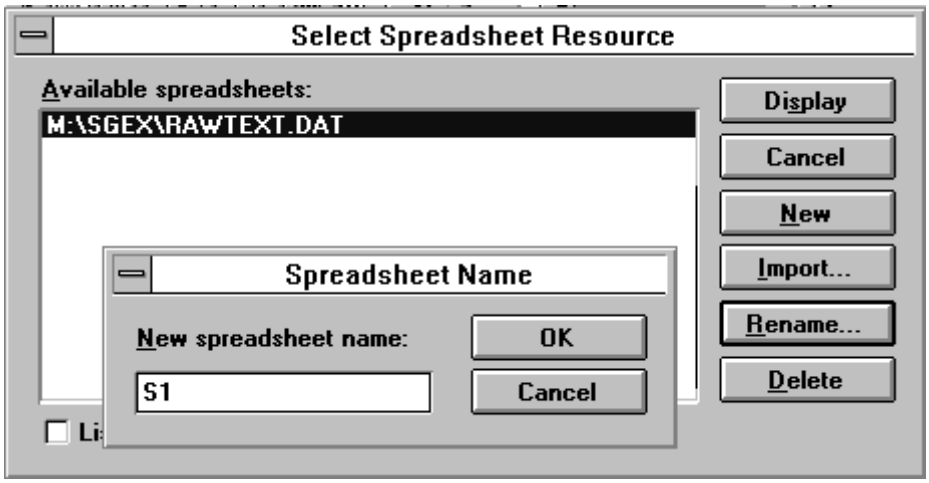
1. Creating one spreadsheet (called S1) by importing a data set
2. Adding a new table (T2) to S1
3. Typing in some data into S1T2
4. Creating a new spreadsheet (called S2) by cutting / pasting from S1T1
5. Drawing graphs based on S1T1, S1T2 and S2T1
6. Creating another column in S2 by using a spreadsheet formula
7. Drawing a graph using this extra column

Creating one spreadsheet (called S1) by importing a data set

First, create an ASCII file called **rawtext.dat** with a text editor containing the following lines

```
5    2
1    10
2    30
3    45
4    60
5    65
```

This data will be imported into Stanford Graphics as a spreadsheet. Note that the first line specifies the number of rows and columns in the spreadsheet. This spreadsheet will therefore have 5 rows and 2 columns.

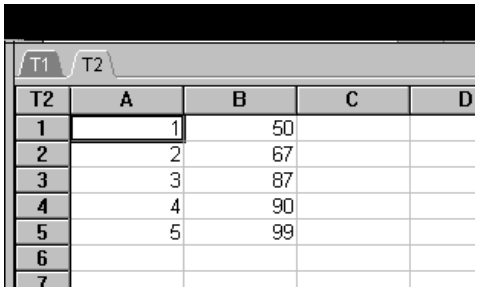


Open Stanford Graphics.	This will open a new presentation called **Untitled 1.**
Select **View/Spreadsheet**	or the **Open Spreadsheet** tool 
Choose **Import**	and select the file **rawtext.dat**. No link to the file is to be maintained
Select **OK**	in the top right of the spreadsheet
Select the **Open Spreadsheet** tool again	to obtain the Spreadsheet Resource Panel and highlight **rawtext.dat**
Select **Rename**.	and type **S1** to rename the spreadsheet
Choose **Display**	to display the spreadsheet S1

Adding a new table (T2) to S1

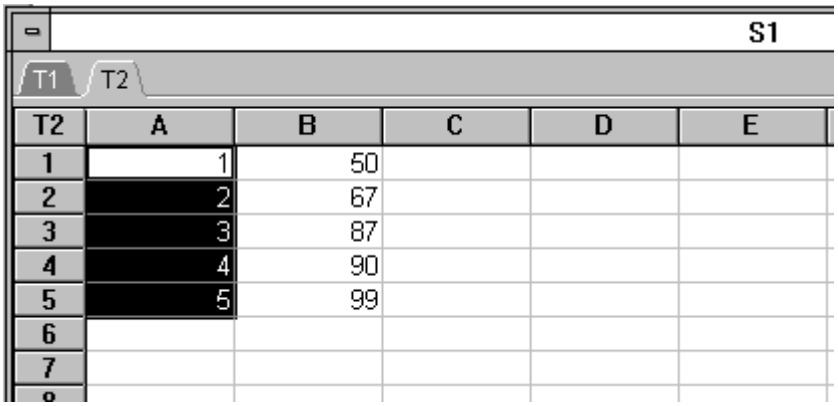
Choose **Edit/New Table** or click on the  icon	which is at the bottom left of the spreadsheet. Notice the new tag **T2** appears
Click on **T1**	to see the data imported previously into S1T1
Click on **T2**	to return to S1T2

Typing in some data into S1T2



Now type the data	as shown in the table T2 above

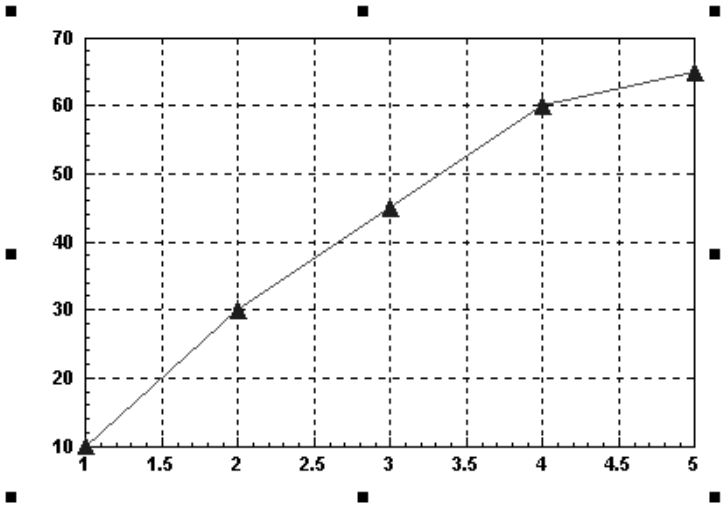
Creating a new spreadsheet (called S2) by cutting/pasting from S1T1



Click on the **Open New Spreadsheet** tool	to create a new spreadsheet
Click on the **Open Spreadsheets** tool	to open the Spreadsheet Resource Panel. Then rename this new spreadsheet as **S2**
Highlight **S1** and then **Display**	to display the spreadsheet S1
Click and drag to select cells **A1-A5**	These cells should be highlighted
Choose **Edit/Copy** or click on the **Copy** tool on the Main toolbar	to make a copy of the cells on the clipboard
Choose the **Open Spreadsheets** tool	and display spreadsheet S2
Make sure the current cell is A1 and select **Edit/Paste**	or the **Paste** Tool The cells A1 to A5 are filled with the clipboard contents
Type in cells B1-B5	the numbers 0, 20, 25, 33, 44

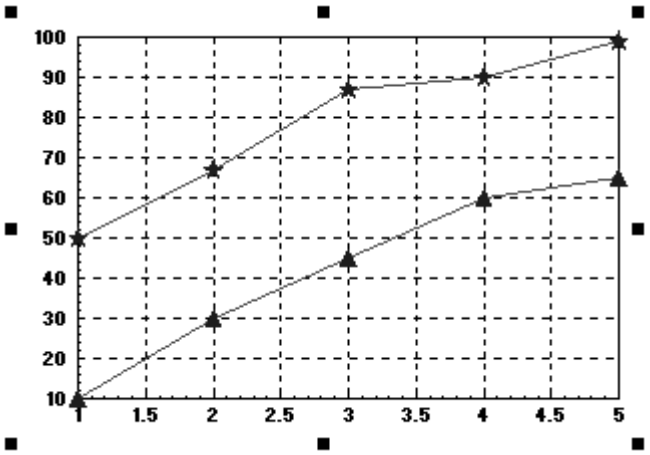
Checkpoint 1

Drawing graphs based on S1T1, S1T2 and S2T1



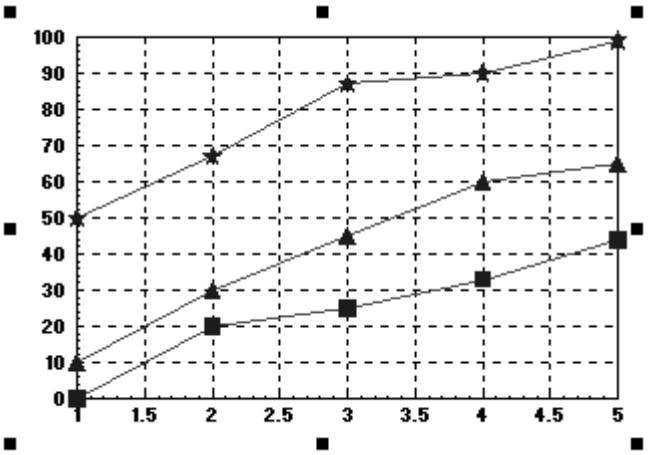
First display **S1** and then select **Graph /Add Graph**	and choose a **2D Technical X-Y** plot
Create a graph of **S1T1**	using the Range Highlighter
Click on the curve and then select **Format/Curve Symbols**	to add curve symbols (use solid triangles)
Click just above the centre of the top horizontal axis	to display the handles - these indicate the graph is selected. See the picture above

Drawing graphs based on S1T1, S1T2 and S2T1 (continued)



Select **Graph/Add Data**	to add another line
Scroll and highlight **X-Y curve**	and then click **OK**. Notice that there are fewer graph types now.
Display spreadsheet **S1**	and then go to table **T2**
Use the Range Highlighter	to set the X-range to cells A1-A5
Similarily set the Y-range to cells B1-B5	and select **OK** to display the graph. Select the new line on the graph
Select **Format/Curve Symbols**	to add the curve symbols (solid stars)

Drawing graphs based on S1T1, S1T2 and S2T1 (continued)

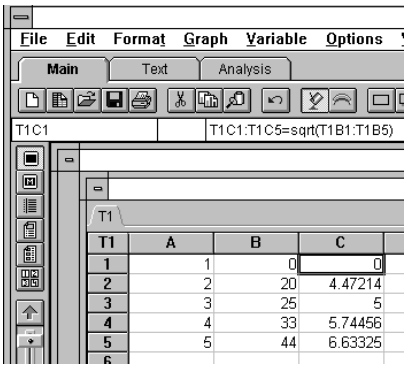


Select the whole graph	
Select **Graph/Add Data**	and choose **X-Y curve** as before
Display spreadsheet **S2**	There is only one table T1
Use the Range Highlighter	to set the X-range to cells A1-A5 and to set the Y-range to cells B1-B5
Select **OK** to display the graph	then select the new line
Select **Format/Curve Symbols**	to add the curve symbols (solid squares)

Checkpoint 2

If you have not obtained a picture similar to the above, then you can either load the file EX5CH2.SGX and continue on the next page or you can load the file EX5CH1.SGX and retrace your steps from Checkpoint 1.

