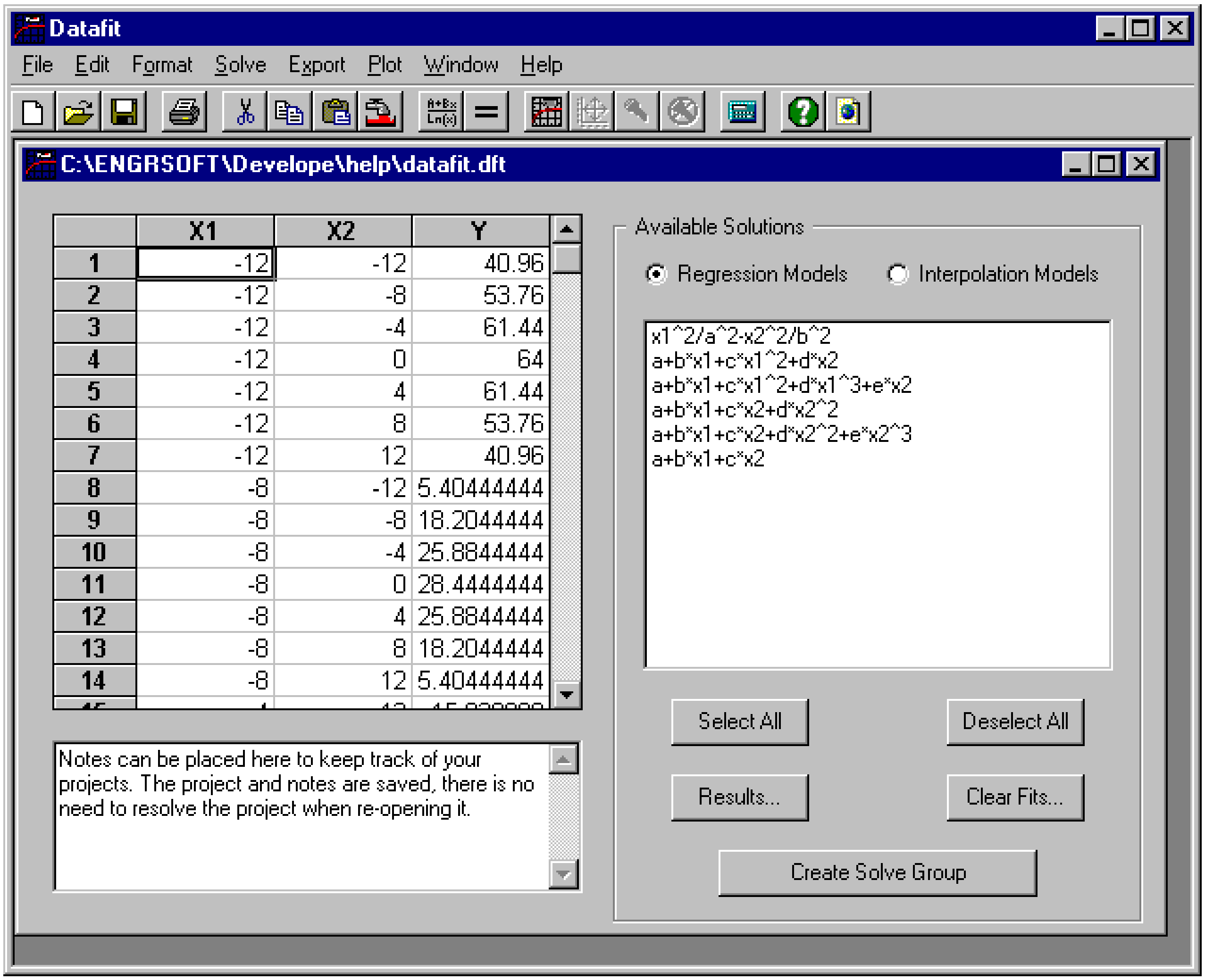
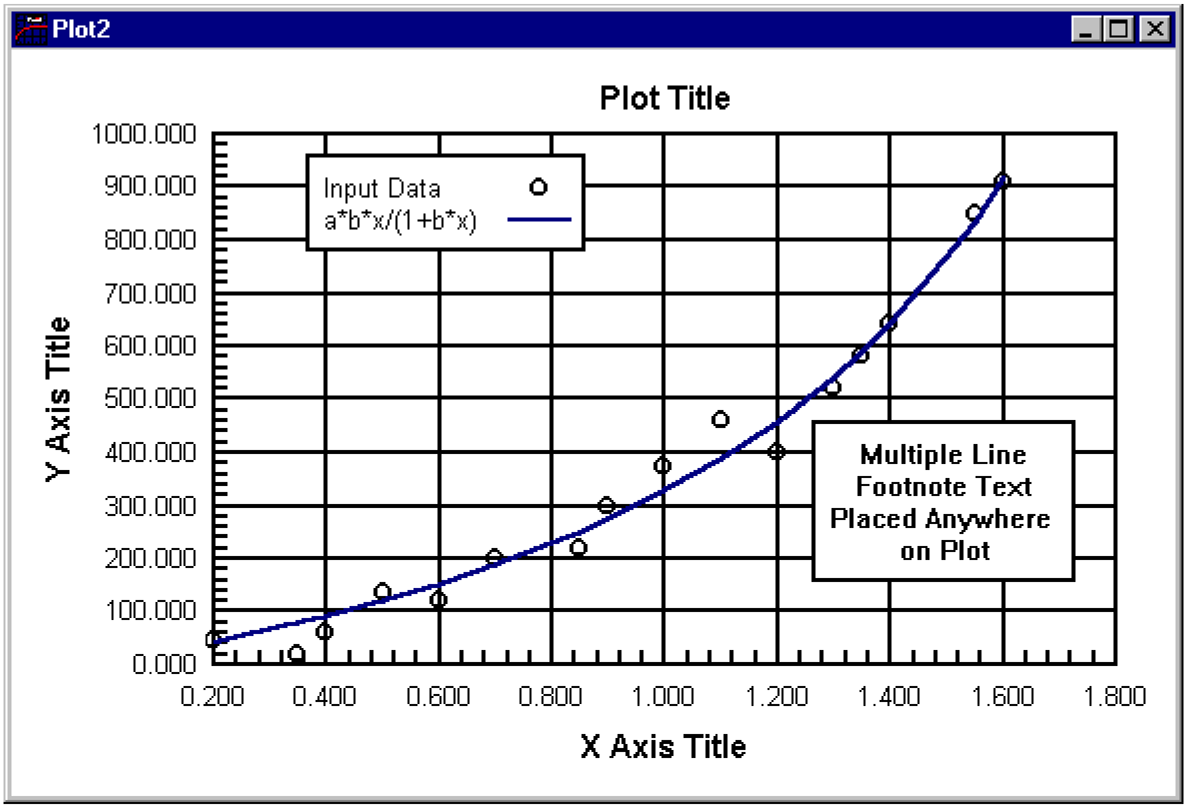
Overview of the DataFit Workplace

DataFit is an engineering and scientific tool utilized for 2D and 3D (up to 9 independent variables) nonlinear regression analysis, linear regression analysis as well as plotting and mathematical manipulation of data. The functionality of the software is divided into two types of interrelated windows. These two types of windows are regression widows and plot windows. Click on the graphics below to get information on the general layout of the DataFit workplace.

Regression Window:



Plot Window:


Plot2
Plot Title
Input Data
a*b*x/(1+b*x)
Multiple Line
Footnote Text
Placed Anywhere
on Plot
Y Axis Title
X Axis Title
1000.000
900.000
800.000
700.000
600.000
500.000
400.000
300.000
200.000
100.000
0.000
0.200
0.400
0.600
0.800
1.000
1.200
1.400
1.600
1.800

Data Entry: allows spreadsheet type editing. Can import delimited data files, as well as copy and paste data between applications.

Available Solution List: Solved models are listed here, automatically sorted in order of best fit.

Model Types: Switch Available Solution List from Regression Models to Interpolation Models.

Select All: Selects all of the models in the Available Solution List.

Deselect All: Deselects all of the models in the Available Solution List.

Results: Brings up the Results window for viewing coefficient values as well as goodness of fit information.

Clear Fits: Allows removing solved models from the Available Solution List. You can choose from the following options:

1. **Clear All Fits** - Clears all fits from the Available Solution list
2. **Clear Selected Fits** - Clears only fits currently selected in the Available Solution list.
3. **Clear Linear Fits (Regression Only)** - Clears only those fits which used the linear solver.
4. **Clear Nonlinear Fits (Regression Only)** - Clear only those fits which used the nonlinear solver.
5. **Clear Fits based on Residual Sum of Squares (Regression Only)** - Clears fits whose residual sum of squares is greater than that specified. The default value is the average of the current worst and best fits.

Create Solve Group: Creates a user defined group from all models in the available solution list. The user may create his or her own group of commonly used models.

Toolbar provides single click access to the most often used menu items.

Notes: Project notes saved along with project.

All text, including Plot Titles, Axis Titles, Axis Numbers, Legends and Footnote text can be formatted. Complete customization of plots is possible, including line and background colors, grids, ticks, et.

All line information, including styles, colors, discreet labels and error bars can be customized.

Customizable Footnote Text can be customized, and placed anywhere on plot.

Axis are completely customizable. Grids/Ticks can be turned on or off, can plot on Log or Linear scale.

The Menu Commands:

File Menu
Edit Menu
Format Menu
Solve Menu
Export Menu
Plot Menu

The File Menu

New
Open
Close
Import
Export
Save
Save As
Page Setup
Print
Exit

See Also:

Menu Commands

The Edit Menu

- Cut
- Copy
- Paste
- Clear
- Insert
- Delete
- Fill
- Exchange
- Sort
- Scale
- Translate

See Also:

Menu Commands

The Format Menu

- Cells
  - Number
  - Alignment
  - Font
- Autofit Rows
- Autofit Columns

See Also:

Menu Commands

The Solve Menu

Regression
Interpolation
Data Statistics
Define User Model
View Log
Prompt for Curve Selection
Preferences

See Also:

Menu Commands

The Export Menu

Function in Basic
Function in C

See Also:

Menu Commands

The Plot Menu

- New
- Open
- Import
- Close
- Save
- Save As
- Format
  - Properties
  - Fit All
  - Zoom In
- Show Coordinates
- Calculator
- Copy to Clipboard
- Page Setup
  - Print

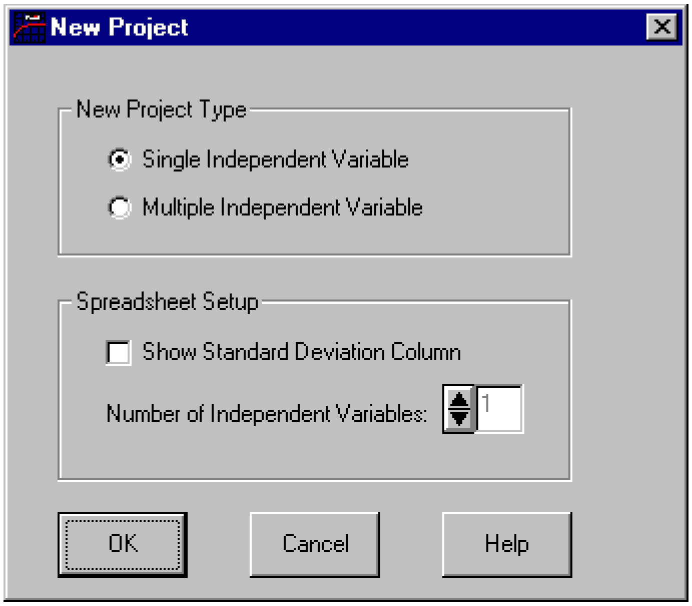
See Also:

Menu Commands

New (File Menu)

Creates a new project.

This will bring up the New Project dialog prompting you for the new project type.



In the **New Project Type** area, select the type of project you want to create. They are defined as follows:

Single Independent Variable (2D): This means that there is a single independent variable (X), and a single dependent variable (Y), and as many as 20 coefficient variables. An example equation of this type would be:

$$y = ax^b$$

Multiple Independent Variable (3D up to 9D): This means that there is at least two independent variables (X1, X2, …X9) and a single dependent variable (Y), and up to 20 coefficient variables. An example 3D equation of this type would be:

$y = \frac{x_1^2}{b^2} - \frac{x_2^2}{a^2}$ (Hyperbolic Paraboloid).

In the **Spreadsheet Setup** area, specify the **Number of Independent Variables** you need. You may have up to 9 independent variables. If you desire to weight the data by uncertainty and know the measurement error, you can choose to display the standard deviation column in the spreadsheet by checking the **Show Standard Deviation Column** check box. If you prefer not to weight the data, or don't have information about measurement error, leave this check box unchecked. For more information on weighting, see Regression Theory.

With DataFit, you can solve up to 9 independent variables with up to 20 parameters or variable coefficients depending on the license you have purchased. When you are finished with your selections, choose **OK** and the new regression window will appear.

See Also:

Entering Data
Overview of the DataFit Workplace
Regression Theory
Menu Commands

Open (File Menu)

Opens a DataFit project file.

This will bring up the File Open dialog, prompting the user for the name of a previously saved DataFit project file. When a file is Saved, everything, including the solution information (if solved) is read in and displayed in a new regression window. The default extension for DataFit files is *.dft. For DataFit versions 2.2 and earlier, the solution file (*.dft) can be read, but due to the solver enhancements, only the notes and input data will be read. If this is the case, simply resolve the project. You can also read the project input file from versions 2.2 and earlier (*.cvt). Again, only the input data and notes will be read.

Up to four of the most recently saved or opened files are shown in the File Menu, allowing quick access to recently used files. As a file is saved or opened, the recent file list updates itself automatically. There is similar operation in the Plot Menu for quick access to saved Plots.

See Also:

Saving Projects
Importing Data
Opening a Plot
Menu Commands

Close (File Menu)

Closes the active regression window.

If changes were made since the file was saved, the user will be warned and prompted to save the changes. If a window is closed and changes are not saved, the changes will be lost.

If the active window is a Plot window, this menu choice will be unavailable. There is a similar operation in the Plot Menu for closing the current plot window.

See Also:

Closing a Plot Window
Menu Commands

Import (File Menu)

Imports delimited data into the spreadsheet.