Creating another column in S2 by using a spreadsheet formula

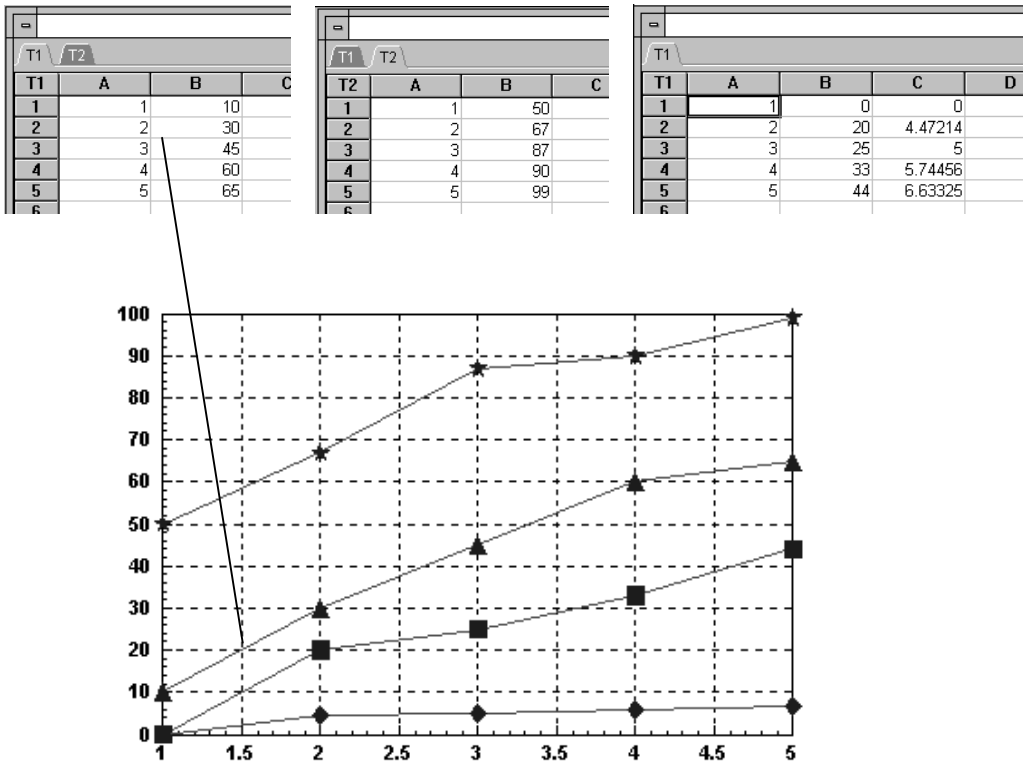


Select **View/Spreadsheet**	Spreadsheet S2 should be displayed
Select the cells C1 - C5	these should be empty
Type **=sqrt(**	You will see the formula in display area
Select the cells B1 - B5	and watch the formula - note the range appears.
Type **)** then press **Enter**	and the square root values should appear in cells C1 to C5
Click **OK**	to return to the graph

Drawing a graph using this extra column

Add the curve for this data to the graph as before using **Graph/Add Data.** Remember to select the whole graph first. Then add solid diamond symbols to the curve produced

The diagram below shows the relationships between the graph and the spreadsheets. All graphs are plotted against the cells A1-A5.



Exercise 6 To create a presentation

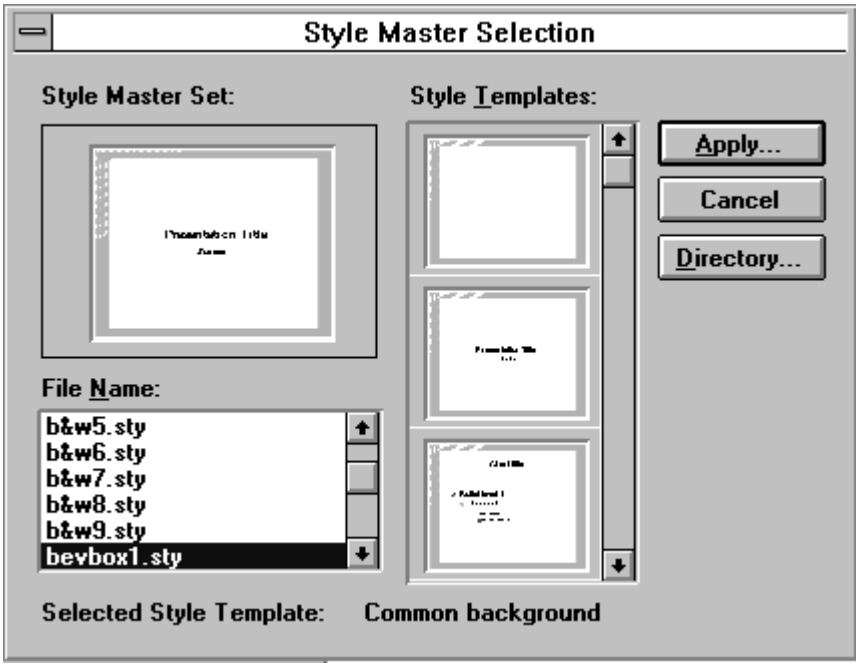
Stanford Graphics, as shown in the previous exercises, is fairly strong on technical / business charting facilities but it is weak as far as presentation facilities are concerned. It is normally recommended by us that a package like Microsoft PowerPoint is used for presentation purposes. However, if no such package is available, Stanford Graphics could well meet your needs. During this next exercise, several slides are created and a slide show is run.

In this example, you will be doing the following:

1. Choosing a background
2. Choosing a master template
3. Using the Outline View
4. Switching to the Slide View
5. Creating bulletted text
6. Adding graphical objects to a slide
7. Inserting two new slides
8. Adding a graph to one slide
9. Adding another graph to the next slide
10. Adding data labels to one graph
11. Using the slide sorter
12. Running a slide show
13. Printing the slides

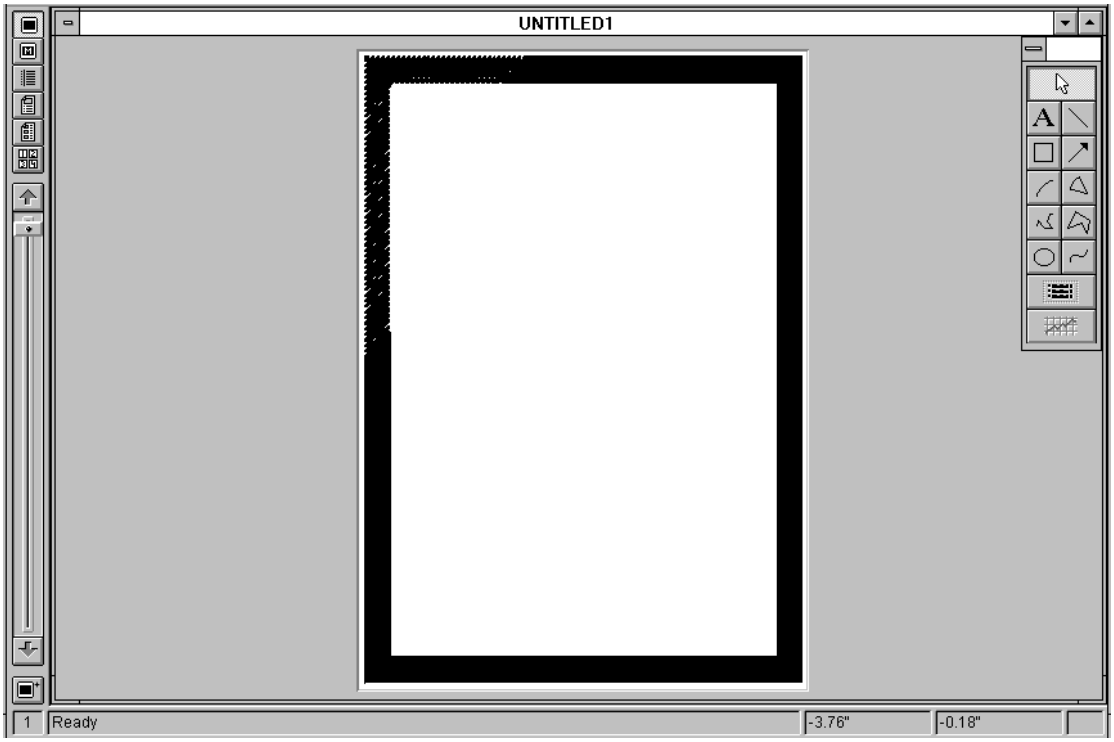
Choosing a background

This is starting a new exercise so you should have created a new presentation in Stanford Graphics. Please use portrait orientation. Notice that the slide number at the bottom left of the presentation is 1.



Click the background symbol 	This is on the left hand side. You should now have the letter B in bottom left corner
Select **Edit/Style Master**	A dialog box appears - this allows a background picture to be placed on all the slides
Click **bevbox1.sty** or another style file	A preview picture appears as in the picture above. You can select another style immediately if the current one does not suit you.
Click **Apply**	You are then asked to confirm that you want this style to be applied to all slides so .....
Click **Yes**	The background slide appears with picture just chosen