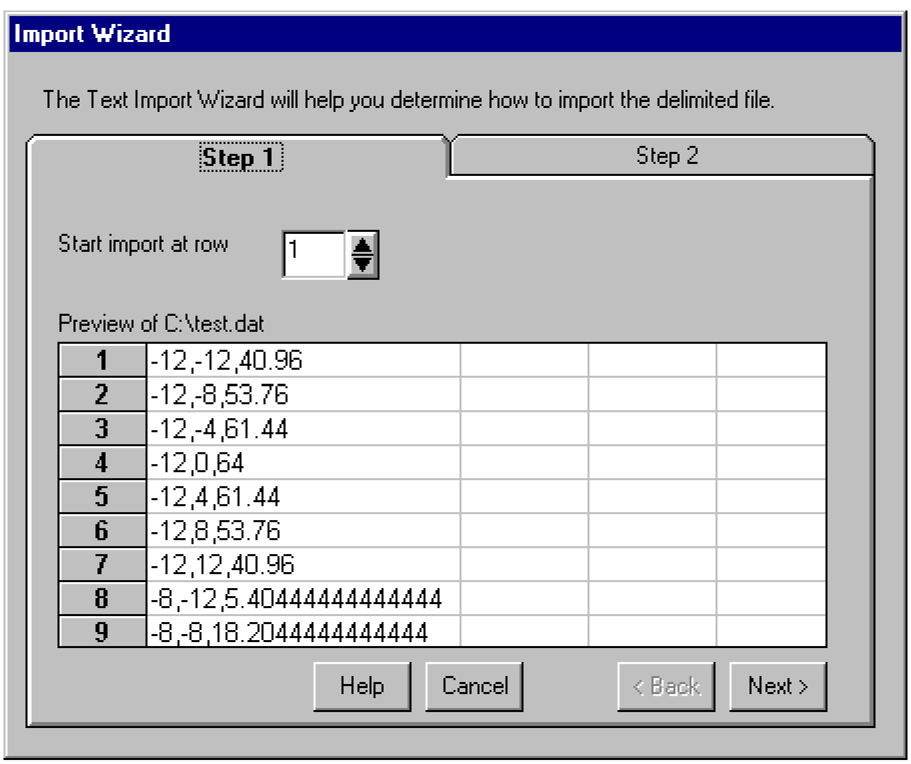
Choosing **Import** from the Data menu will prompt you for a filename to import. The file structure needs to be multiple values per line and can be comma delimited, tab delimited, or space delimited, semicolon delimited or a combination of these. For example:

1.0,2.0,3.0, 4.0	Valid (comma delimited, 4 points per line)
1.0,2.0	Valid (comma delimited, 2 points per line)
1.0, 2.0, 3.0	Valid (comma delimited with space)
1.0 2.0 3.0	Valid (tab delimited or multiple space delimited)
1.0, 2.0, 3.0	Valid (comma delimited with multiple tabs or multiple spaces)
1.0 2.0	Valid (space delimited)

The data will be placed in the spreadsheet as it appears in the file. Each delimiter will cause the placement of the number following it to appear in the next cell in that row. Carriage returns place the number following it in the first column in the next row.

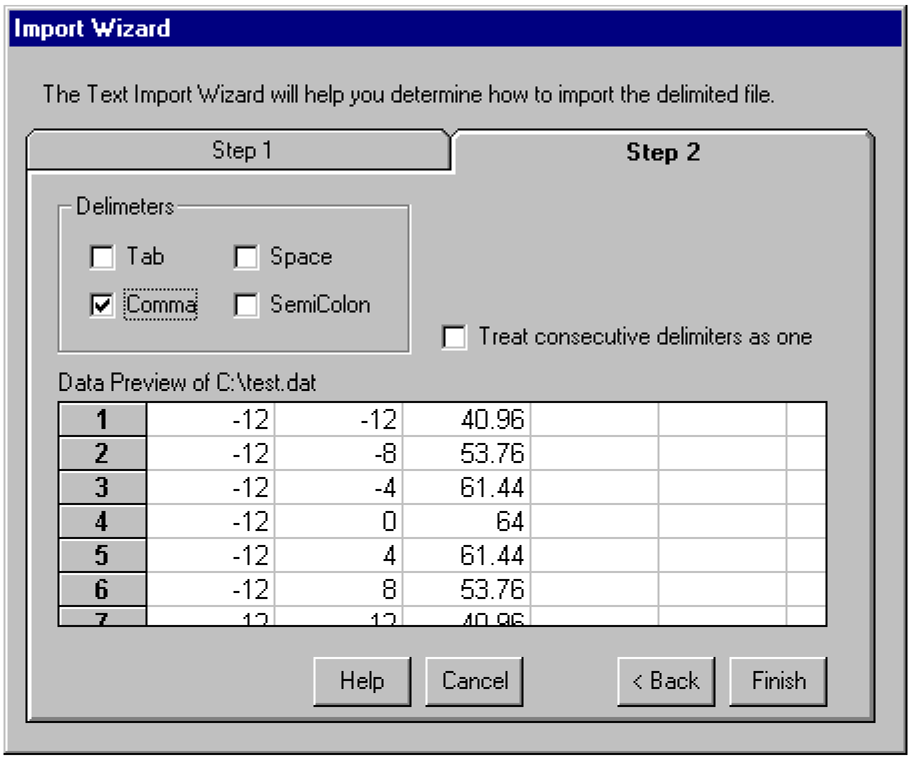
It is not necessary to know the file structure being imported, the software will lead you through importing the data with the Import Wizard.

Import Wizard Step 1 of 2



In step 1, you are shown a preview of the data file. To skip lines at the beginning of a file, either type the number of lines to skip or use the spin button to get the desired number. DataFit will begin importing the file at the line number specified in the text box. Move on to step two by clicking the **Next** button.

Import Wizard Step 2 of 2



Select the delimiter(s) by clicking on the check boxes. The preview spreadsheet will adjust itself so that you can see what effect the changes make. If you want to ignore multiple successive delimiters, check **Treat successive delimiters as one**. This means, for example, that if comma delimited format was chosen for the following data:

1, 2 would import the same as 1,,2 because the second comma would be ignored.

If more than one delimiter is selected and **Treat successive delimiters as one** is checked, any consecutive delimiters, even of different types, will be treated as a single delimiter.

Note: *If you want to import data from another software package, like Microsoft's Excel, choose* ***File|Save as...*** *and select* ***Comma****,* ***Tab****, or* ***Space*** *delimited format from the Excel File menu. You can also Copy the data from another spreadsheet and Paste it into the DataFit spreadsheet. If any of the columns of data are reversed, you can correct this by selecting the two columns and choosing Exchange from the Edit Menu.*

If the active window is a Plot window, this menu choice will be unavailable. There is a similar operation in the Plot Menu for importing data into the current plot.

See Also:

Cutting, Copying and Pasting Data
Menu Commands

Export (File Menu)

Exports the spreadsheet data to a file in delimited format.

When selecting **File|Export**, there are three formats two choose from: **comma** delimited, **tab** delimited, or **space** delimited. Other spreadsheets are able to read some sort of delimited ASCII text files, so they may be imported into another spreadsheet. You can also transfer the data to another spreadsheet application by Copying the data from the DataFit spreadsheet, and Pasting it into another application.

If the active window is a Plot window, this menu choice will be unavailable.

See Also:

Cutting, Copying and Pasting Data
Importing Data
Menu Commands

Save, Save As... (File Menu)

Saves a DataFit project to a file.

This will allow the user to save the contents of the currently active regression window. All information, including the solution (if solved) and project notes are saved in a single file with a (*.dft) extension. If the current window is 'Untitled' and save is chosen, it will be treated as a **'Save As...'** prompting the user for the new filename.

If the active window is a Plot window, this menu choice will be unavailable. There is a similar operation in the Plot Menu for saving the current plot.

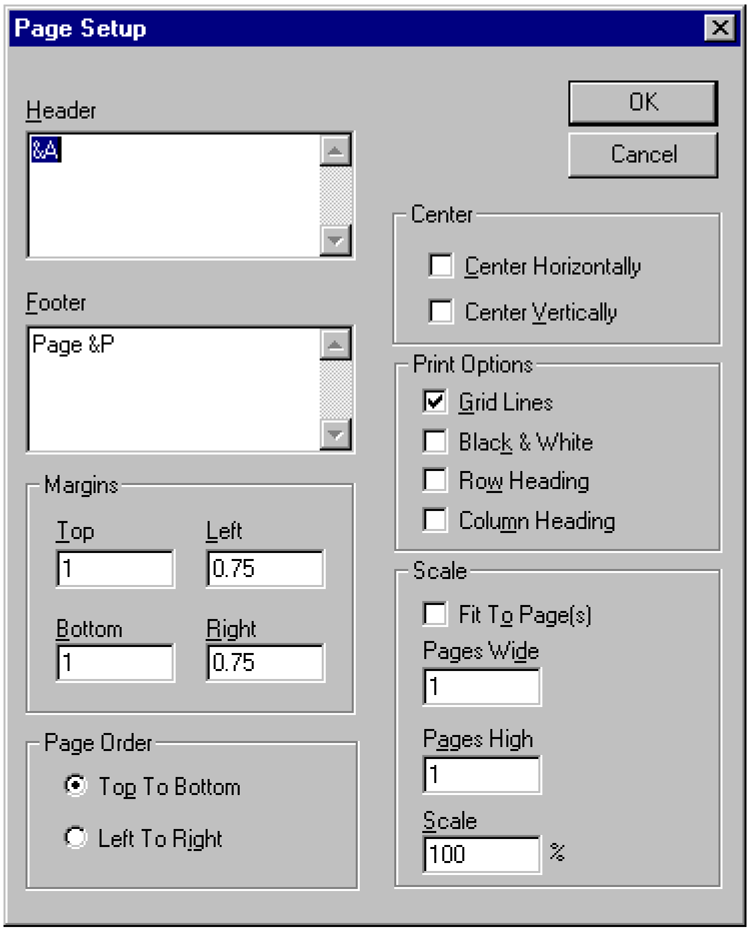
See Also:

Saving Plots
Menu Commands

Page Setup (File Menu)

Sets up the page for printing the Spreadsheet data from the active regression window.

The **Page Setup** dialog is shown below, allowing you to specify the page layout, as well as specifying headers and footers which will appear on the printed page.



If the active window is a Plot window, this menu choice will be unavailable.

See Also:

Header and Footer Formatting Codes
Printing (File Menu)
Printing Results
Menu Commands

Header and Footer Format Codes

Format Code	Description
&L	Left-aligns the characters that follow
&C	Centers the characters that follow
&R	Right-aligns the characters that follow
&D	Prints the current date
&T	Prints the current time
&F	Prints the workbook name
&A	Prints the worksheet name
&P	Prints the page number
&P+number	Prints the page number plus number
&P-number	Prints the page number minus number
&&	Prints an ampersand
&N	Prints the total number of pages in the document

Codes and text are, by default, centered unless &L or &R is specified.

The following font codes must appear before other codes and text or they are ignored. The alignment codes (e.g., &L, &C, and &R) restart each section; new font codes can be specified after an alignment code.

Format Code	Description
&B	Use a bold font
&I	Use an italic font
&U	Underline the header
&S	Strikeout the header
&"fontname"	Use the specified font
&nn	Use the specified font size - must be a two digit number

See Also:

Printing (File Menu)
Printing Results

Print (File Menu)

Prints the spreadsheet data from the active window.

Note: File|Print prints only the spreadsheet data. Spreadsheet data along with the solution results can be printed while viewing the results. For more information, see Printing Results.

If the active window is a Plot window, this menu choice will be unavailable.

See Also:

Page Setup (File Menu)
Printing Results
Header and Footer Formatting Codes
Menu Commands

Exit (File Menu)

Exits DataFit.

If changes were made in any of the open regression or plot windows and not saved, the user will be warned and prompted to save the changes. If the software is exited and any changes are not saved, the changes will be lost.

See Also:

Menu Commands

Cut, Copy, Paste (Edit Menu)

These are standard Windows Clipboard functions for working with the data in the spreadsheet of a regression window. All of these commands work with the currently selected cell or range of cells in the spreadsheet.

Note: These commands work only with a single range selection of cells. For more information on selecting cells, see the help topic Selecting Cells in the Spreadsheet.

Cut: removes selected data and puts it on the Clipboard. This command is available only when the spreadsheet is active, or has focus. Data that you place on the Clipboard remains there until you replace it with a new item.

Copy: copies selected data to the Clipboard, leaving the original data untouched. This command is available only when the spreadsheet is active, or has focus. Data that you place on the Clipboard remains there until you replace it with a new item.

Paste: places information from the clipboard to the selected range in the spreadsheet. How the information is pasted in the worksheet depends on the size of the selected range.

- If the selected range consists of a single cell, all information in the clipboard is pasted to the worksheet.
- If the selected range is smaller than the clipboard information, only as much information as will fit -in the range is pasted.
- If the selected range is larger than the clipboard information, the clipboard information is replicated to fill the range.

Any of these menu items can be used to transfer data to and from other applications. For example, a spreadsheet in Microsoft Excel may be pasted into the active DataFit regression window in order to perform regression analysis.

Changes made to the spreadsheet will result in clearing the current solutions. This is by design, so that the solution will match the spreadsheet data. To re-solve the current solution list, simply choose **Solve Last Solved Models** in the Solution Setup Window once the data has been modified.

If the active window is a Plot window, these menu choices will be unavailable.

See Also:

Inserting and Deleting Data
Selecting Cells in the Spreadsheet.
Overview of the DataFit Workplace
Menu Commands

Clear Selection, Clear Sheet (Edit Menu)

Clear Selection: removes a range of selected data in the spreadsheet of the current regression window.
Clear Sheet: removes the contents of the entire spreadsheet.

Note: The Clear Selection command works only with a single range selection of cells. For more information on selecting cells, see the help topic Selecting Cells in the Spreadsheet.

You cannot re-insert data removed by using the either the **Clear Selection** or **Clear Sheet** commands.

Changes made to the spreadsheet will result in clearing the current solutions. This is by design, so that the solution will match the spreadsheet data. To re-solve the current solution list, simply choose **Solve Last Solved Models** in the Solution Setup Window once the data has been modified.

If the active window is a Plot window, these menu choices will be unavailable.

See Also:

Overview of the DataFit Workplace
Menu Commands

Insert, Delete (Edit Menu)

Insert: inserts new cells at the current cell in the spreadsheet of the active regression window. All subsequent rows will be shifted down to allow room for the new rows.

Delete: deletes the current cell or range of cells. All subsequent rows will be shifted up to take the place of the deleted cell(s).

*Note: The **Delete** command works only with a single range selection of cells. For more information on selecting cells, see the help topic* *Selecting Cells in the Spreadsheet.*

Changes made to the spreadsheet will result in clearing the current solutions. This is by design, so that the solution will match the spreadsheet data. To re-solve the current solution list, simply choose **Solve Last Solved Models** in the Solution Setup Window once the data has been modified.

If the active window is a Plot window, these menu choices will be unavailable.

See Also:

Cutting, Copying and Pasting Data
Overview of the DataFit Workplace
Menu Commands

Fill (Edit Menu)

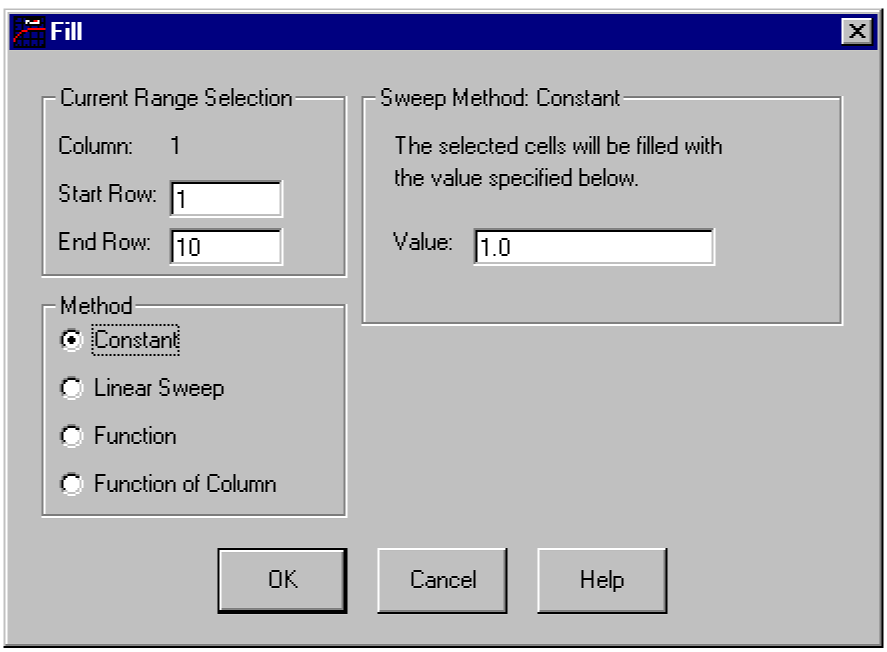
Enables a selected range of cells to be filled with data.

*Note: The **Fill** command works only with a single range selection of cells. For more information on selecting cells, see the help topic Selecting Cells in the Spreadsheet.*

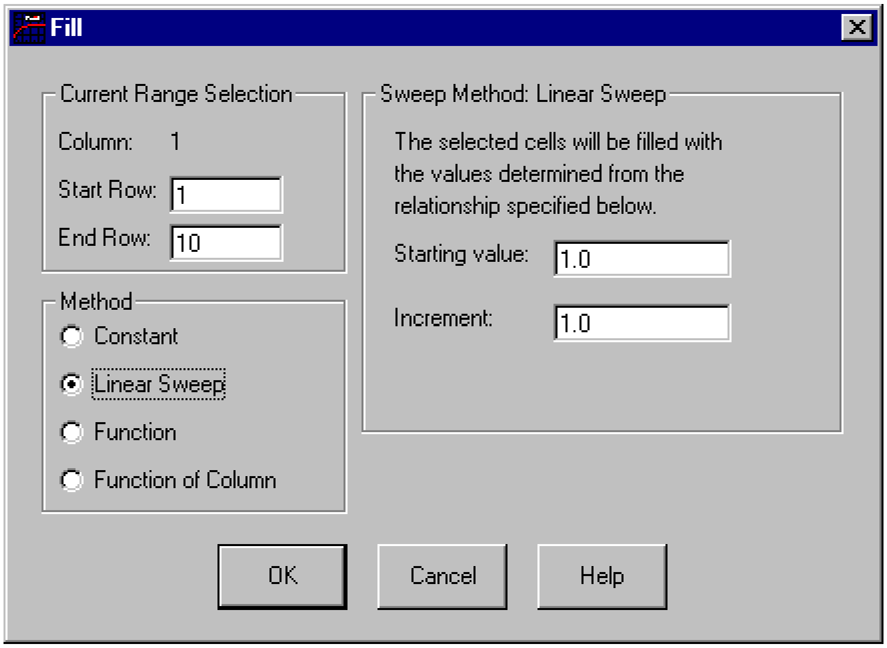
To fill a range of cells with data, click in a cell or range of cells in the spreadsheet from the desired column, then. choose **Fill** from the **Edit** menu. The top left corner of the Fill Dialog under **Current Range Selection** shows the currently selected range of cells. You can modify the range in the appropriate text boxes. This allows you to fill large ranges of data without pre-selecting the cells.

There are four different methods of filling, or 'sweeping' the data:

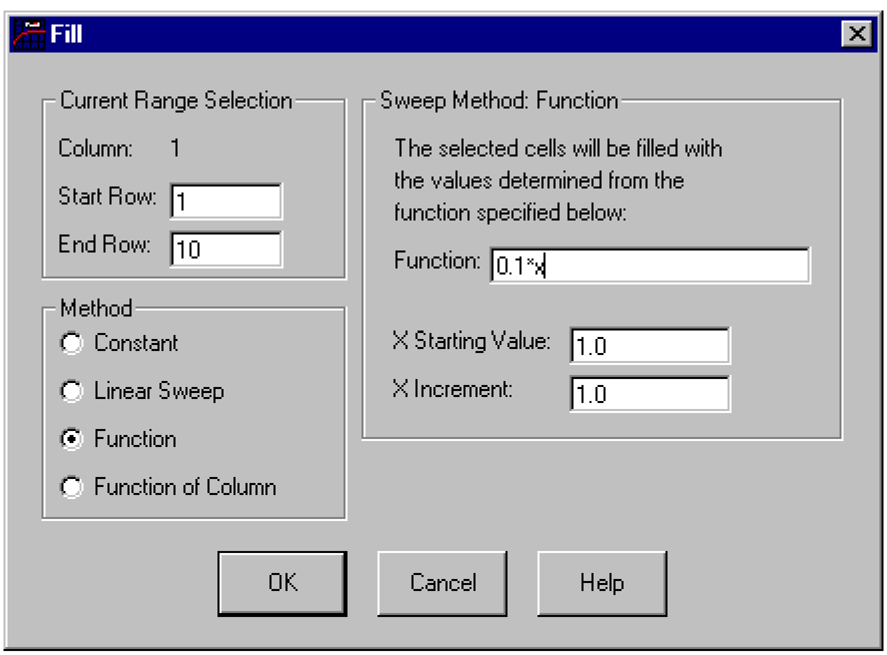
1. **Constant** - The selected range of cells in the spreadsheet will be filled in with the value specified in the text box visible when this option is specified. This option is useful for entering data in a range of rows with the same value. For example, if the standard deviation of the measurement error is constant through the range of measured data, this method can be used to enter this value.



2. **Linear Sweep** - The selected range of cells in the spreadsheet will be filled in with the values calculated from the text box entries visible when this option is specified. This option is useful for entering data in a range of rows with linearly increasing values. For example, if the spacing of the independent variable X is equally spaced, this method can be used to enter the values. The starting value will appear in the first selected cell, and each subsequent cell will contain the previous cells data plus the increment.

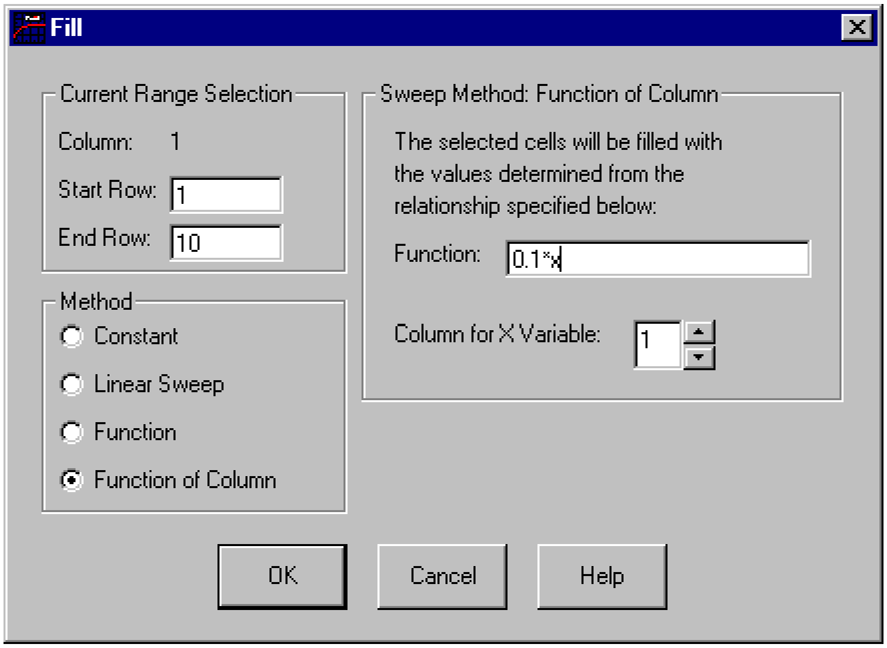


3. **Function** - The selected range of cells in the spreadsheet will be filled in with the values calculated from the Function, X Starting Value and X Increment text boxes. This option is useful for entering data in a range of rows with a known functional value. F(Initial Value) will appear in the first selected cell, and each subsequent cell will contain F(Initial Value + Increment).



4. **Function of a Column** - The selected range of cells in the spreadsheet will be filled in with the values calculated from the Function and Column for X Variable text boxes. The X variable in the Function will be supplied from the column

specified in the Column for X Variable text box. This option is useful for entering data in a range of rows with a known dependence of another column. For example, measurement error may be some known function of the magnitude of the measured data, et. F(Column, Row) will appear in each cell in the selected range



Changes made to the spreadsheet will result in clearing the current solutions. This is by design, so that the solution will match the spreadsheet data. To re-solve the current solution list, simply choose **Solve Last Solved Models** in the Solution Setup Window once the data has been modified.

If the active window is a Plot window, this menu choice will be unavailable.

See Also:

Supported Variables, Operators and Functions
Cutting, Copying and Pasting Data
Inserting and Deleting Data
Overview of the DataFit Workplace
Menu Commands

Exchange (Edit Menu)

Exchanges two ranges of data.

*Note: The **Exchange** command works with either a single selection containing at most two rows, or two non-adjacent selections which contain the same rows. For more information on selecting cells, see the help topic Selecting Cells in the Spreadsheet.*

The Exchange command is useful for re-arranging data in the spreadsheet. For example, you may have imported data which may not be in the appropriate columns. Simply select the two columns you want to exchange and select **Edit|Exchange** from the menu.

Changes made to the spreadsheet will result in clearing the current solutions. This is by design, so that the solution will match the spreadsheet data. To re-solve the current solution list, simply choose **Solve Last Solved Models** in the Solution Setup Window once the data has been modified.

If the active window is a Plot window, this menu choice will be unavailable.

See Also:

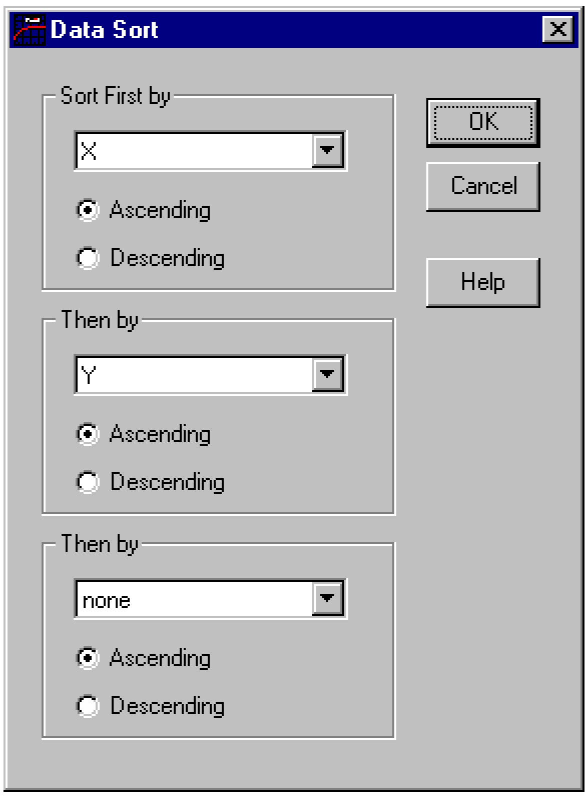
Cutting, Copying and Pasting Data
Overview of the DataFit Workplace
Menu Commands

Sort (Edit Menu)

Sorts data in either ascending or descending order.

*Note: The **Sort** command works only with a single range selection of cells. For more information on selecting cells, see the help topic Selecting Cells in the Spreadsheet.*

Sort the data by first selecting the range of data that you want to sort, then choose **Edit|Sort**. The Sort Dialog, shown below, will appear:



You can choose up to three sort keys, and they are identified by the column headers in the spreadsheet. The sorting will occur in the order that the sort keys appear, either in ascending or descending order.

Changes made to the spreadsheet will result in clearing the current solutions. This is by design, so that the solution will match the spreadsheet data. To re-solve the current solution list, simply choose **Solve Last Solved Models** in the Solution Setup Window once the data has been modified.

If the active window is a Plot window, this menu choice will be unavailable.

See Also:

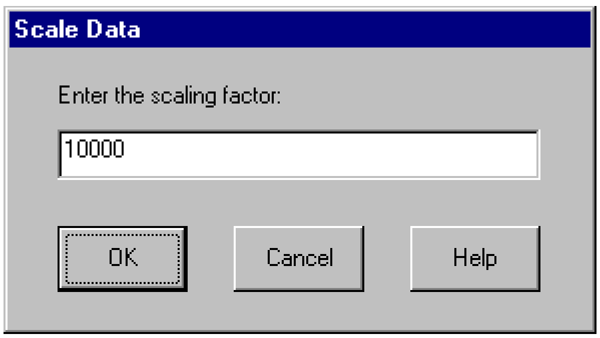
Cutting, Copying and Pasting Data
Inserting and Deleting Data
Overview of the DataFit Workplace
Menu Commands

Scale (Edit Menu)

Scales ranges of data by a specified scaling factor.

*Note: The **Scale** command works with either a single selection of cells, or multiple selections of cells. For more information on selecting cells, see the help topic Selecting Cells in the Spreadsheet.*

Scale the data by first selecting the range of data that you want to scale, then choose **Edit|Scale**. The Scale Dialog, shown below, will appear:



All of the selected cells will be multiplied by the scaling factor you enter.

Changes made to the spreadsheet will result in clearing the current solutions. This is by design, so that the solution will match the spreadsheet data. To re-solve the current solution list, simply choose **Solve Last Solved Models** in the Solution Setup Window once the data has been modified.

If the active window is a Plot window, this menu choice will be unavailable.

See Also:

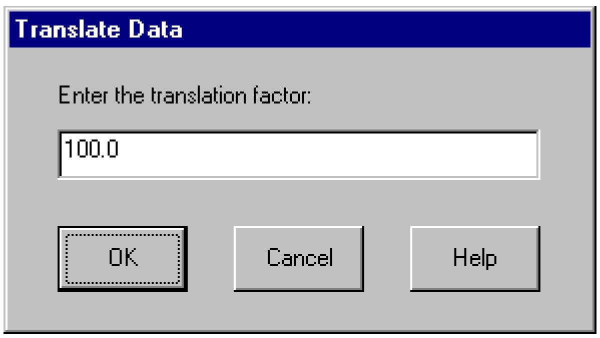
Cutting, Copying and Pasting Data
Translating Data
Overview of the DataFit Workplace
Menu Commands

Translate (Edit Menu)

Translates ranges of data by a specified translation factor.

*Note: The **Translate** command works with either a single selection of cells, or multiple selections of cells. For more information on selecting cells, see the help topic Selecting Cells in the Spreadsheet.*

Translate the data by first selecting the range of data that you want to scale, then choose **Edit|Translate**. The Translate Dialog, shown below, will appear:



All of the selected cells will be offset by the translating factor you enter.