Choosing a master template

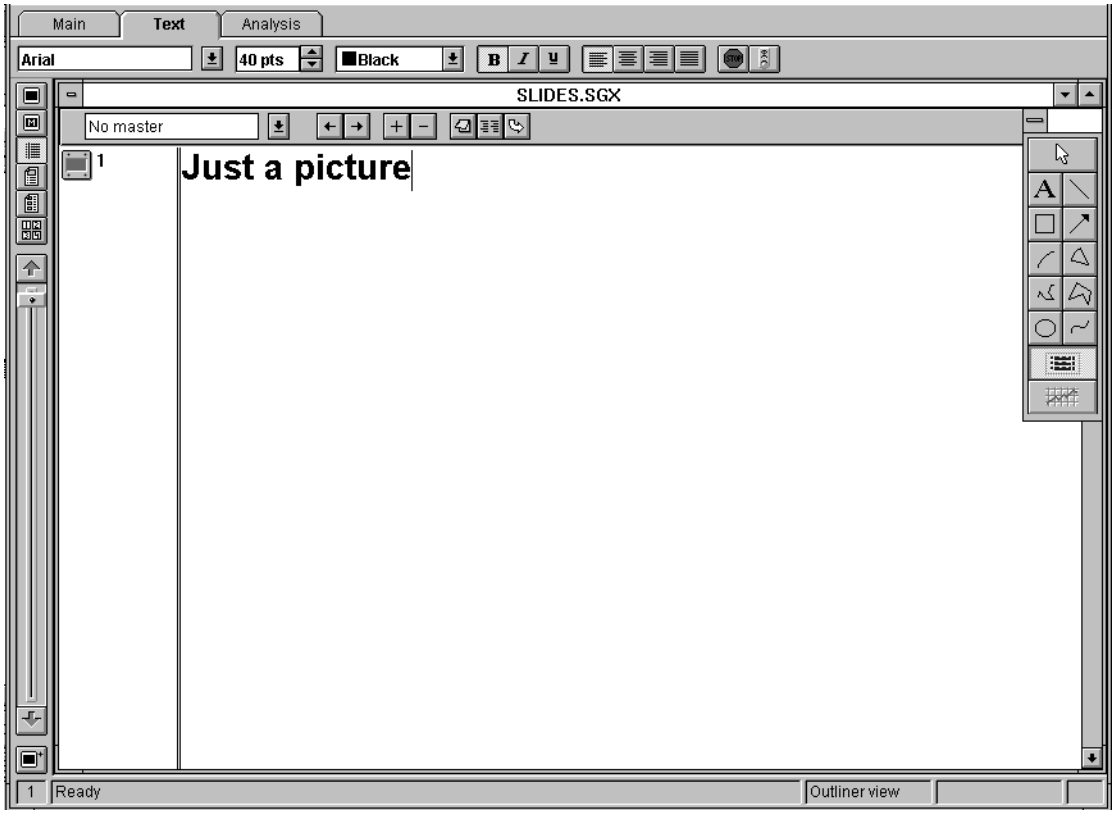


Click on the background picture	and change the size so it fits the page
Click the **Slide View** symbol	The number 1 appears in bottom left and the slide has a background. You may also have boxes which are called placeholders such as one for a title. The background border cannot be changed unless you return to the backgound slide and update it..
Select **Edit/Include Master**	This allows a choice from various templates such as a title and a graph or 3 graphs on a page. You can create your own templates - see the Stanford Graphics User Guide for details
Click **None**	Any boxes such as Title Placeholder now disappear

Checkpoint 1
If you have not obtained the picture above, then you can either load the file EX6CH1.SGX or you can start from the beginning again

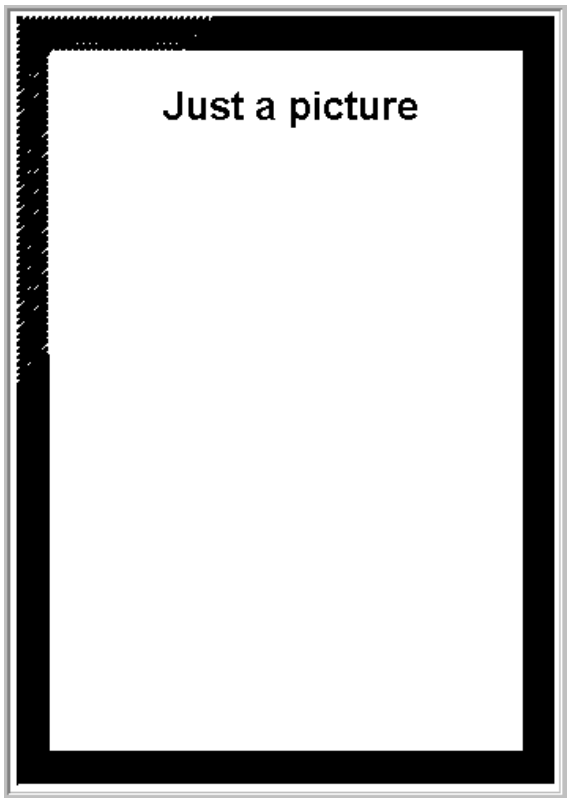
Using the Outline View

If a presentation is consisted mostly of text, it is much faster to create the slides by using the Outline View.



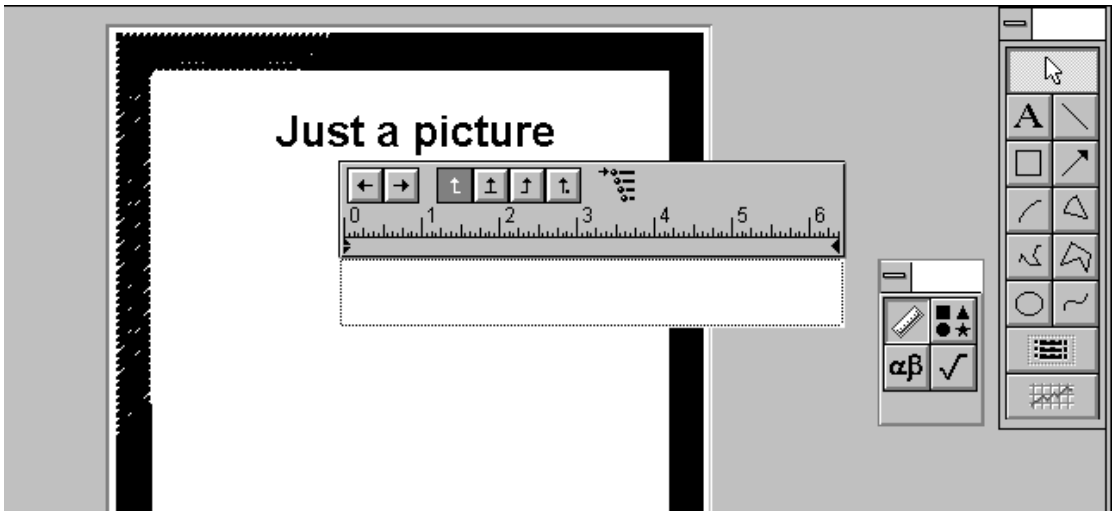
Click the **Outline View** symbol 	A panel where only text can be input appears. Notice that you are told which is the current view on the bottom line towards the right.
Type **Just a picture**	The text appears by the symbol representing slide 1. Be careful not to press the Return key since this creates a new slide. If you do have two slide symbols, delete the empty one.
Click on the **Text** index card and change the size to **40**	Notice that the text on the Outline view changes in size

Switching to the Slide View

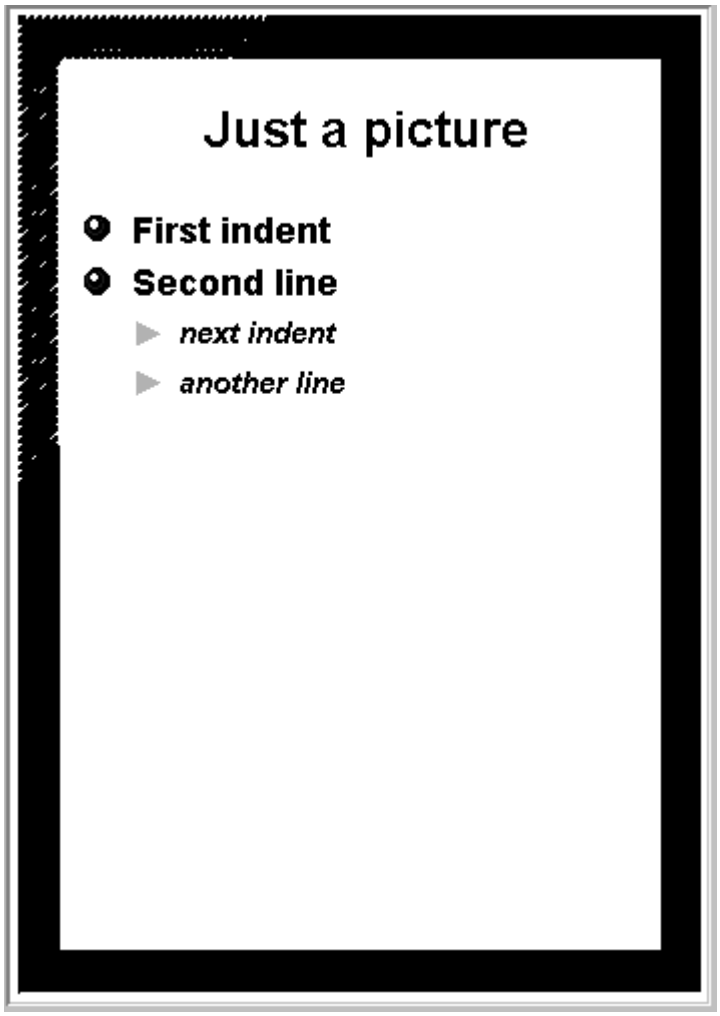


Click on the **Slide View** symbol 	Depending on what defaults have been set by the local support, the text may have a filled background and it may not be at the top of the page.
Click on the text and select **Format/Fill**	and choose **None** for the fill style
Move the text up to the top of the page	if necessary, so the picture appears similar to the above.

Creating bulleted text



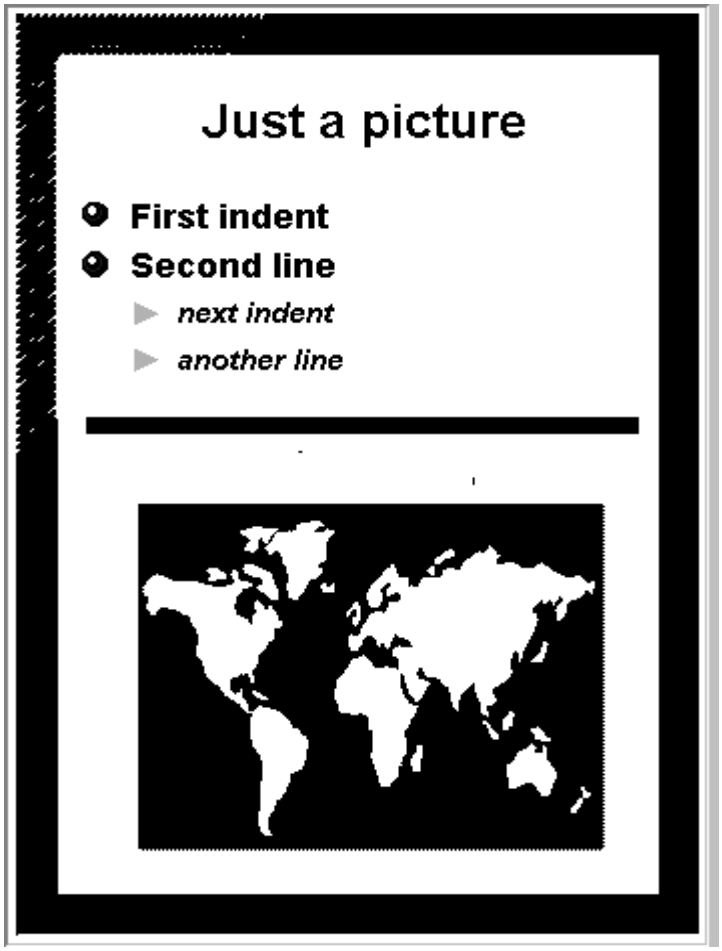
Click the **Bullet text** symbol  which is on the toolbar	staying in the Slide View. Note that bullets can be created in Outline View as well
Type **First indent** followed by the **Return** key	in the text panel. It is ready to receive more text when the Return key is pressed.
Type **Second line** followed by the **Return** key	Both of these lines are at the same bullet level
Press the **Tab** key and then type **next indent**	By using the Tab key, text is now at the next bullet level. Press **Return** again
Type **another line**	This is at same bullet level as previous text. To return to the previous level, use Shift+Tab
Click anywhere on the picture	All four new lines of text should appear. As an exercise, try moving the text and then using **Format/Bullet Scheme** to change the bullets and the text formatting