Changes made to the spreadsheet will result in clearing the current solutions. This is by design, so that the solution will match the spreadsheet data. To re-solve the current solution list, simply choose **Solve Last Solved Models** in the Solution Setup Window once the data has been modified.

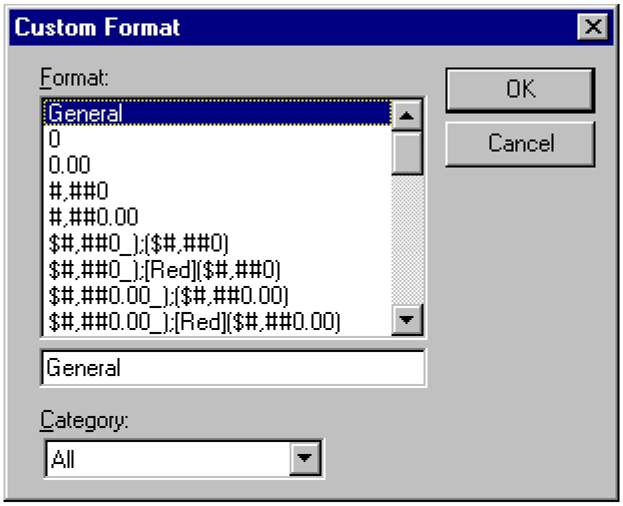
If the active window is a Plot window, this menu choice will be unavailable.

See Also:

Cutting, Copying and Pasting Data
Scaling Data
Overview of the DataFit Workplace
Menu Commands

Number (Format|Cells Menu)

Formats the entire spreadsheet based on the selected number format.



You may select from one of the Pre-defined Numeric Formats, or define your own Custom Number Formats.

If the active window is a Plot window, this menu choice will be unavailable.

See Also:

Pre-Defined Number Formats
Custom Number Formats.
Alignment (Format|Cells Menu)
Font (Format|Cells Menu)
AutoFit Rows, AutoFit Columns (Format Menu)
Menu Commands

Pre-Defined Numeric Formats

The following table lists the built-in number formats and the result after the format is applied to a positive, negative, and decimal number.

Category	Format	3	-3	.3
All	General	3	-3	.3
Currency	$#,##0_);($#,##0)	$3	($3)	$0
	$#,##0_);[RED]($#,##0)	$3	($3) in red	$0.3
	$#,##0.00_);($#,##0.00)	$3.00	($3.00)	$0.30
	$#,##0.00_);[RED]$(#,##0.00)	$3.00	($3.00) in red	$0.30
Fixed	0	3	-3	0
	0.00	3.00	-3.00	0.30
	#,##0	3	-3	0
	#,##0.00	3.00	-3.00	0.30
	#,##0_);(#,##0)	3	(3)	0
	#,##0_);[RED](#,##0)	3	(3) in red	0
	#,##0.00_);(#,##0.00)	3.00	(3.00)	0.30
	#,##0.00_);[RED](#,##0.00)	3.00	(3.00) in red	0.30
Percent	0%	300%	-300%	30%
	0.00%	300.00%	-300.00%	30.00%
Fraction	# ?/?	3	-3	2/7
	# ??/??	3	-3	3/10
Scientific	0.00E+00	3.00E+00	-3.00E+00	3.00E-01

See Also:

Custom Number Formats.
Alignment (Format|Cells Menu)
Font (Format|Cells Menu)
AutoFit Rows, AutoFit Columns (Format Menu)
Menu Commands

Custom Number Formats

The following table lists the format symbols that can be used in a custom format string.

Format Symbol	Description
General	Displays the number in General format.
0	Digit placeholder. If the number contains fewer digits than the format contains placeholders, the number is padded with 0's. If there are more digits to the right of the decimal than there are placeholders, the decimal portion is rounded to the number of places specified by the placeholders. If there are more digits to the left of the decimal than there are placeholders, the extra digits are retained.
#	Digit placeholder. This placeholder functions the same as the 0 placeholder except the number is not padded with 0's if the number contains fewer digits than the format contains placeholders.
?	Digit placeholder. This placeholder functions the same as the 0 placeholder except that spaces are used to pad the digits.
. (period)	Decimal point. Determines how many digits (0's or #'s) are displayed on either side of the decimal point. If the format contains only #'s left of the decimal point, numbers less than 1 begin with a decimal point. If the format contains 0s left of the decimal point, numbers less than 1 begin with a 0 left of the decimal point.
%	Displays the number as a percentage. The number is multiplied by 100 and the % character is appended.
, (comma)	Thousands separator. If the format contains commas separated by #'s or 0's, the number is displayed with commas separating thousands. A comma following a placeholder scales the number by a thousand. For example, the format 0, scales the number by 1000 (e.g., 10,000 would be displayed as 10).
E- E+ e- e+	Displays the number as scientific notation. If the format contains a scientific notation symbol to the left of a 0 or # placeholder, the number is displayed in scientific notation and an E or an e is added. The number of 0 and # placeholders to the right of the decimal determines the number of digits in the exponent. E- and e- place a minus sign by negative exponents. E+ and e+ place a minus sign by negative exponents and a plus sign by positive exponents.
$ - + / ( ) :	Displays that character. To display a character other than those listed, precede the character with a back slash (\) or enclose the character in double quotation marks (" "). You can also use the slash (/) for fraction formats.
\	Displays the next character. The backslash is not displayed. You can also display a character or string of characters by surrounding the characters with double quotation marks (" "). The backslash is inserted automatically for the following characters:! ^ & ` (left quote) ' (right quote) ~ { } = < >
* (asterisk)	Repeats the next character until the width of the column is filled. You

	cannot have more than one asterisk in each format section.
_ (underline)	Skips the width of the next character. For example, to make negative numbers surrounded by parentheses align with positive numbers, you can include the format _) for positive numbers to skip the width of a parenthesis.
"text"	Displays the text inside the quotation marks.
@	Text placeholder. If there is text in the cell, the text replaces the @ format character.
m	Month number. Displays the month as digits without leading zeros (e.g., 1-12). Can also represent minutes when used with h or hh formats.
mm	Month number. Displays the month as digits with leading zeros (e.g., 01-12). Can also represent minutes when used with the h or hh formats.
mmm	Month abbreviation. Displays the month as an abbreviation (e.g., Jan-Dec).
mmmm	Month name. Displays the month as a full name (e.g., January-December).
d	Day number. Displays the day as digits with no leading zero (e.g., 1-2).
dd	Day number. Displays the day as digits with leading zeros (e.g., 01-02).
ddd	Day abbreviation. Displays the day as an abbreviation (e.g., Sun-Sat).
dddd	Day name. Displays the day as a full name (e.g., Sunday-Saturday).
yy	Year number. Displays the year as a two-digit number (e.g., 00-99).
yyyy	Year number. Displays the year as a four-digit number (e.g., 1900-2078).
h	Hour number. Displays the hour as a number without leading zeros (1-23). If the format contains one of the AM or PM formats, the hour is based on a 12-hour clock. Otherwise, it is based on a 24-hour clock.
hh	Hour number. Displays the hour as a number with leading zeros (01-23). If the format contains one of the AM or PM formats, the hour is based on a 12-hour clock. Otherwise, it is based on a 24-hour clock.
m	Minute number. Displays the minute as a number without leading zeros (0-59). The m format must appear immediately after the h or hh symbol. Otherwise, it is interpreted as a month number.
mm	Minute number. Displays the minute as a number with leading zeros (00-59). The mm format must appear immediately after the h or hh symbol. Otherwise, it is interpreted as a month number.
s	Second number. Displays the second as a number without leading zeros (0-59).
ss	Second number. Displays the second as a number with leading zeros (00-59).
[h]	Outputs total number of hours
[m]	Outputs total number of minutes
[s]	Outputs total number of seconds
[BLACK]	Displays cell text in black.
[BLUE]	Displays cell text in blue.
[CYAN]	Displays cell text in cyan.
[GREEN]	Displays cell text in green.
[MAGENTA]	Displays cell text in magenta.
[RED]	Displays cell text in red.

[WHITE]	Displays cell text in white.
[YELLOW]	Displays cell text in yellow.
[COLOR n]	Displays cell text using the corresponding color in the color palette. n is a color in the color palette.
[conditional]	Each format can have as many as four sections - one each for positive numbers, negative numbers, zeros, and text. Using the conditional value brackets ([ ]), you can designate a different condition for each section. For example, you might want positive numbers displayed in black, negative numbers in red, and zeros in blue. The following string formats a number for these conditions:[>0] [BLACK]General; [<0] [RED]General; [BLUE]General

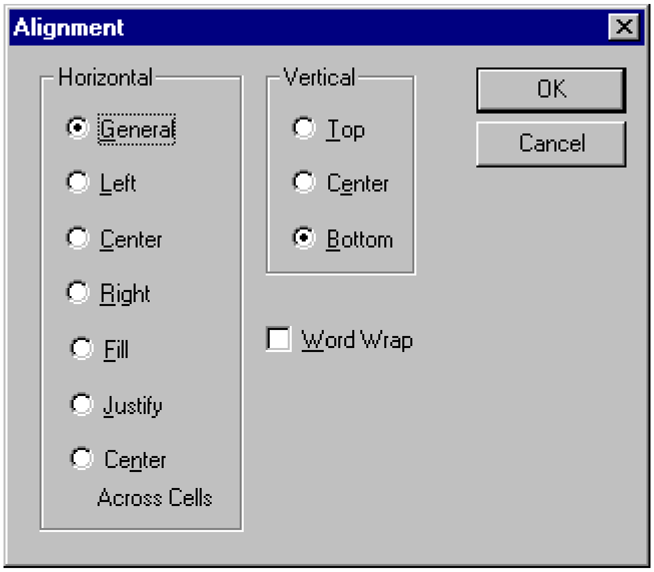
The following table shows some examples of custom number formats and numbers displayed using the custom formats.

Format	Cell Data	Display
#.##	123.456	123.46
	0.2	.2
#.0#	123.456	123.46
	123	123.0
#,##0"CR";#,##0"DR";0	1234.567	1,235CR
	0	0
	-123.45	123DR
#,	10000	10
"Sales="0.0	123.45	Sales=123.5
	-123.45	-Sales=123.5
"X="0.0;"x="-0.0	-12.34	x=-12.3
$* #,##0.00;$* -#,##0.00	1234.567	$ 1,234.57
	-12.34	$ -12.34
000-00-0000	123456789	123-45-6789
"Cust. No." 0000	1234	Cust. No. 1234
;;;	Anything	(Not Displayed)
"The End"	123.45	The End
	-123.45	-The End
	text	text
m-d-yy	2/3/94	2-3-94
mm dd yy	2/3/94	02 03 94
mmm d, yy	2/3/94	Feb 3, 94
mmmm d, yyyy	2/3/94	February 3, 1994
d mmmm yyyy	2/3/94	3 February 1994
hh"h" mm"m"	1:32 AM	01h 32m
h.mm AM/PM	14:56	2.56 PM
hhmm "hours"	3:15	0315 hours

See Also:
Pre-Defined Number Formats
Alignment (Format|Cells Menu)
Font (Format|Cells Menu)
AutoFit Rows, AutoFit Columns (Format Menu)
Menu Commands

Alignment (Format|Cells Menu)

Allows you to format how the text appears in the cells for the entire spreadsheet.



See Also:

Pre-Defined Number Formats
Custom Number Formats.
Font (Format|Cells Menu)
AutoFit Rows, AutoFit Columns (Format Menu)
Menu Commands

Font (Format|Cells Menu)

Allows you to format how the text font appears in the cells for the entire spreadsheet.

See Also:

Pre-Defined Number Formats
Custom Number Formats.
Alignment (Format|Cells Menu)
AutoFit Rows, AutoFit Columns (Format Menu)
Menu Commands

AutoFit Rows, AutoFit Columns (Format Menu)

Sets the widths of the spreadsheet columns or rows to automatically adjust to the largest column entry, including the header.

See Also:

Pre-Defined Number Formats
Custom Number Formats.
Alignment (Format|Cells Menu)
Font (Format|Cells Menu)
AutoFit Rows, AutoFit Columns (Format Menu)
Menu Commands

Regression (Solve Menu)

Starts the regression solution process.

Choosing **Solve|Regression** will bring up the Solution Setup window allowing you to select which regression models you want to solve.

Note: *If the software goes directly into the solution process without showing the Solution Setup window, you have, sometime during your session, unchecked Prompt for Solution Setup. This option is there so that if you are solving the same options repeatedly during sessions while modifying data, you need not keep going through the Solution Setup window. You can toggle this option so that the Solution Setup window is shown by simply checking it.*

When the setup is completed, the software will complete the solution process and place the solved model(s) into the Regression Models list, sorted according to the Residual Sum of Squares for the model. The smaller the Residual Sum of Squares, the more accurate the fit. Once a solution has been solved, you may save the solution by selecting File - Save/Save As...

If the active window is a Plot window, this menu choice will be unavailable.

See Also:

Solution Setup
Built In Regression Models
User Defined Regression Models
Regression Theory
Overview of the DataFit Workplace
Menu Commands

Interpolation (Solve Menu)

Starts the Interpolation solution process.   Applies to 2D or single independent variable projects only.

Choosing **Solve|Interpolation** will bring up the Solution Setup window allowing you to select which interpolation models you want to solve.

Note: *If the software goes directly into the solution process without showing the Solution Setup window, you have, sometime during your session, unchecked Prompt for Solution Setup. This option is there so that if you are solving the same options repeatedly during sessions while modifying data, you need not keep going through the Solution Setup window.   You can toggle this option so that the Solution Setup window is shown by simply checking it.*

When the setup is completed, the software will complete the solution process and place the equations into the Interpolation Models list.   All of these types of interpolation techniques pass the curve through each data point, so there is no meaning to the ordering of the equations in the list.

Note: *Interpolation with Splines or Polynomials should not, in general, be used for data modeling.   This is why they are treated a bit differently than regression models.   There are, however, instances where these methods may be useful.*

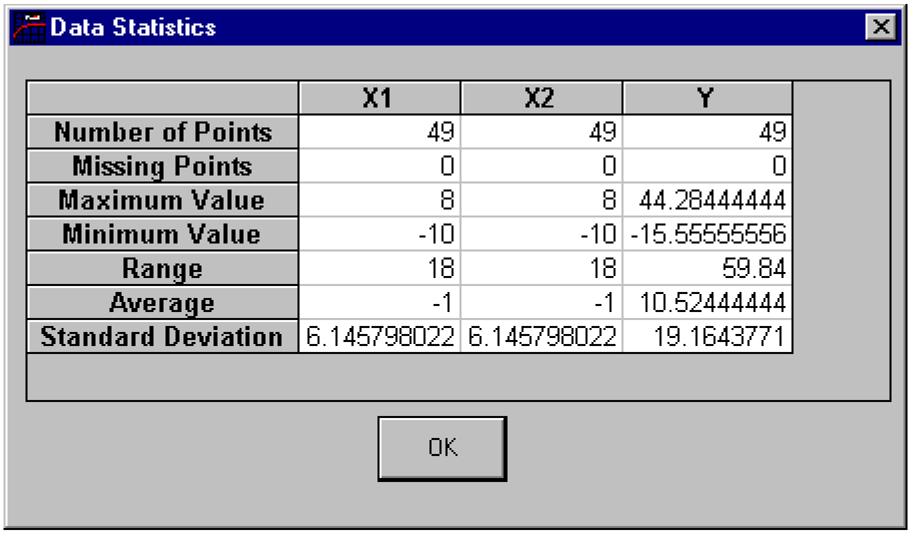
If the active window is a plot window or is a multiple variable regression window, this menu choice will be unavailable.