Checkpoint 2

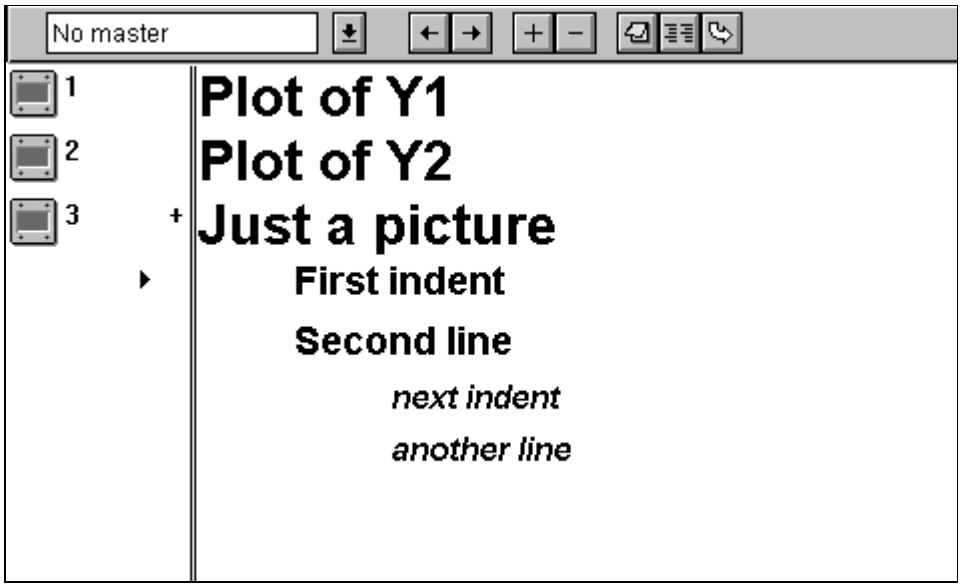
If you have not obtained a picture similar to the picture above, then you can either load the file EX6CH2.SGX and carry on or you can load the file EX6CH1.SGX and start from the previous checkpoint.

Adding graphical objects to a slide



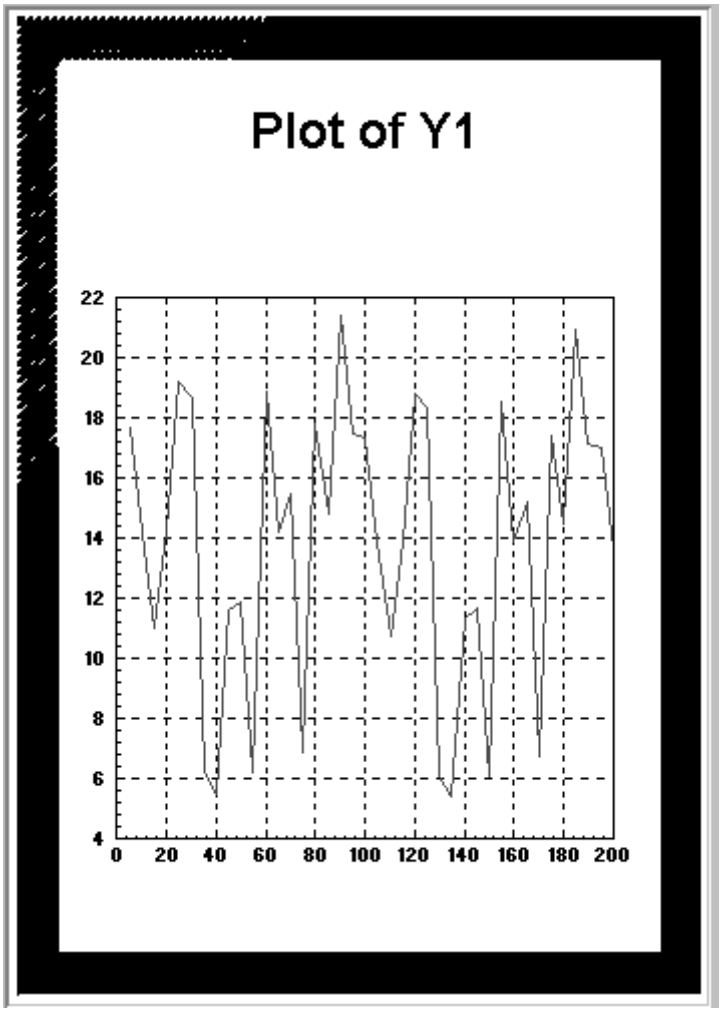
Click the **Rectangle** tool on the toolbar 	This is a good way of drawing a straight horizontal line. The rectangle is created by dragging from one corner to the opposite corner. Keep the rectangle selected.
Select **Format/Fill**	Try using a **Gradient** fill pattern
Select **Insert/Picture**	A dialog panel appears
Scroll to and click on **WMF** for the type of file	Stanford has a number of clipart files available for use. See the local documentation section about how to access the clipart files.
Click on **mapworld.wmf** then on **OK**	after finding the way to the clipart directory. Resize and shift the map so it appears as above.

Inserting two new slides



Move to the **Outline View**	and check that the cursor is at the start of **Just** ...
Press **Return**	and a new slide icon should appear
Click at the start of the new line and add the text **Plot of Y1**	and then repeat for the second slide. Make sure that the cursor is on the first line before returning to the Slide View

Adding a graph to one slide

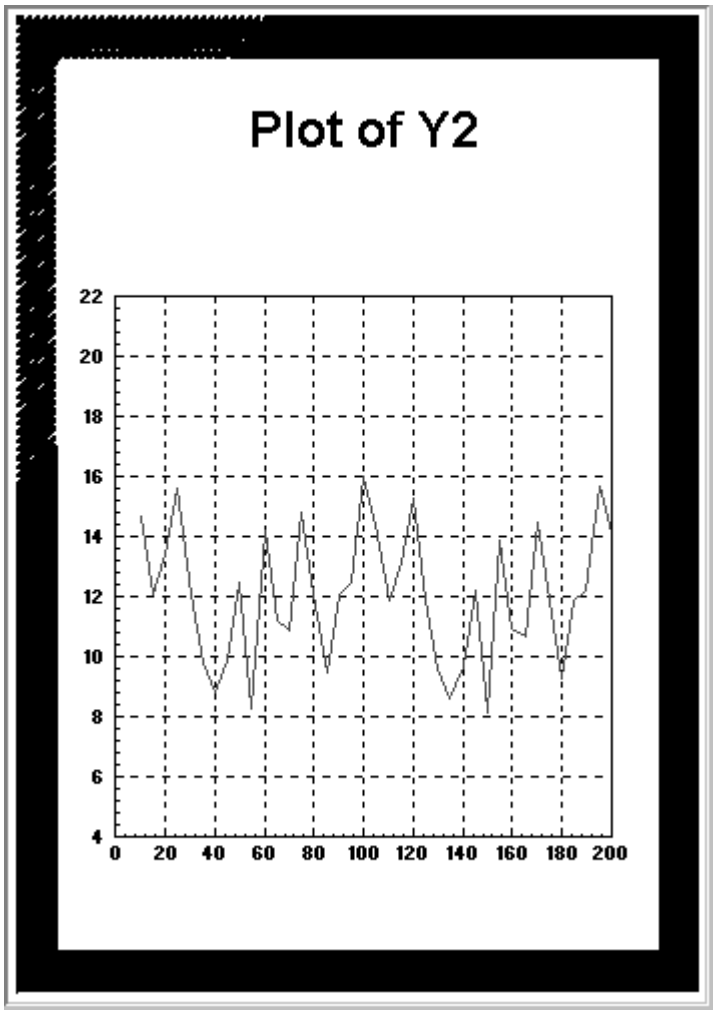


Create the **X-Y Plot** of Y1	using the file **xy1.dat** (see Example 1)
Select **Arrange/Size**	and set the size of the graph to 6 x 6 or other suitable values (depending on your printer). Make sure the graph has been selected, first!
Select **Arrange/Move**	and set the position of the graph to (1.2,3.2) or other suitable values

Checkpoint 3

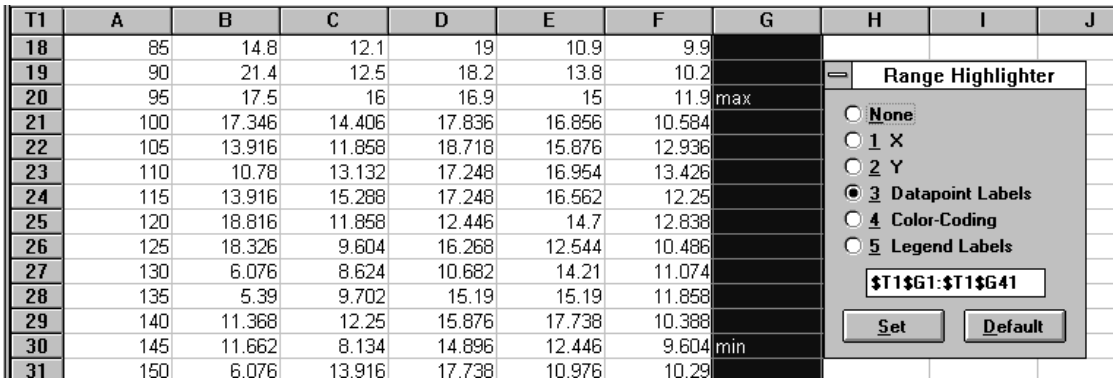
If you have not obtained a picture similar to the picture above, then you can either load the file EX6CH3.SGX and carry on or you can load the file EX6CH2.SGX and start from the previous checkpoint.