See Also:

Solution Setup
Interpolation Theory
Overview of the DataFit Workplace
Menu Commands

Statistics (Solve Menu)

Provides fundamental statistical calculations of the data in the spreadsheet.



Data Statistics

	X1	X2	Y
Number of Points	49	49	49
Missing Points	0	0	0
Maximum Value	8	8	44.28444444
Minimum Value	-10	-10	-15.55555556
Range	18	18	59.84
Average	-1	-1	10.52444444
Standard Deviation	6.145798022	6.145798022	19.1643771

OK

Number of Points: This is the total number of points for independent and dependent variable data entered into the spreadsheet. Since the data must be entered one coordinate per line, the number of points is chosen to be the larger of the entered parameters. If there are points missing from either independent or dependent variable columns (or both) they will show up as missing points.

Missing Points: This is the total number of missing points for independent and dependent variable data entered into the spreadsheet. Since the data must be entered one coordinate per line, the number of points is chosen to be the larger of the entered parameters. If there are points missing from either independent or dependent variable columns (or both) they will show up here. Any missing points will generate a warning message upon solving, and will be assumed to be zero if ignored.

Maximum Value: This is the maximum value entered into the spreadsheet for each column.

Minimum Value: This is the minimum value entered into the spreadsheet for each column.

Range: This is the data range entered into the spreadsheet for each column. (Maximum Value - Minimum Value).

Average: This is the average of the data entered into the spreadsheet for each column.

Standard Deviation: This is the Standard Deviation of the data entered into the spreadsheet for each column.

OK: Closes the Data Statistics window.

See Also:

Solution Setup
Interpolation Theory
Overview of the DataFit WorkplaceOVERVIEW
Menu Commands

Define User Model (Solve Menu)

Allows the user to define his or her own nonlinear regression model.

If a suitable model does not exist within the Built In Models in DataFit, User Defined Regression Models may be defined.   This allows virtually any model to be entered and kept in an equation database.

If the active window is a plot window, this menu choice will be unavailable.

See Also:

Solution Setup
Interpolation Theory
Overview of the DataFit Workplace
Menu Commands

View Log (Solve Menu)

Shows the user a history of the solver from the last solution process.

The **Solve Log** is basically a history list generated by the solver. If there are errors, such as non-convergence, or functional evaluation errors, the Solve Log can tell you where the errors occurred. With this feature, you may gain insight into problems with a particular model. The **Solve Log** is refreshed and updated after every solution. Below is a typical **Solve Log** from a successful nonlinear solution:

Log Text

Beginning non-linear solution for model x^a
Obtaining Initial Estimates
Initial Estimates successful
Beginning non-linear iterations
Solution converged to a residual of 1.2457e-7
Total number of non-linear iterations = 3
Residual Sum of Squares = 4.562e-6
Solution complete

If an error is encountered, you may see text as follows:

Log Text

Beginning non-linear solution for model log(a*x+b)
Obtaining Initial Estimates
Initial Estimates successful
Beginning non-linear iterations
Error evaluating the function at X = -12.564
Solution for log(a*x+b) failed: numerical error

When this happens, check for things such as illegal function calls (log of a negative number...), division by zero, etc. This may mean that the particular model may not be suitable for the data you have entered. Scaling or translation of the data may be required.

The log text may report an error such as "Error Occurred while taking the derivative at…", as another example. Derivatives are required for performing nonlinear regression, so a function may evaluate at f(x) = 0.0, but when numerically computing the derivative may require evaluating at a very small negative number. By viewing the log text, errors of this sort are much easy to pinpoint and correct.

If the active window is a Plot window, this menu choice will be unavailable.

See Also:

Regression Theory (Nonlinear and Linear Models)
Specifying Initial Estimates for Nonlinear Models
Menu Commands

Prompt for Solution Setup (Solve Menu)

Allows the user to show or bypass the solution setup window.

If you are solving the same solution options repeatedly during sessions while modifying data, you need not keep going through the Solution Setup window. You can check the box labeled **Use This Setting as Default** in the Solution Setup window and the default settings will be used until the **Prompt for Solution Setup** menu is again checked. You can check or uncheck the menu by simply clicking on it in the Solve Menu.

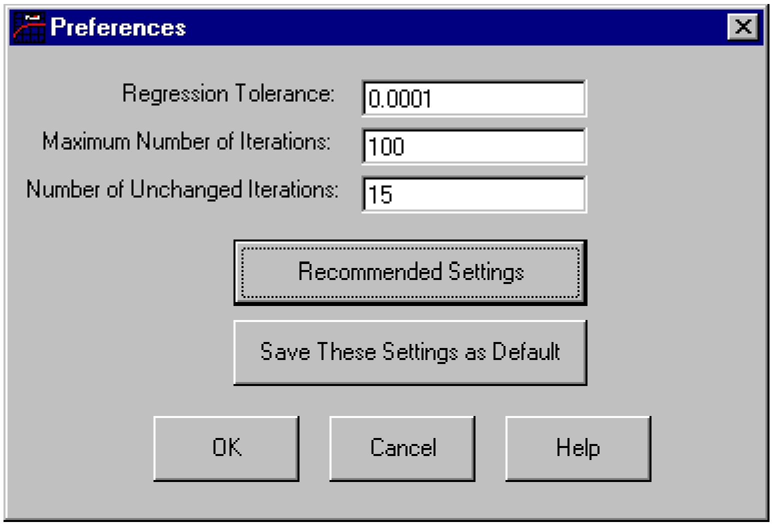
If the active window is a Plot window, this menu choice will be unavailable.

See Also:

Solution Setup
Interpolation Theory
Overview of the DataFit Workplace
Menu Commands

Preferences (Solve Menu)

Allows modification of parameters used during the nonlinear regression solution process.



Regression Tolerance: When performing non-linear regression, the solver returns the best estimate of the variables reached so far in the iterative process. The solver calculates the merit function for each iteration and compares it to the previous iteration. When the difference is less than the Regression Tolerance specified, the iteration process will terminate. For more information, see the help topic Regression Theory.

Maximum Number of Iterations: This is the maximum number of nonlinear iterations the solver will perform if the solution has failed to reach the **Regression Tolerance** specified above. This does not mean the solution is not any good, it may mean that the solution is not as good as it could be. When the number of iterations exceeds this value, the iteration process will terminate. This stops a model from running on 'forever'. For more information, see the help topics Regression Theory and Interpreting the Results.

Number of Unchanged Iterations: As mentioned above, solver returns the best estimate reached so far in the iterative process. If the merit function remains unchanged for the specified number of unchanged iterations, the iterative process will terminate. Again, this does not mean that the solution is not any good, but possibly it is as good as it can be for the initial estimates used. For more information, see the help topics Regression Theory and Interpreting the Results.

Recommended Settings:	This will replace the current settings with the default recommended software settings built into the program. The default settings are shown above in the graphic.
Save These Settings as Defaults:	This will save the current settings in the system registry as defaults for the current and later sessions.
OK:	Accepts the changes and closes the **Solve Preferences** window.
Cancel:	Ignores changes and closes the **Solve Preferences** window.

If the active window is a plot window, this menu choice will be unavailable.

See Also:

Regression Theory
Menu Commands

Function in BASIC (Export Menu)

Exports an equation solution as BASIC subroutine source code. Applies to 2D or single independent variable projects only.

Once solutions have been obtained for the various models, you have the capability of generating source code in the form of functions in order to incorporate them into other program source code. **BASIC** and C are currently supported. Select the model (one at a time) you want to export from the **Available Solutions** list and choose **BASIC** from the **Export** menu. You will be prompted for a function name. This function name can be any syntactically correct BASIC function name. The function name syntax is not checked here. You will then be prompted for a filename for which to save the function.

How to use an exported function:

Three variables are passed to the function. The first variable is the X value you wish to have interpolated. The second value is the result passed back to the calling routine. The third variable is a string which contains a textual description of why a failure occurred. The function returns a boolean which evaluates to TRUE if the function call is a success, or to a FALSE if the function call fails. The function call will return a failure if the X value passed to it lies outside of the range of input values, numerical overflow has occurred, or an illegal function call has occurred. Define the X and Result as double precision, and define the Error String variable as string. The source code generated is also self documented. Any supporting functions not defined in the **BASIC** language will be generated as well. The following is a sample of exported **BASIC** code:

```
Public Function interp(X As Double, Result As Double, Errstring As String) As Boolean

   'This function returns a predicted f(x) value from x
   'for the function x/(a+b*x+c*sqr(x))

   Dim a As Double
   Dim b As Double
   Dim c As Double
   Dim Max As Double
   Dim Min As Double

   On Error GoTo InterpolateError

   a = 1
   b = 3.6
   c = 1.7
   Min = 1
   Max = 6

   'Check to see if X lies within the valid range.
   If X < Min Or X > Max Then
       Errstring = "X lies outside of the range of f(x)."
       interp = False
       Exit Function
```

```
    End If

    'Evaluate the function.
    Result = (X / ((a + (b * X)) + (c * Sqr(X))))
    interp = True
    Exit Function

'Error Trap.
InterpolateError:
    Errstring = "Error evaluating the function at x = " & CStr(X)
    interp = False
    Exit Function

End Function
```

The calling routine the user creates can look like the following example**:**

```
Sub get_data ()

    Dim XData As Double, YData As Double
    Dim Errstring As String

    XData = 2.5

    If interp(XData, YData, Errstring) = True Then
        Print "Y = "; YData
    Else
        Print "Error: " & Errstring
    End If

End Sub
```

Simple example, but you get the idea.
Remember, the equation is valid ONLY within the range of input data.

If the active window is a plot window, this menu choice will be unavailable.

See Also:

Function in C
Overview of the DataFit Workplace
Menu Commands

Function in C (Export Menu)

Exports an equation solution as C subroutine source code. Applies to 2D or single independent variable projects only.

Once solutions have been obtained for the various curve options, you have the capability of generating source code in the form of functions in order to incorporate them into other program source code. BASIC and **C** are currently supported. Select the model (one at a time) you want to export from the **Available Solutions** list and choose **C** from the **Export** menu. You will be prompted for a function name. This function name can be any syntactically correct **C** function name. The function name syntax is not checked here. You will then be prompted for a filename for which to save the function.

How to use an exported function:

Two variables are passed to the function. The first variable is the X value you wish to have interpolated. The second value is the result passed back to the calling routine. The function returns a '1' if the function call is a success, or '0' if the function call fails. The function call will return a failure if the X value passed to it lies outside of the range of input values. Define the X and Result as double precision. The source code generated is also self documented. Any supporting functions not defined in the **C** language will be generated as well. The following is a sample of exported **C** code:

```
int interp(double X, double Result)

    /* This function returns a predicted f(x) value from x */
    /* for the function a*x^b*/
{
    double a = 1;
    double b = 2;
    double Max = 1;
    double Min = 5;

    /* Check to see if X lies within the valid range */
    If (X < Min || X > Max)
         return (0);

    /* Evaluate the function */
    Result = (a * (pow(x , b)))
    return (1);
}
```

The calling routine the user creates can look like the following example**:**

```
#include <math.h>
#include <stdio.h>

void main()
{
```

```
double y_value;
double x_value;
int success;

y_value = interpolate(x_value, success);
if (success == 1)
        printf ("Y = %e", y);
else
        printf ("Y was outside valid range");

}
```

Simple example, but you get the idea.
Remember, the equation is valid ONLY within the range of input data.

If the active window is a plot window, this menu choice will be unavailable.

See Also:

Function in BASIC
Overview of the DataFit Workplace
Menu Commands

New (Plot Menu)

Creates a new plot window from the current input data and solutions.

Note: projects with more then 2 independent variables will appear as a 2D plot. The plot format is such that the data point number is on the horizontal axis and the independent variable is on the vertical axis.

To plot input data only:

1. If solved models exist in the **Available Solution** list, make sure they are all de-selected. Press **Deselect All** beneath the **Available Solution** to deselect them.
2. Choose **Plot|New**.

To plot input data and equation(s):

1. Select the model(s) you want included in the plot from the **Available Solution** list.
2. Choose **Plot|New**.

Note: *When models are selected in the list, they will appear highlighted. To multi-select models listed consecutively, click and drag the mouse through the list. To select data that are not consecutively listed, hold down the Control key on the keyboard while clicking the mouse on individual models.*

If the active window is a plot window, this menu choice will be unavailable.

See Also:

Opening an Existing Plot
Overview of the DataFit Workplace
Creating Plots
Menu Commands

Open (Plot Menu)

Creates a new plot window from a plot previously saved to file.

Note: Up to four of the most recently saved or opened plot files are shown in the Plot Menu, allowing quick access to recently used plot files. As a plot file is saved or opened, the recent file list updates itself automatically. There is similar operation in the File Menu for quick access to saved DataFit projects.

See Also:

Saving Plots
Importing Plots
Opening a DataFit Project
Menu Commands

Import (Plot Menu)

Allows importing of DataFit solutions, raw data and/or plot files into the current plot window. Applies to 2D or single independent variable projects only.

If you want to compare the results of two separate curve fitting sessions, or have parsed your data into separate sections, this gives you the ability to display them all at the same time.

To import data into the current plot window:

1. Select **Plot|Import.**
2. Enter the filename you wish to import data from.
3. Select the data you with to import from the list shown.

If you are importing raw data, the file structure needs to be two or three values per line (X Y) or (X Y StDev) format but the data can be **comma** delimited, **tab** delimited, or **space** delimited, or a combination of these. For example:

1.0,2.0,3.0	Valid (comma delimited, 3 points per line)
1.0,2.0	Valid (comma delimited, 2 points per line)
1.0, 2.0, 3.0	Valid (comma delimited with space)
1.0 2.0 3.0	Valid (tab delimited or multiple space delimited)
1.0, 2.0, 3.0	Valid (comma delimited with multiple tabs or multiple spaces)
1.0 2.0	Valid (space delimited)

Any non-numeric data will be ignored. It is not necessary to know the file structure being imported, the software will automatically parse the data. All leading and trailing spaces and tabs are ignored. If you want to import data from another software package, like Excel, choose File - Save as... and select **Comma**, **Tab**, or **Space** delimited format from the Excel file menu.

If the active window is a regression window, this menu choice will be unavailable.

See Also:

Saving Plots
Plot Calculator
Menu Commands

Close (Plot Menu)

Closes the current plot window.

If the active window is a regression window, this menu choice will be unavailable.   There is a similar operation in the **File** Menu for closing the current regression window.

See Also:

Close (File Menu)
Menu Commands

Save, Save As... (Plot Menu)

Saves the current plot to disk as either a DataFit plot file or enhanced metafile.

When a plot is **Saved** as a DataFit Plot file (*.plt), all properties, including line color and style information, plot axis labeling information, legend placement and fonts are saved along with the data. This will allow retrieving the plot file for Printing or Importing plots at a later time.

A second option for saving the files is to save them as an Enhanced Metafile (*.emf). A metafile is a collection of commands that store an image in device independent format. This is an important feature in that a metafile will look the same no matter what device it is displayed on, which is what sets it apart from a bitmap. Another important feature is than metafiles are vector based and can be resized without distorting their appearance. Since all of the information about the creation of the image is stored along with the image, it is also possible (if the presentation software supports this) to edit the attributes of the image outside of the application they were generated in.

Windows Metafiles vs. Enhanced Metafiles:
There are two types of metafiles: enhanced and Windows. An enhanced metafile is used in applications written using the Microsoft Win32 application programming interface (API). A Windows metafile is used for applications written using the Windows version 3.x API. Windows-format metafiles are limited in their capabilities and should no longer be used except in cases to maintain backward compatibility with applications that were written to run with Windows version 3.x. As written above, DataFit creates Enhanced Metafiles by using the Win32 API.

Enhanced metafiles (along with bitmaps) can also be created and copied to the windows clipboard. This allows them to be pasted directly into another application, such as Microsoft Word or Microsoft Powerpoint.

If the active window is a regression window, this menu choice will be unavailable. There is a similar operation in the **File** Menu for saving the current regression widow.

See Also:

Formatting Plots
Saving Projects
Menu Commands

Format Properties... (Plot Menu)

Allows customization of plots.

This will bring up the **Graph Properties** window, allowing you to customize the plot. You are able to format fonts, titles, text, line appearance, as well as previewing the changes.

If the active window is a regression window, this menu choice will be unavailable.

Click on the links below to go to the appropriate topic:

2D Plot Formatting

2D Title Formatting
2D Data Formatting
2D Axis Formatting
2D Footnote Formatting
2D Appearance
Saving Default Settings

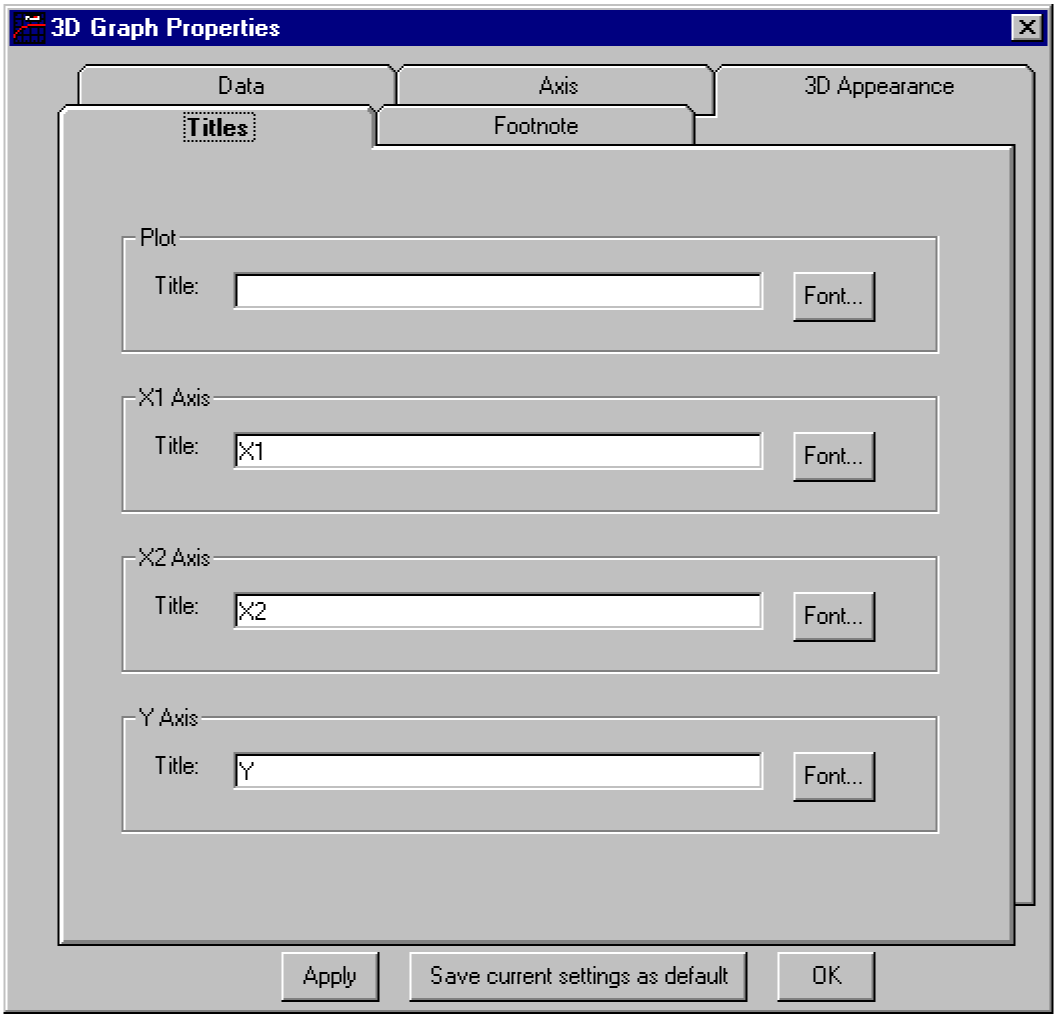
3D Plot Formatting

3D Title Formatting
3D Data Formatting
3D Axis Formatting
3D Footnote Formatting
3D Appearance
Saving Default Settings

See Also:

Menu Commands

3D Title Formatting



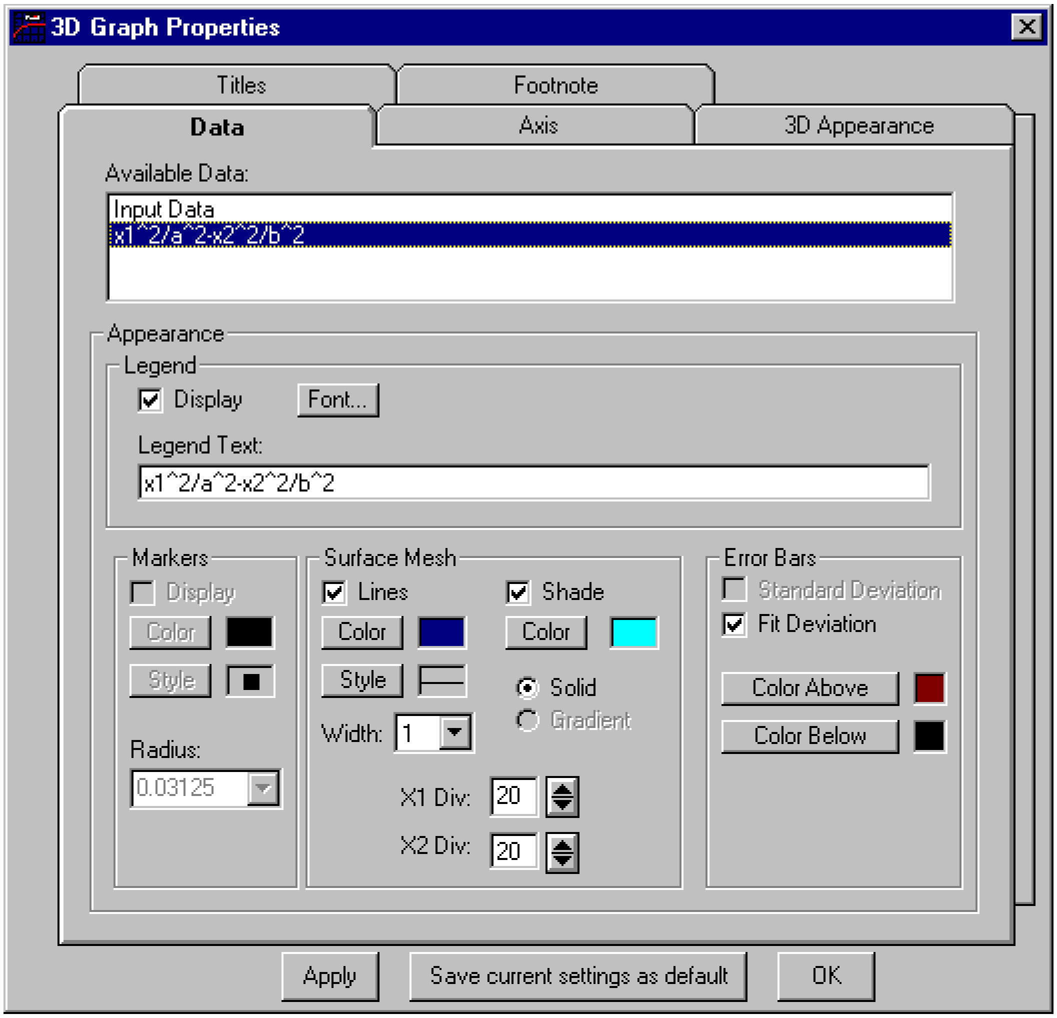
The Plot title, X1 axis title, X2 axis title and Y axis title can be entered by typing the desired text into the text boxes.   You may change the fonts individually by clicking the **Font** button.

Note: In order for text to appear rotated, you must select a ***True Type*** *Font in the Font Dialog.*

See Also:

3D Data Formatting
3D Axis Formatting
3D Footnote Formatting
3D Appearance
Saving 3D Default Settings

3D Data Formatting



Available Data: This is a list of the data and equations in the current plot. All of the equations or data plotted will appear in the list box. The names given by default are the equation type solved prefixed by the DataFit project name. If the data was imported from a delimited file, the filename will appear to represent the data. All of the following properties associated with lines can be modified individually by selecting the name in the list, and editing the properties.

Legend Section:

Legend Text: This is the text that is displayed in the legend. It applies only to visible lines. To modify the Legend Text of any line, select the line in the list, and modify the text as desired. If the legend for any particular line is blank, it will not appear in the legend.

Font: Use the Font button to change the font of the legend text.

Markers Section:

Display: If this checkbox is selected, the discreet markers are not displayed on the plot. The line itself is not removed from memory if it is not displayed, it just becomes invisible.
Color: Specifies the discreet marker color. Clicking on the button brings up the Windows color dialog.
Style: Specifies the style of the discreet marker.
Radius: The radius of discreet markers in inches. This setting applies to all visible lines.

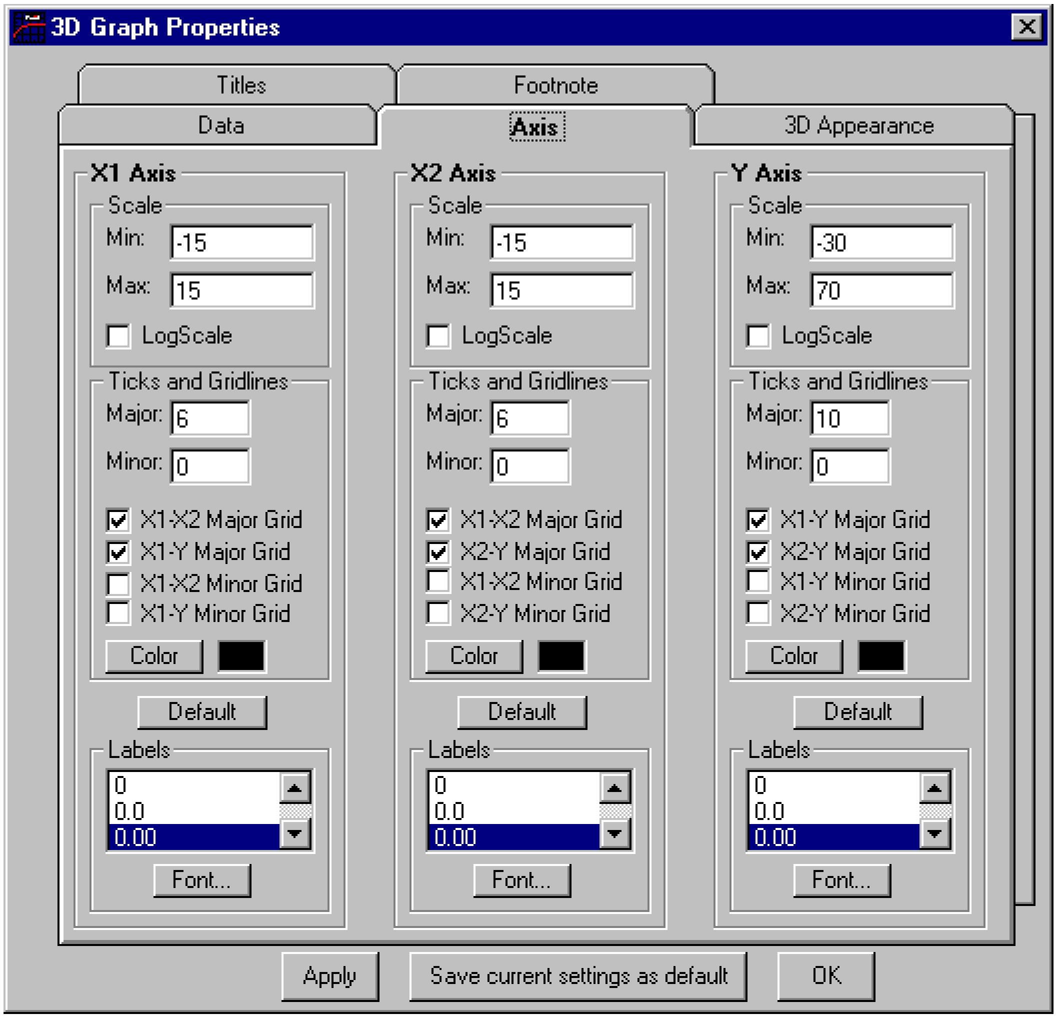
Surface Mesh Section:
Lines: If this checkbox is selected, the surface mesh lines for 3D functions are not displayed on the plot. The line itself is not removed from memory if it is not displayed, it just becomes invisible.
Color: Specifies the color of the surface mesh lines. Clicking on the button brings up the Windows color dialog.
Style: Specifies the style of the surface mesh lines.
Width: Specifies the width of the surface mesh lines.
Shade: If this checkbox is selected, the surface mesh for 3D functions is shaded.
Color: If Shade is selected, the surface mesh for 3D functions will be shaded with this color.
X1 Div: Divisions along the X1 axis for which the 3D function will be evaluated to create the surface mesh.
X2 Div: Divisions along the X2 axis for which the 3D function will be evaluated to create the surface mesh.