Adding another graph to the next slide



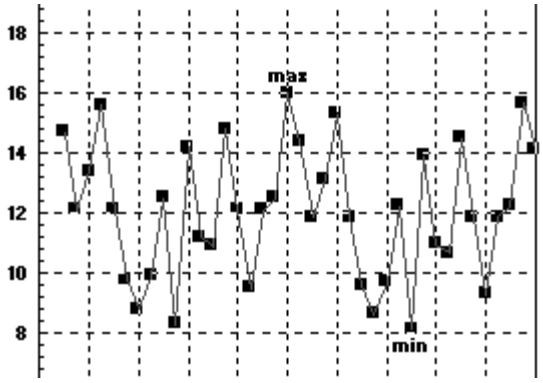
Use the scroll down button on left of slide	if you have stayed in the Slide View, then slide 2 should appear. You can also use the Page Down button on keyboard.
Add similar graph for Y2	as done on previous page. You can use the same spreadsheet.
Click on Y axis	and change the limits to 4 and 22
Use the **Arrange** menu	to change position and size to the same values as for Y1

Adding data labels to one graph

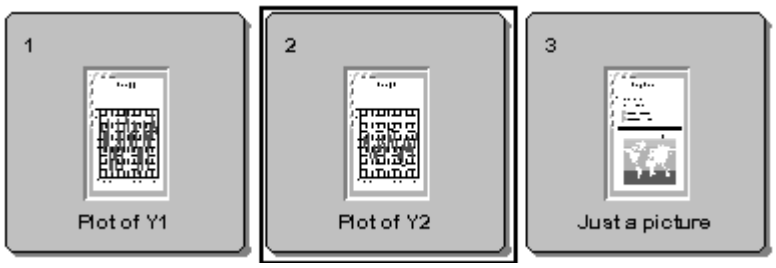


T1	A	B	C	D	E	F	G
18	85	14.8	12.1	19	10.9	9.9	
19	90	21.4	12.5	18.2	13.8	10.2	
20	95	17.5	16	16.9	15	11.9	max
21	100	17.346	14.406	17.836	16.856	10.584	
22	105	13.916	11.858	18.718	15.876	12.936	
23	110	10.78	13.132	17.248	16.954	13.426	
24	115	13.916	15.288	17.248	16.562	12.25	
25	120	18.816	11.858	12.446	14.7	12.838	
26	125	18.326	9.604	16.268	12.544	10.486	
27	130	6.076	8.624	10.682	14.21	11.074	
28	135	5.39	9.702	15.19	15.19	11.858	
29	140	11.368	12.25	15.876	17.738	10.388	
30	145	11.662	8.134	14.896	12.446	9.604	min
31	150	6.076	13.916	17.738	10.976	10.29	

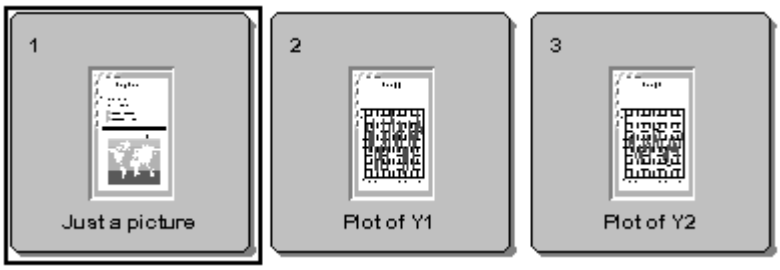
Select **View/Spreadsheet**	and make sure that you are using the Range Highlighter for the second graph
Add text labels **max** and **min** as shown	in cells G20 and G30
Click column **G**	and set the **Datapoint Labels** in the Range Highlighter to that column
Click **OK**	to return to the graph
Click the line graph and select **Format/Data Labels**	A new dialog panel appears. On this panel, click **Labels** and **Perimeter** to obtain the picture below



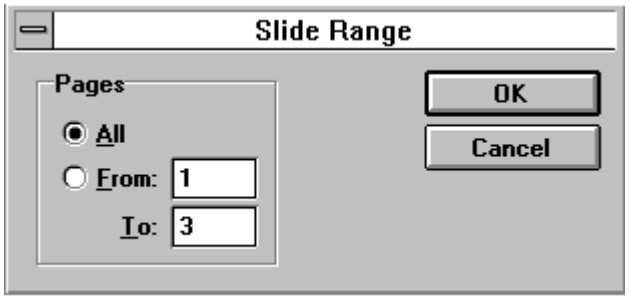
Using the slide sorter



Click the **Slide Sorter** button 	A picture showing the slides in their current order appears
Click **Slide 3**	and drag it in front of Slide 1. See picture below
Click the **Slide View** button	and you should be looking at slide 1 which is the picture slide.



Running a slide show



Select **View/Present Slides**	The panel shown above appears
Click **OK**	to create the slide show
Click **OK**	to run the slide show. Click the mouse to move to next slide and use the Escape key to stop.

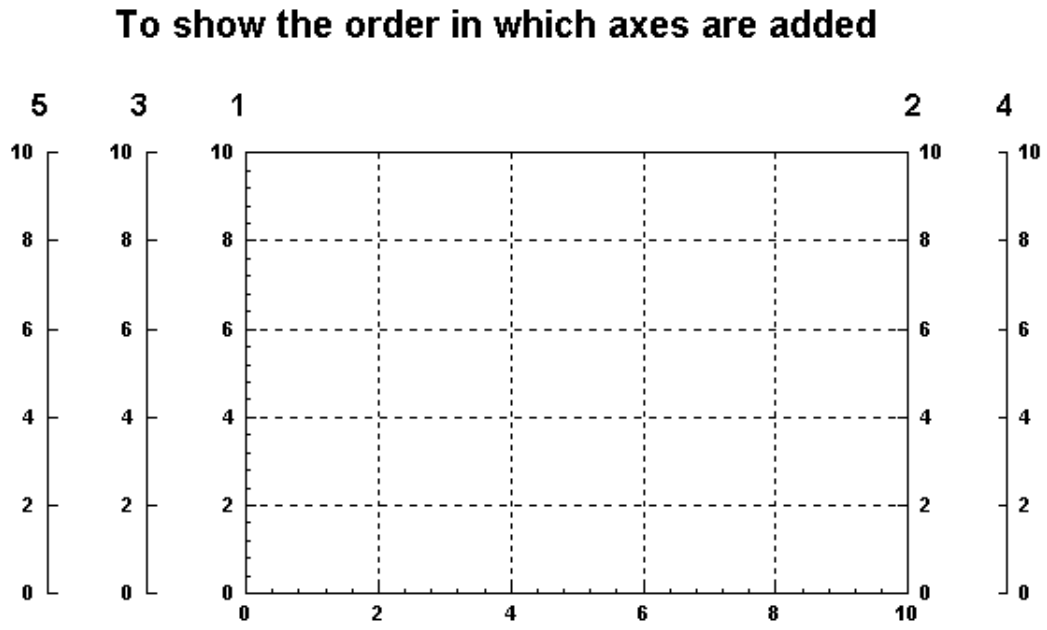
Printing the slides

Select **File/Print**	and choose whether you want the slides or handouts or notes printing. Also choose what range of slides you wish to be printed.
Click **OK**	to do the printing

Exercise 7 To draw a plot with multiple axes

Overview of concepts

This example shows how graphs with multiple axis systems can be created. Stanford Graphics allows any number of axes to be added to a graph. As each axis is added, it is positioned alternately to the right and then to the left of the graph as illustrated in the figure below.



When a dataset (a column of a spreadsheet) is added to a graph, it is plotted against the left hand axis and the scale of this axis changes to accommodate the maximum and minimum values of the dataset. Previously plotted datasets of much smaller scales can, under such circumstances, be difficult to see (and to select with the mouse) since the data points will all be too close to the x-axis.

To avoid problems caused by this phenomenon, we recommend a fixed way of working. This is not the only way of proceeding but it is one we have found useful.

Here is an overview (detailed instructions are given later).

1. Decide which datasets are to be plotted against the left hand axis. These will be added to the graph last of all.

2. Add each dataset which is to be plotted against the first new axis, then add the new axis, and then assign this group of datasets to the new axis.

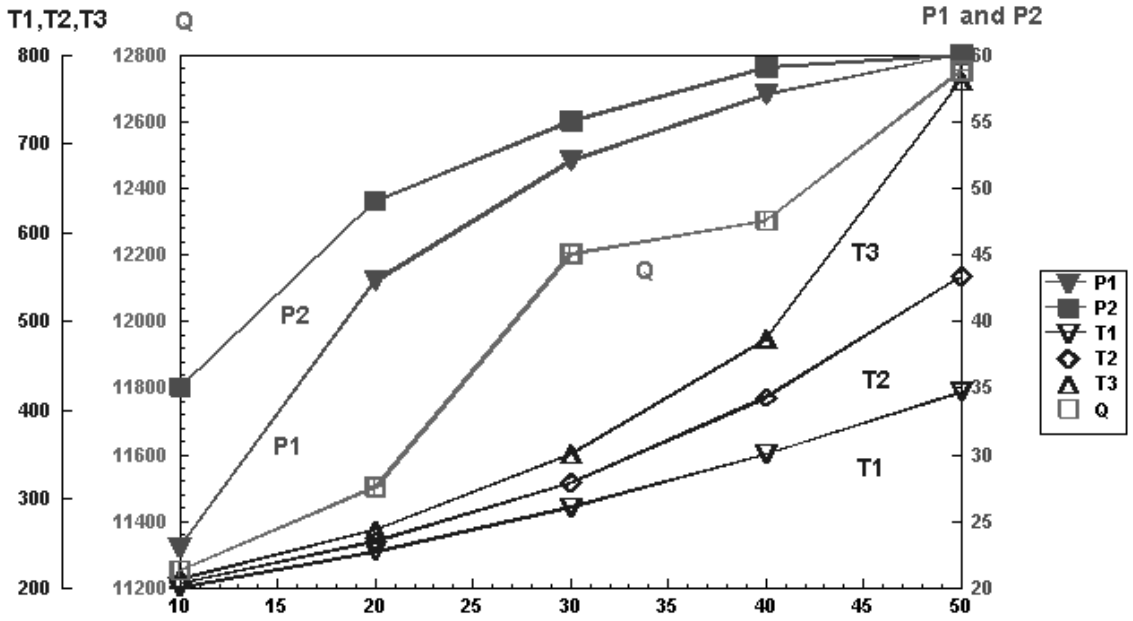
3. Repeat step 2 for each new axis.

4. Add the group of datasets which is to be plotted against the first left hand axis (this will automatically be assigned to the left hand axis).

These are the steps followed in the detailed instructions given in the example which begins on the next page. The example only creates 3 axes and normally, you would be advised never to use more than 3 or 4 axes on a graph so these steps are not as complicated as they look, in practice!

Example to draw a plot with multiple axes

In this exercise, we plot six lines and we assign the lines to three different Y axes.



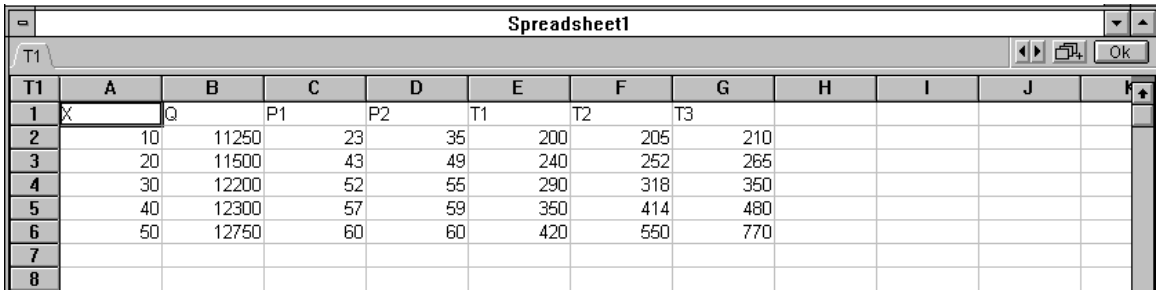
In this exercise, you will be following the set of actions summarised below

1. Creating a spreadsheet and adding datasets
2. Creating a graph for one group of datasets
3. Adding a new axis and assigning the datasets
4. Adding a new group of datasets to the graph
5. Adding a new axis and assigning the datasets
6. Adding the last group of datasets to the graph
7. Adding axis titles and changing axis colours
8. Coping with ‘disappearing’ lines

More detailed instructions under the above headings follow now. It is assumed that you have opened Stanford Graphics and that you have set the printer to be a colour printer using landscape orientation.

Creating a spreadsheet and adding datasets

Notice that the datasets in the spreadsheet below have different orders of magnitude and so they could not appear on the same graph using one axis scale.

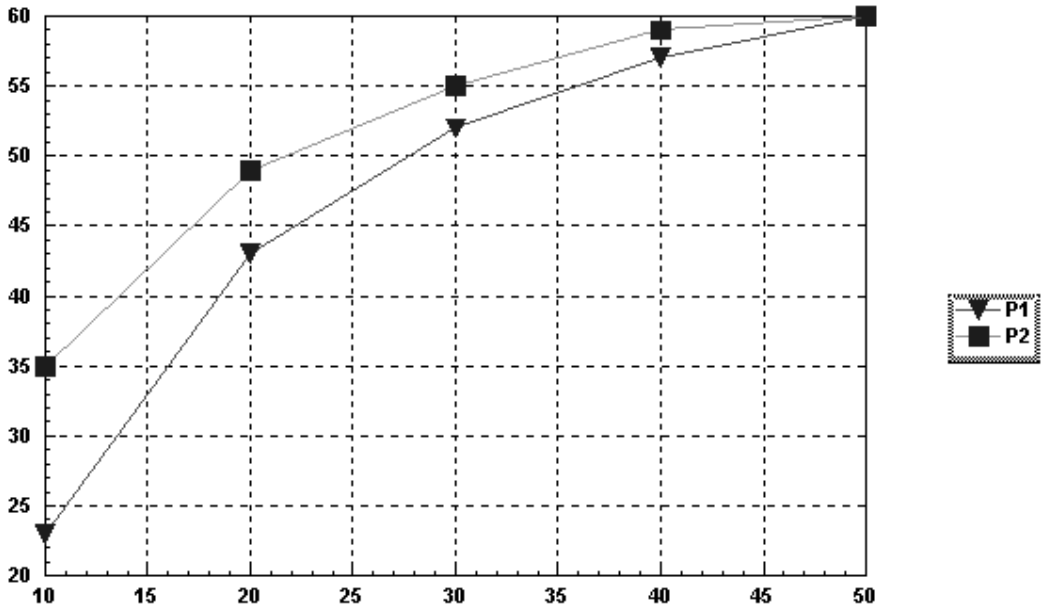


T1	A	B	C	D	E	F	G	H	I	J	K
1	X	Q	P1	P2	T1	T2	T3				
2	10	11250	23	35	200	205	210				
3	20	11500	43	49	240	252	265				
4	30	12200	52	55	290	318	350				
5	40	12300	57	59	350	414	480				
6	50	12750	60	60	420	550	770				
7											
8											

Select **View/Spreadsheet**	to open the Spreadsheet Resource Panel (SRP)
Select **New**	on the SRP
Type the data	as shown above

Creating a graph for one group of datasets

The aim is to have one axis on the right showing the range for P1 and P2, one on the extreme left showing the range for T1, T2 and T3 then the default one on the left showing the range for Q. We start by plotting P1 and P2.



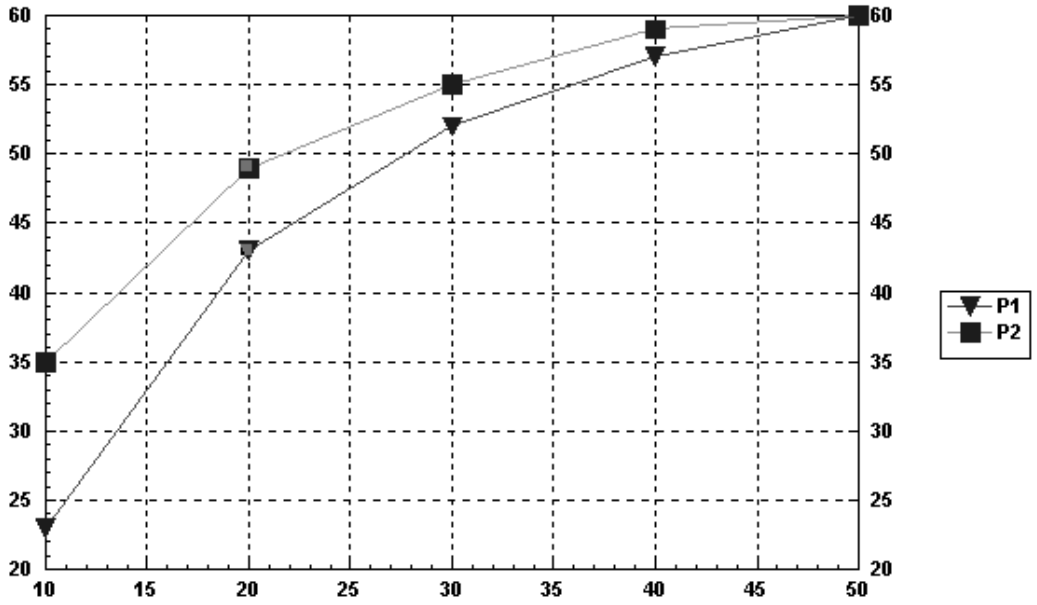
Select **Graph/Add Graph**	We are about to draw the curve for one group of datasets
Select **X-Y plot**	from the 2D Technical list
Highlight cells **T1A2** to **T1A6**	and set to X in Range Highlighter
Highlight cells **T1C2** to **T1D6**	and set to Y in Range Highlighter
Highlight **T1C1** and **T1D1**	and set to Legend Labels in Range Highlighter
Select **OK**	and the graph appears. Add symbols and legend so that the graph looks like the above picture

Checkpoint 1

If you have not obtained the picture above, then you can either load the file EX7CH1.SGX or you can start from the beginning again

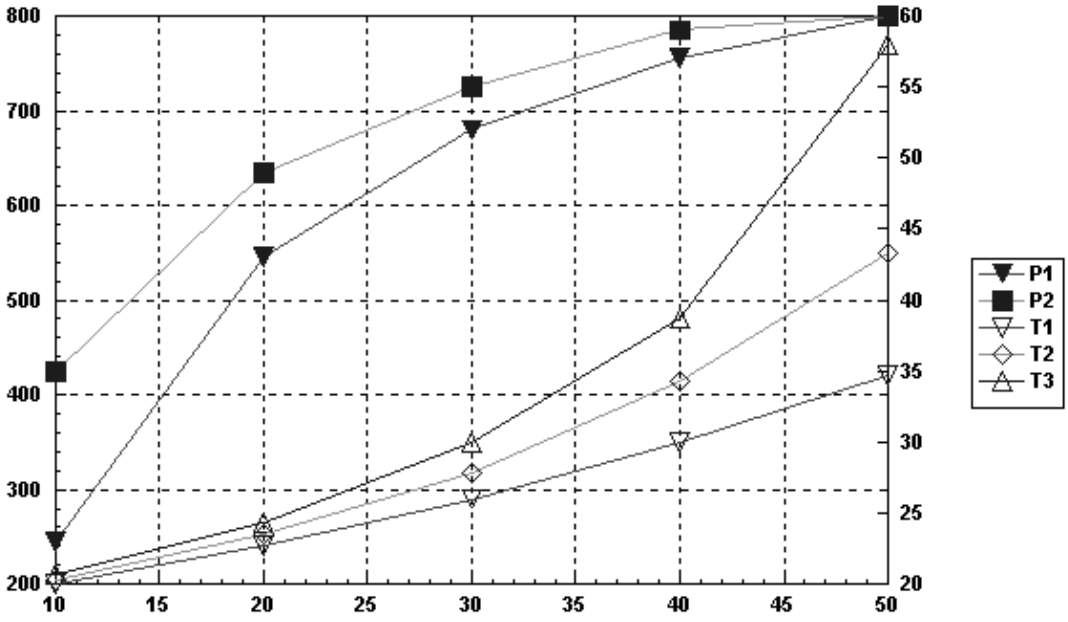
Adding a new axis and assigning the datasets

Note that we have plotted P1 and P2 first because we want those datasets to be assigned to the axis to be created on the right.