Error Bars Section:
Standard Deviation: If standard deviation information is available, checking this box will display error bars on the plot. Discreet input data error is obtained from the standard deviation information entered into the spreadsheet.
Fit Deviation: Checking this box will display error bars from the discreet input to the surface of the 3D mesh showing the deviation between the entered value and the evaluated function.

See Also:

3D Title Formatting
3D Axis Formatting
3D Footnote Formatting
3D Appearance
Saving 3D Default Settings

3D Axis Formatting



Scale Section:

Min: Minimum X1, X2 or Y plot extreme. The equation data is plotted only in the valid data range if this value lies outside of the valid data range.

Max: Maximum X1, X2 or Y plot extreme. The equation data is plotted only in the valid data range if this value lies outside of the valid data range.

LogScale: Plots X1, X2 and/or Y data on Log Scale if this box is checked.

Ticks and Gridlines Section:

Major: This is the number of major divisions (divisions with numeric values next to them) on either the X1 X2, or Y Axis. The value must be in the range of (1-20).

Minor: This is the number of tick marks appearing between each major division. The value can be in the range (0-20).

X1-X2 Major Grid: Displays major gridlines on the X2-X2 plane if this box is checked.

X1-Y Major Grid: Displays major gridlines on the X1-Y plane if this box is checked.
X1-X2 Minor Grid: Displays minor gridlines on the X2-X2 plane if this box is checked.
X1-Y Minor Grid: Displays minor gridlines on the X1-Y plane if this box is checked.
Color Color of the axis lines, grid lines and ticks.

Default: Automatically fills the Maximum Value and Minimum Value entries to fit the data extremes. This applies only to visible lines.

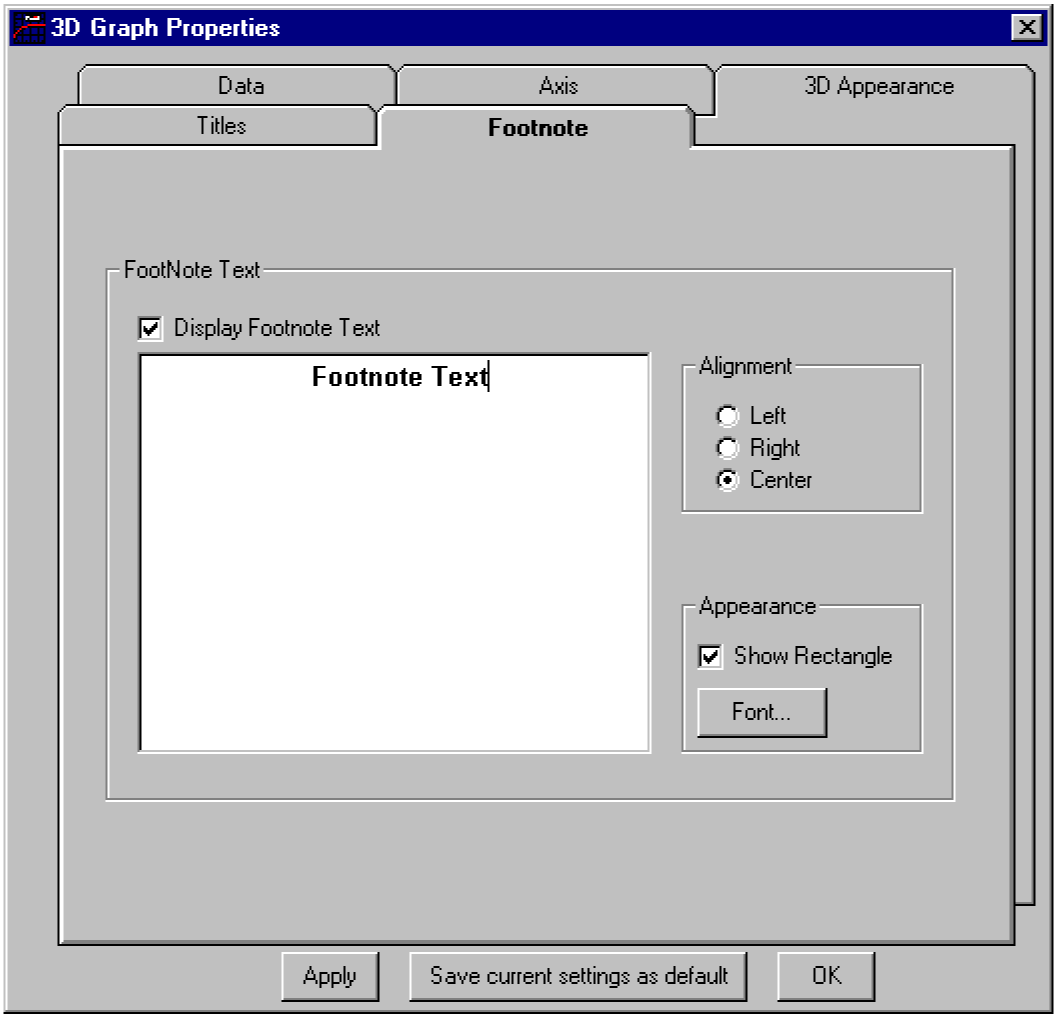
Labels Section: You can modify the precision of the numerical labels on the plot by selecting the label you want in the list.

Note: In order for text to appear rotated, ***True Type*** *fonts must be used.*

See Also:

3D Data Formatting
3D Title Formatting
3D Footnote Formatting
3D Appearance
Saving 3D Default Settings

3D Footnote Formatting



Footnote Text section:

Display Footnote: If this item is checked, the footnote will be displayed on the plot. The position of the footnote can be changed by clicking and dragging the footnote to a new location on the plot while in the plot window.

FootNote Text: This is the actual footnote text to be displayed on the plot. To enter footnote text, simply type the text in the text box provided.

Alignment Section: The width of the footnote text bounding box is calculated from the width of the longest line entered for the footnote. Choosing **Left**, **Center** or **Right** alignment will align the text in the text bounding box according to the calculated dimensions of the bounding box.

Appearance Section:

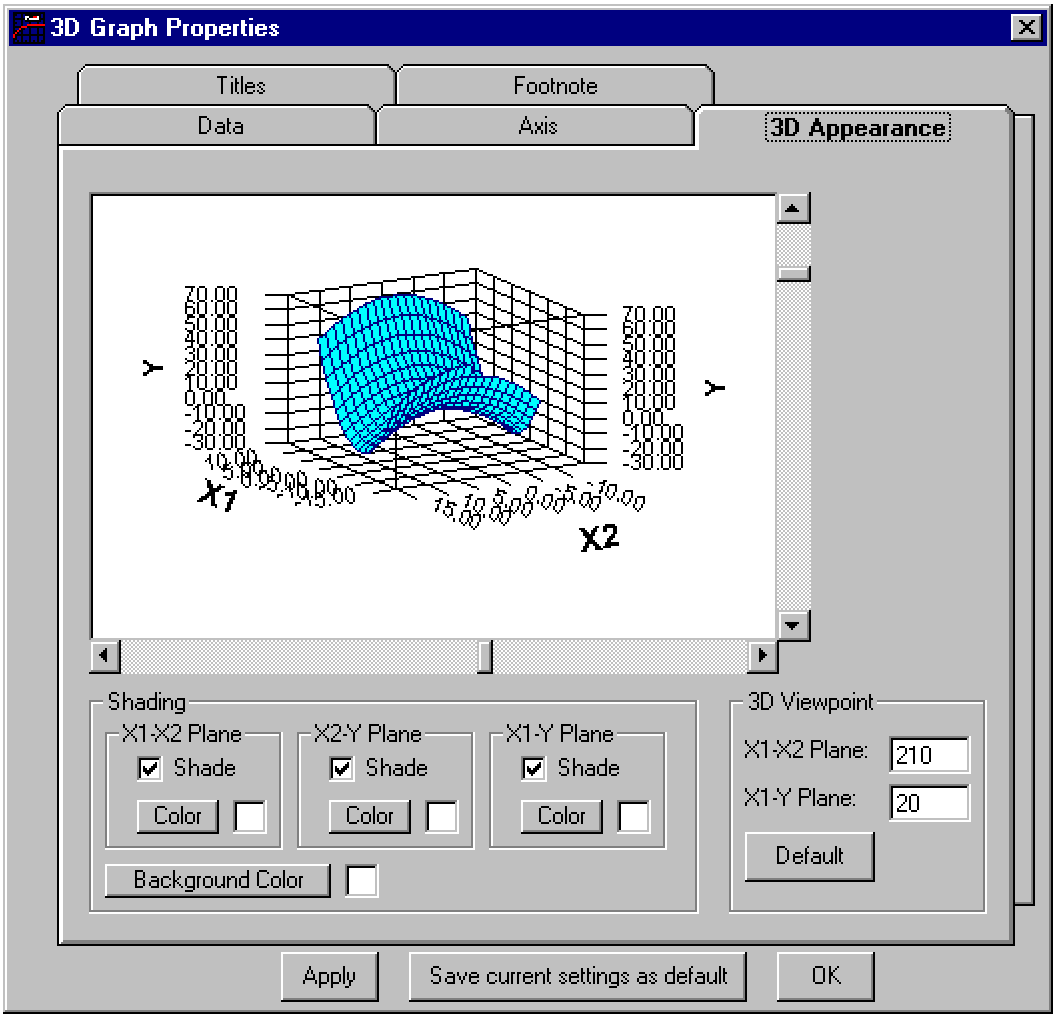
Show Rectangle: If this item is checked, the footnote text bounding box will be displayed.

Font: Allows the user to edit the Footnote font by changing the typeface, size, and other font attributes. Clicking on this button will bring up the Windows font dialog.

See Also:

3D Title Formatting
3D Data Formatting
3D Axis Formatting
3D Appearance
Saving 3D Default Settings

3D Appearance



Shading Section: Use the Shade check boxes and the Color buttons to shade the X1-X2, X2-Y and X1-Y planes on the 3D Graph bounding region.

Background Color: Specifies the background color of the Plot Window.

Note: The horizontal and vertical scrollbars can be used to rotate the 3D View of the plot about the X1-X2 Axis and the Y Axis. To return to the default view, click the ***Default*** *button.*

See Also:

3D Title Formatting
3D Data Formatting
3D Axis Formatting
3D Footnote Formatting
Saving 3D Default Settings

Saving 3D Default Plot Settings

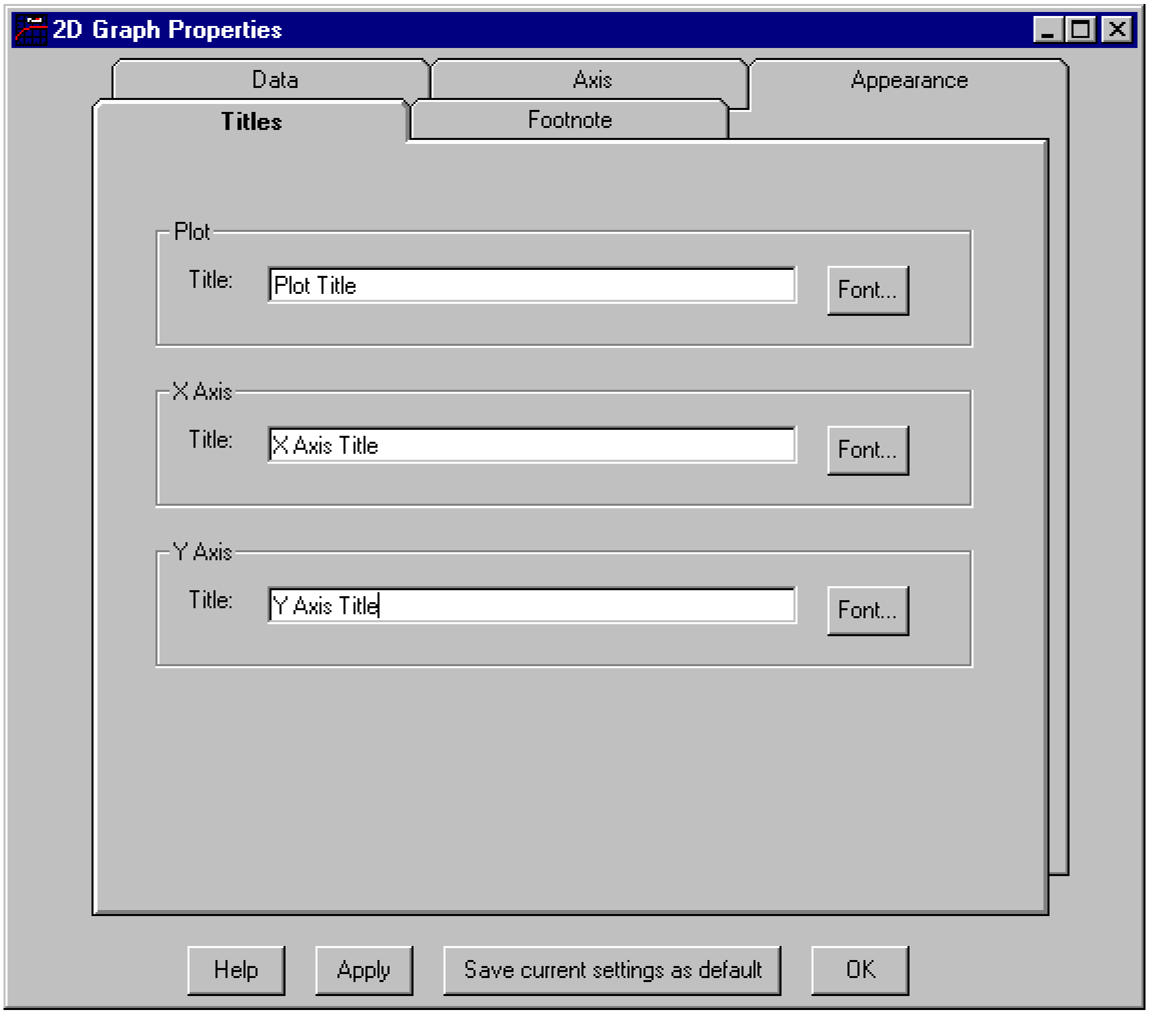
By clicking **Save Current Settings As Default** in the plot properties dialog**,** data independent settings used for formatting a plot can be saved as default settings. These settings are:

1. Number Formats (Axis tab)
2. Log Scale or Normal Scale (Axis tab)
3. Axis and Plot Title Fonts (Titles tab)
4. Axis Label Fonts (Axis tab)
5. Plot Legend Font (Data tab)
6. Background Color (Appearance tab)
7. Discreet Point Radius (Data tab)
8. Footnote Font (Footnote Tab)

See Also:

3D Title Formatting
3D Data Formatting
3D Axis Formatting
3D Footnote Formatting
3D Appearance