Select **Graph/Add Axis**	presuming that the graph is still selected
Make sure that **Y axis** is selected and then click **OK**	A new axis appears on the right. The limits for all new axes is 0 to 10.
Click on line for P2	to select that dataset
Select **Format/Style**	A new dialog box appears
Click **Axis assigns**	The axes are numbered according to the order in which they are created.
Click **2**	in the list for Y axes. This means that you want to assign P2 to Yaxis 2 (on the right) but in fact BOTH datasets P1 and P2 will be assigned since they were grouped together in the Range Highlighter
Click **OK** twice	and the limits of the axis change to accommodate the range of both datasets

Adding a new group of datasets to the graph



Select **Graph/Add Data**	after ensuring that the whole graph has been selected
Select **X-Y curve** from the list of types then click **OK**	You have to scroll through this list. The spreadsheet or the SRP should appear.
Highlight cells **T1A2** to **T1A6**	and set to X in Range Highlighter
Highlight cells **T1E2** to **T1G6**	and set to Y in Range Highlighter
Highlight cells **T1E1** to **T1G1**	and set to Legend Labels in Range Highlighter
Click **OK.**	and the graph appears. Note-the limits of the left axis have changed to accommodate the range of the datasets T1, T2 and T3.
Also add symbols	

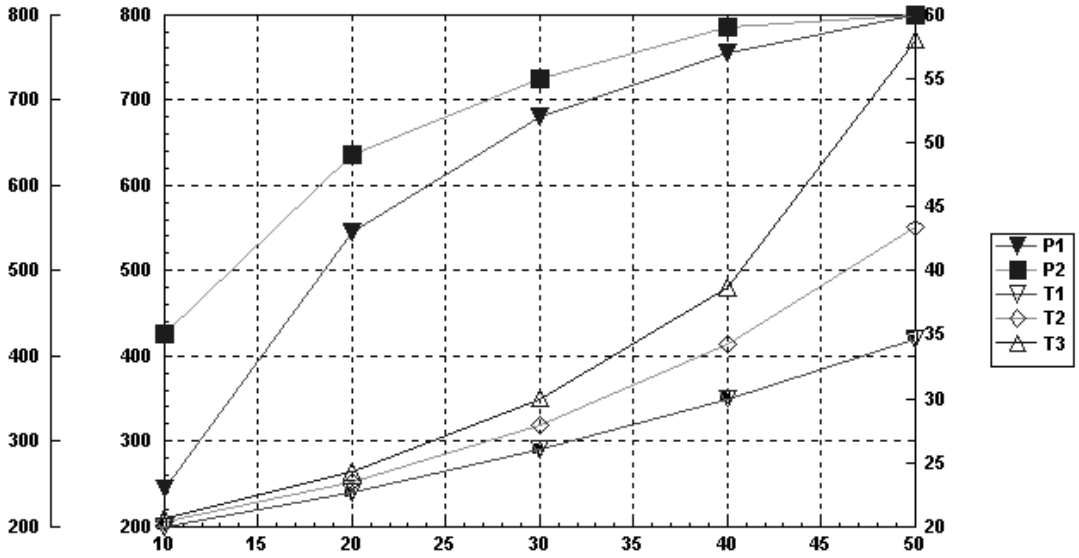
Checkpoint 2

If you have not obtained a picture similar to the picture above, then you can either load the file EX7CH2.SGX and carry on or you can load the file EX7CH1.SGX and start from the previous checkpoint.

Adding a new axis and assigning the datasets

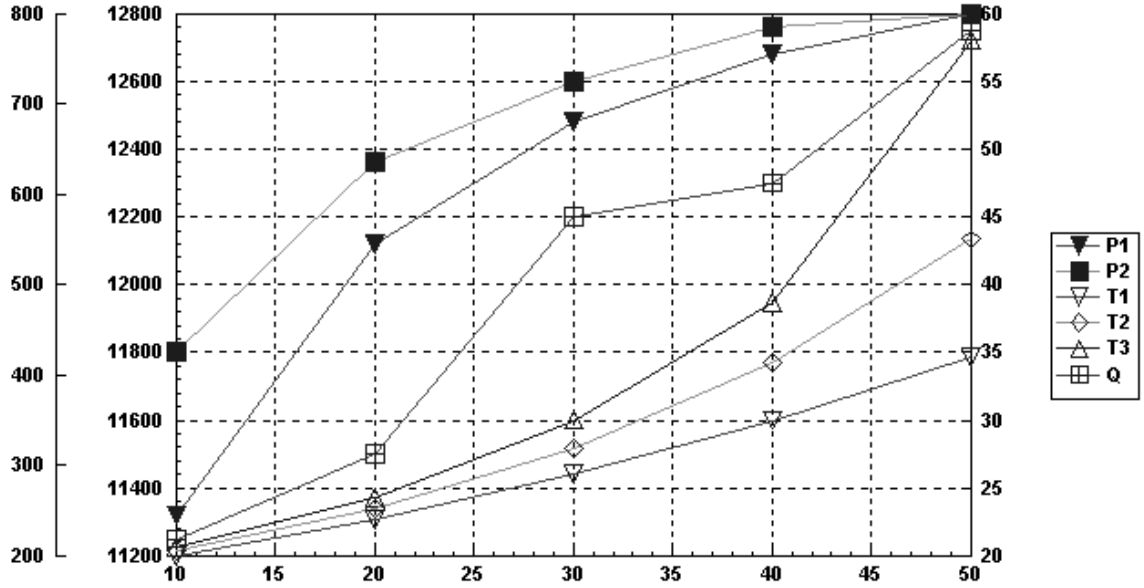
We are about to add a new axis. This will appear on the left of the first Y axis. Then we assign the three datasets that we have just added to the new axis.

First, the graph has to be selected for this operation.



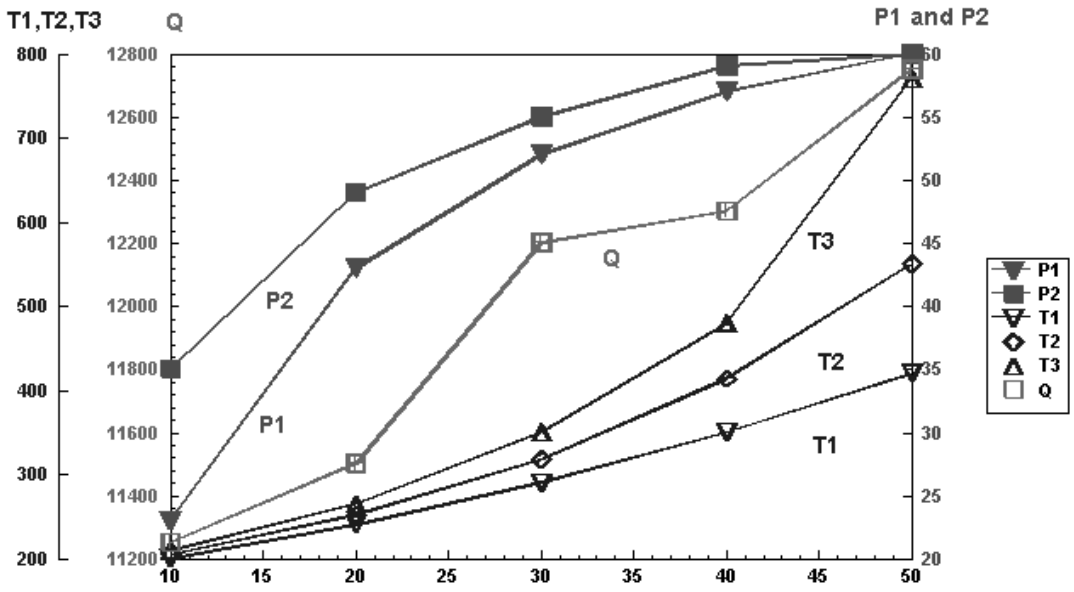
Select **Graph/Add Axis**	and ask for Y axis. The new Y axis appears on the left.
Click on the line which represents T1 in the graph	to select that dataset
Select **Format/Style**	and make the axis assigment to axis 3 (which is the new axis). Notice that the range on the new axis covers the range of all three datasets T1, T2 and T3 and not the range just for T1
Click on another line and select **Format/Style**	and check that the axis assignment has been made for one of the other datasets.

Adding the last group of datasets to the graph



Use **Graph/Add Data**	to add a new curve for the last dataset Q to the graph. Add suitable curve symbols.
Click the line for Q and select **Format/Style**	to check that **Y Axis 1** is assigned to this dataset.

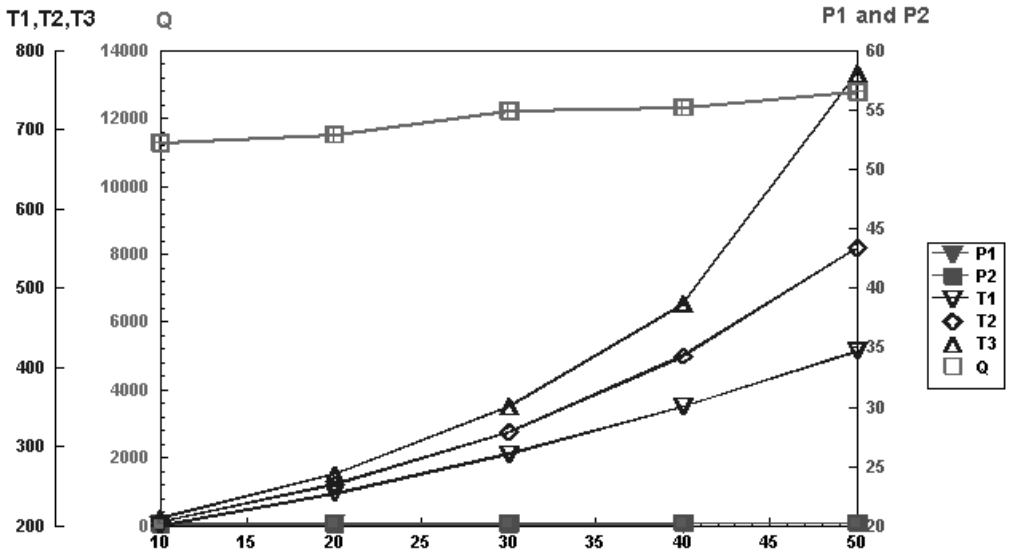
Adding axis titles and changing axis colours



Use the large **A** on the toolbox	to add the text on top of all three Y axes as shown in picture above.
Click one line of the graph and select **Format/Colour**	to change the line colour for that line. Also change the line thickness. It is suggested that you make the lines and symbols for P1 and P2 red, those for T1, T2 and T3 blue and those for Q purple.
Click one axis and select **Format/Colour**..	to change the colour of the axis labels etc to the same one chosen for the assigned dataset. Repeat for the other axes.
Select **Format/Style**	provided one axis is still selected and remove the gridlines. Repeat for the X axis as well.

Coping with 'disappearing' lines

If you have followed this example as suggested, you should not have had to face the problem where the lines have been plotted close to the X axis and thus they have been difficult to see and almost impossible to select. In the last part of this exercise, one line is deliberately assigned to the 'wrong' Y axis. Then you are shown how to recover from this situation.

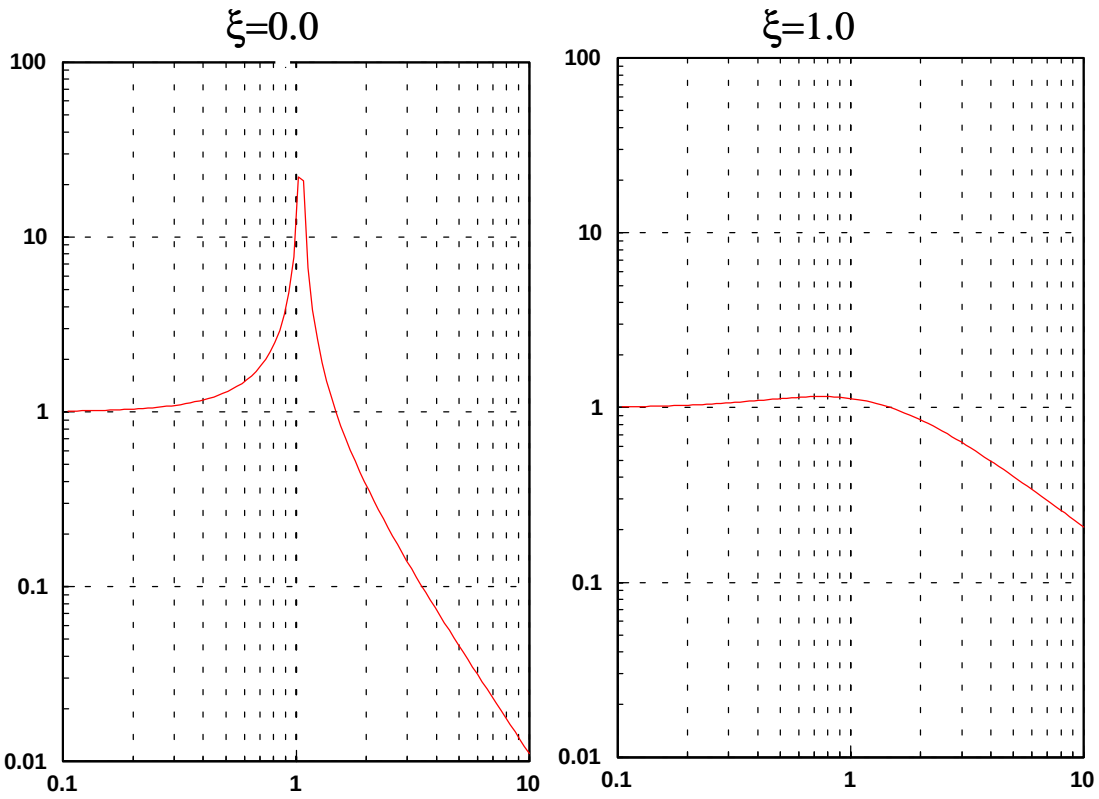


Click the line for **P1**	which is currently assigned to axis 2
Select **Format/Style**	and assign it to axis 1. The lines for P1 and P2 'disappear' (see picture above). All the values are plotted close to the X axis. If the symbols had not been inserted, you would not have been able to see where the lines had been plotted.
Try picking the line for P1 or P2	Almost (but not quite!) impossible ....So we need to find a way of retrieving the lines so we can assign them to axis 2 again.
Create a temporary axis 4	and assign Q to that axis. The lines for P1 and P2 reappear
Assign P1 or P2 to axis 2	and reassign Q to axis 1. Then remove axis 4

WARNING: Axis scales are not adjusted to accommodate new datasets if the axis limits have been explicitly set. So you should never set the axis limits unless you are satisfied with all the axis assignments.

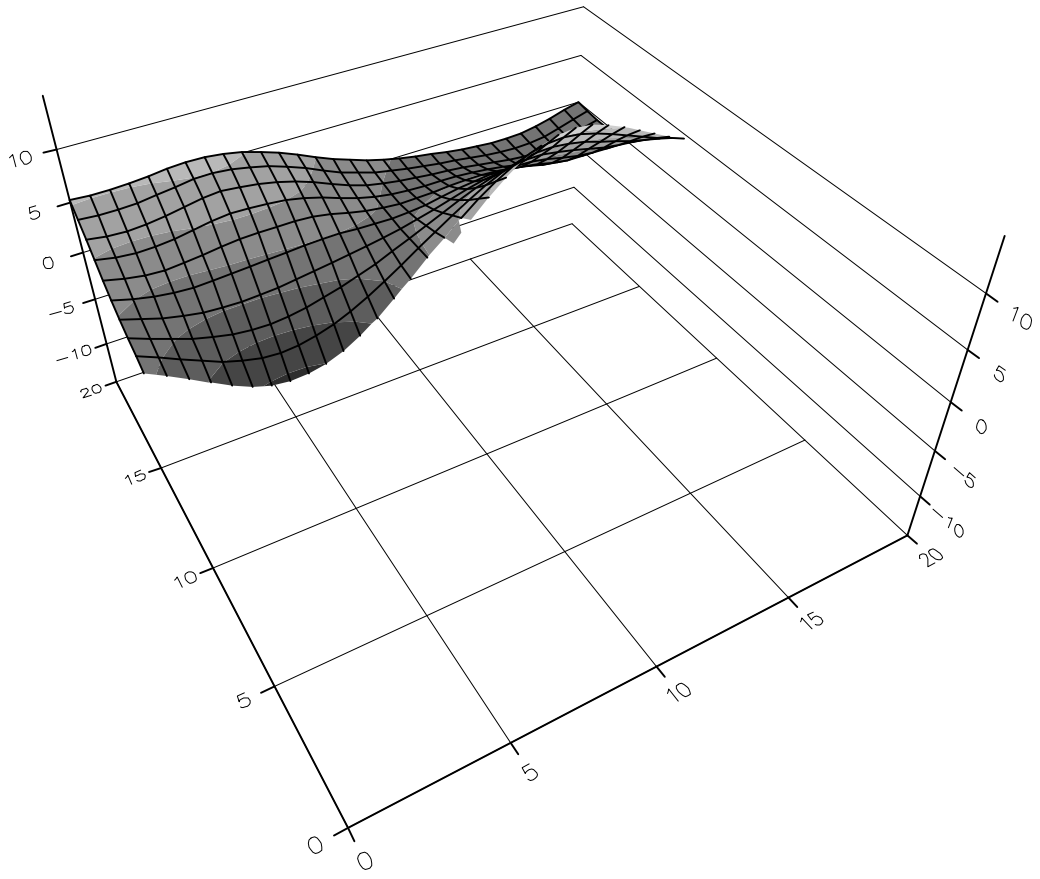
Optional Examples

Try to reproduce the following picture. The data is stored in a file called vib.dat (see section on local access in the appendix which gives details on how to find the data). The first column stores the X values. The column e0 represents the Y values for the graph on the left and the column e5 represents the Y values for the graph on the right.



This next example is an optional one to show that Stanford Graphics does not always produce good results!

The following picture of a surface was produced by another package (Unimap on the Unix system) from the file of irregularly distributed data called **saddle.dat**. (Look at the section on local access to find out how to use this file of data). If this data is imported into Stanford Graphics using the 3D technical option, **Surface Plot from Triplets**, the resultant picture is very dissimilar to the one below. Since the data was originally created from a function which has saddle points, we can say that the picture below is a more accurate representation of the data.



Appendix 1 Workbook Datasets

Both the datafiles **xy1.dat** and **surface3.dat** are part of the Stanford Graphics installation so please see the section **Accessing locally the datasets used in these exercises** in Appendix 2. The files **vib.dat** and **saddle.dat** should also be available locally so please consult the same section as above to see where the files are stored. However, in case the file saddle.dat is not available, you could type in the data, shown below. The file vib.dat is too long to be included here.

Datafile saddle.dat

0.000	0.000	0.000
20.000	20.000	0.000
1.500	17.500	0.940
1.500	11.500	-6.315
3.500	13.500	-8.500
3.500	10.500	-13.255
3.500	2.500	1.845
4.500	18.500	3.862
6.500	15.500	-3.061
6.500	11.500	-12.394
6.500	7.500	-10.755
7.500	17.500	1.464
7.500	5.500	-4.642
8.500	14.500	-2.980
8.500	9.500	-6.754
8.500	7.500	-5.480
9.500	18.500	0.612
9.500	13.500	-1.492
9.500	11.500	-2.176
11.500	16.500	0.209
11.500	10.500	6.754
12.500	2.500	-1.464
13.500	7.500	10.755
15.500	15.500	3.393
15.500	10.500	14.694
16.500	11.500	12.394
16.500	10.500	13.255
16.500	6.500	8.500
17.500	17.500	-1.464
17.500	9.500	10.520
17.500	4.500	2.429
18.500	2.500	-0.940

Appendix 2 Local Setup of Stanford Graphics

[This is for local support people to fill according to their own needs. What follows are the local pages for the University of Liverpool]

Accessing Stanford Graphics locally

First, logon to the PC Managed Network Service and run Windows. Double click on the group **Stanford Graphics**. If you do not have the Stanford Graphics group on the Windows desktop, then you need to do the following:

- Double click the **NewApps** icon and then the **Other Applications** icon

- Click on **Stanford Graphics** in the list of applications and then click **Install**. A program group called Stanford Graphics containing several icons appears on the desktop.

Accessing local printers

Stanford Graphics is integrated with Windows and so all the printers that you have set up are available for use in Stanford Graphics. The recommended colour printers are the HP Deskjet 1200 printers (**dj1200c** queue) and the QMS ColorScript printer (**qms** queue). You should be using the Seiko Colorpoint PS Model 4 for the DJ1200C queue and the QMS ColorScript 100 driver for the QMS queue. If these are not available on your Windows desktop, then do the following:

To access the DJ1200C queue,

- Double click the **NewApps** icon on the Windows desktop and then the **OtherApplications** icon

- Click on **Colour Printer** in the list of applications and then click **Install**. You should agree to Windows being restarted.

- To check that there is a colour printer available, double click the **Main** icon on your Windows desktop then the one for the **Control Panel**. Double click **Printers** and the list should contain a Seiko Colourpoint Model 04 printer on LPTn (where n is a number depending on how many printers have been installed already) - this will have been connected to the dj1200 queue for you.

To access the QMS queue, read the online poster **Using Unix Printers from the PC Managed Network Service**. To access online posters, double click the **Posters** icon in the **Utilities** program group.

It is recommended that you use the dj1200c colour printer as the default printer for the time being (see the section **Accessing locally the checkpoint files used in these exercises** which gives the reason for making this recommendation)

Accessing locally the datasets and clipart files used in these exercises

The following files are all to be found on the **N:** drive at location **\sg\gallery**

xy1.dat
surface3.dat
vib.dat
saddle.dat

The clipart files (in Windows Metafile format and with a file extension of WMF) are to be found on the N: drive at location **sg\clipart**

Accessing locally the checkpoint files used in these exercises

The checkpoint files have been created using the Seiko Colorpont driver which is suitable for dj1200c colour printer. This means that if you are using the QMS ColorScript 100 driver, the pictures produced by loading the checkpoint files may not fit very well in the window on the screen. It is hoped eventually to create another set of checkpoint files set up to use the QMS colour printer.

The checkpoint files are to be found on the **N:** drive at location **\sg\checkp\dj**

Leaving Stanford Graphics locally

After selecting **File/Exit** to leave Stanford Graphics, you are returned to your Windows desktop. You can leave Windows in the normal way and then logout from the PC Managed Network Service.

Comments Sheet

If you feel there are inaccuracies or omissions or if you have any suggestions to improve future editions, please send email to m.thorp@liverpool.ac.uk or make your comments below and post them to us. It would be helpful if you quoted the relevant page number.

Name: Email address: Date:

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