2D Title Formatting



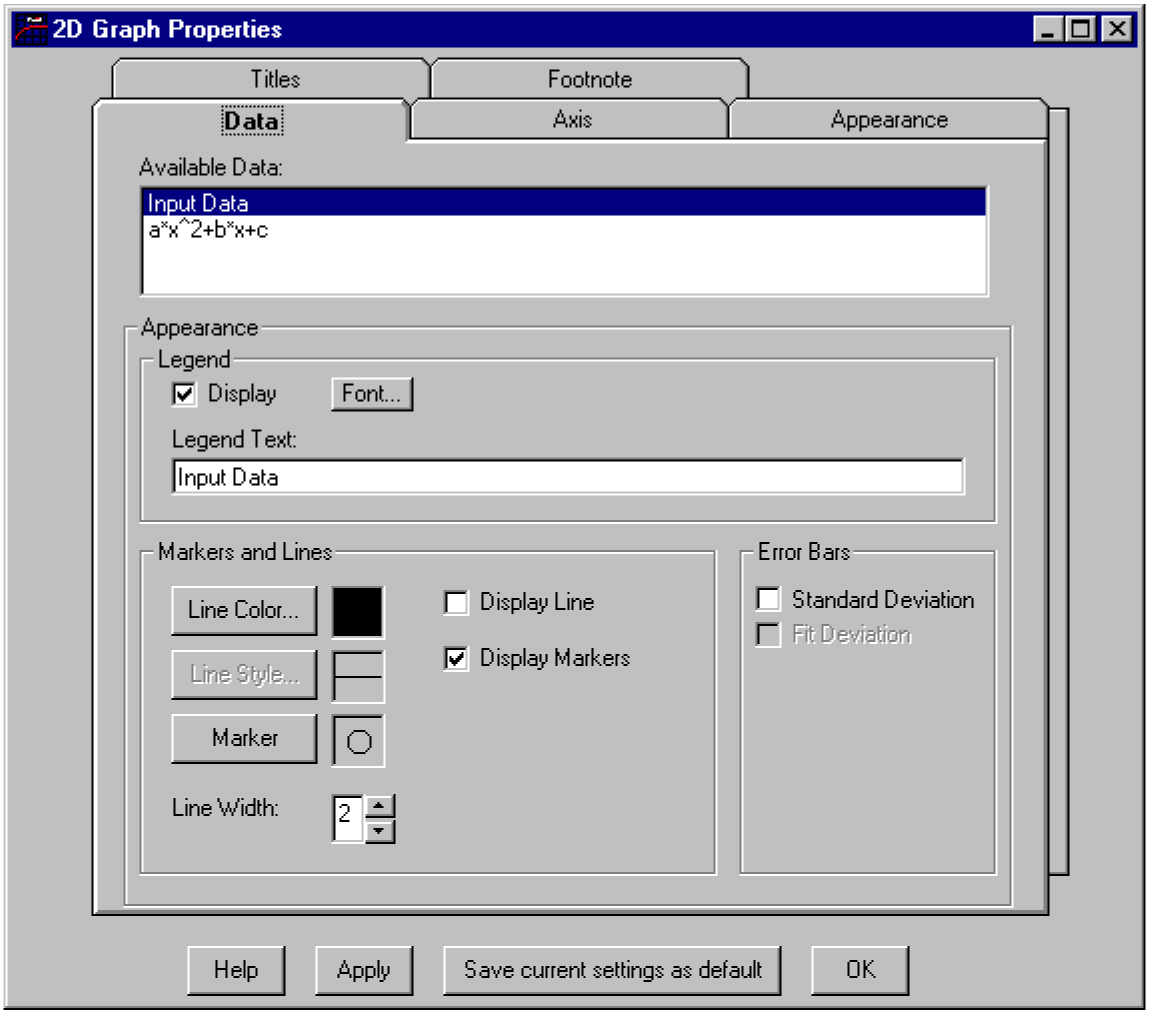
The Plot title, X axis title and Y axis title can be entered by typing the desired text into the text boxes.   You may change the fonts individually by clicking the **Font** button.

*Note: In order for text to appear rotated, you must select a **True Type** Font in the Font Dialog.*

See Also:

2D Data Formatting
2D Axis Formatting
2D Footnote Formatting
2D Appearance
Saving 2D Default Settings

2D Data Formatting



Available Data: This is a list of the data and equations in the current plot. All of the equations or data plotted will appear in the list box. The names given by default are the equation type solved prefixed by the DataFit project name. If the data was imported from a delimited file, the filename will appear to represent the data. All of the following properties associated with lines can be modified individually by selecting the name in the list, and editing the properties.

Legend Section:

Legend Text: This is the text that is displayed in the legend. It applies only to visible lines. To modify the Legend Text of any line, select the line in the list, and modify the text as desired. If the legend for any particular line is blank, it will not appear in the legend.

Font: Use the Font button to change the font of the legend text.

Markers and Lines Section:

Display Line: If this checkbox is selected, the line is displayed on the plot. The line itself is not removed from memory if it is not displayed, it just becomes invisible. Lines and Markers can be turned on or off independently of each other. If both Display Marker and Display Line are not selected, no information about the line will be displayed on the plot.

Display Marker: If this checkbox is selected, the discreet point markers are displayed on the plot. Lines and Markers can be turned on or off independently of each other. If both Display Marker and Display Line are not selected, no information about the line will be displayed on the plot.

Line Color: Specifies the discreet marker color. Clicking on the button brings up the Windows color dialog.

Line Style: Specifies the line style. Line style can only be changed when the Line Width = 1.

Line Width: Specifies the width (in pixels) in which to display the line. The Line Width can be controlled by using the spin buttons, or typing the it in the line width text box. You can specify line widths from values of 1 to 5. The line style property can only be changed when the line width is set to 1.

Marker: Specifies the Marker used to mark discreet points. The Markers can be turned on or off by selecting or de-selecting the Display Marker checkbox.

Error Bars Section:

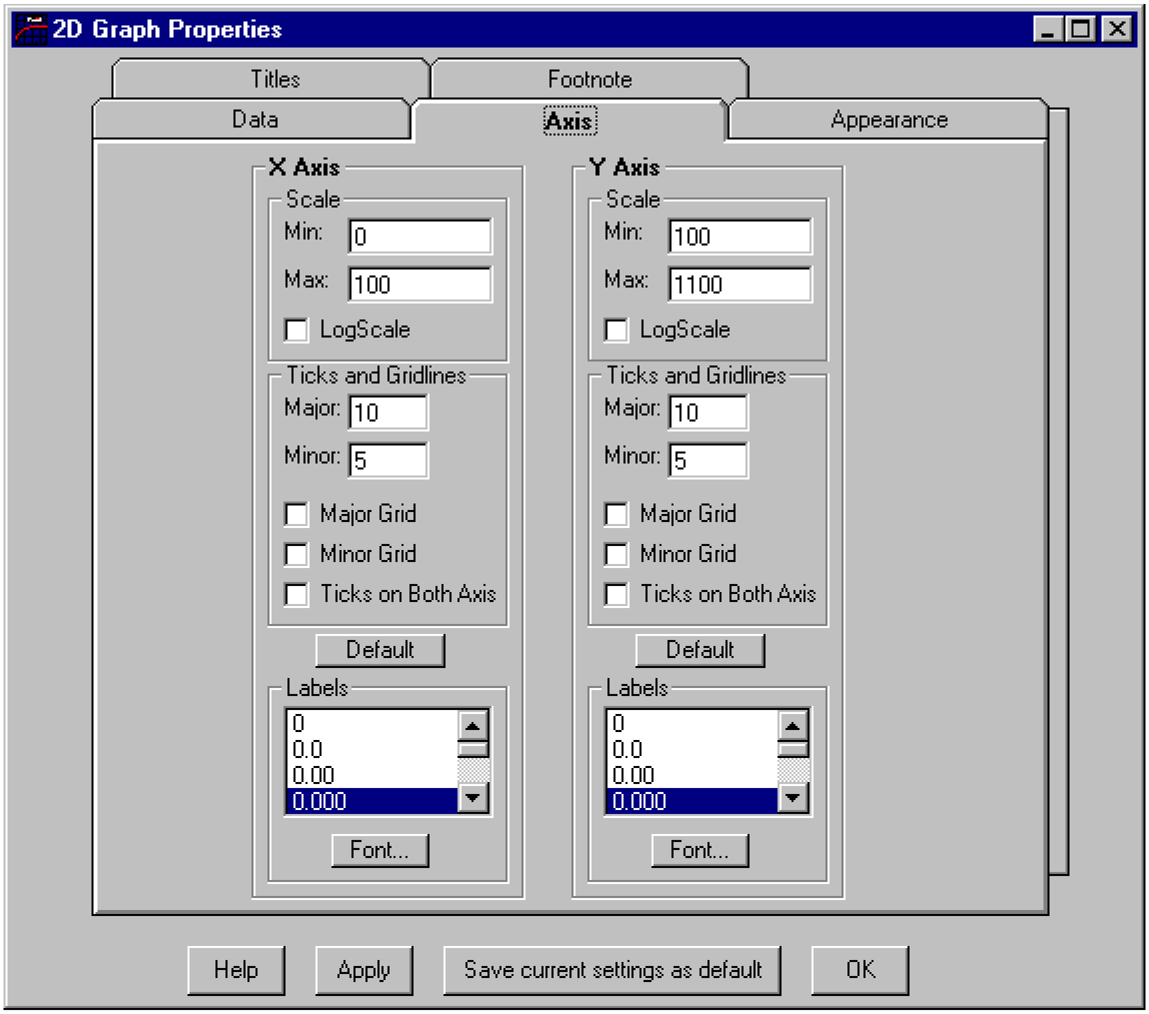
Standard Deviation: If standard deviation information is available, checking this box will display error bars on the plot. Discreet input data error is obtained from the standard deviation information entered into the spreadsheet.

Fit Deviation: Checking this box will display error bars from the discreet input to the surface of the 3D mesh showing the deviation between the entered value and the evaluated function.

See Also:

2D Title Formatting
2D Axis Formatting
2D Footnote Formatting
2D Appearance
Saving 2D Default Settings

2D Axis Formatting



Scale Section:

Min: Minimum X or Y plot extreme. The equation data is plotted only in the valid data range if this value lies outside of the valid data range.

Max: Maximum X or Y plot extreme. The equation data is plotted only in the valid data range if this value lies outside of the valid data range.

LogScale: Plots X and/or Y data on Log Scale if this box is checked.

Ticks and Gridlines Section:

Major: This is the number of major divisions (divisions with numeric values next to them) on either the X or Y Axis. The value must be in the range of (1-20).

Minor: This is the number of tick marks appearing between each major division. The value can be in the range (0-20).

Major Grid: Displays major gridlines on the X2-X2 plane if this box is checked.

Minor Grid: Displays minor gridlines on the X2-X2 plane if this box is checked.
Ticks in Both Axis: Displays tick marks on right and top of plot region opposite the X and Y major axis.

Default: Automatically fills the Maximum Value and Minimum Value entries to fit the data extremes. This applies only to visible lines.

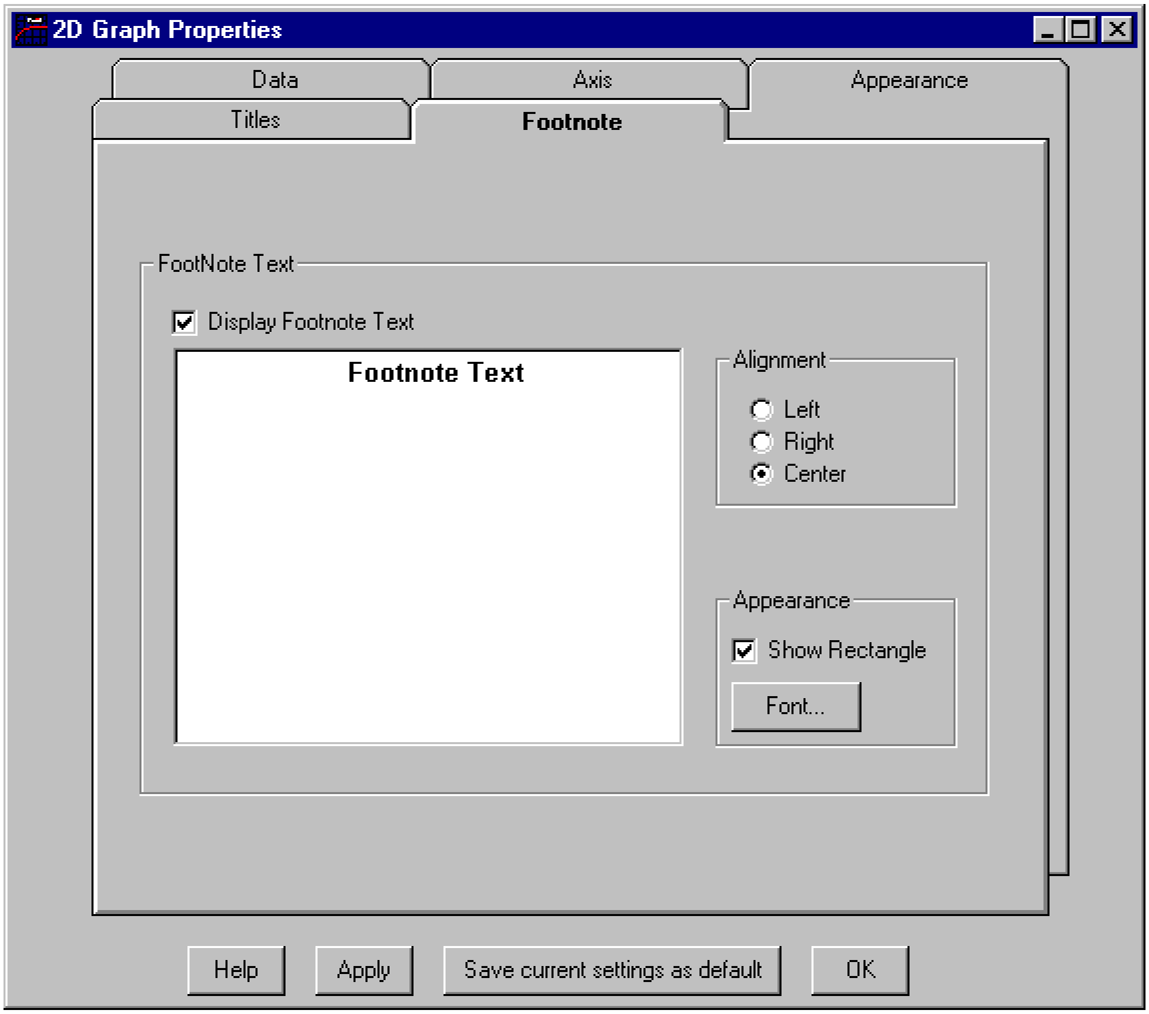
Labels Section: You can modify the precision of the numerical labels on the plot by selecting the label you want in the list.

Note: In order for text to appear rotated, ***True Type*** *fonts must be used.*

See Also:

2D Title Formatting
2D Data Formatting
2D Footnote Formatting
2D Appearance
Saving 2D Default Settings

2D Footnote Formatting



Footnote Text section:

Display Footnote: If this item is checked, the footnote will be displayed on the plot. The position of the footnote can be changed by clicking and dragging the footnote to a new location on the plot while in the plot window.

FootNote Text: This is the actual footnote text to be displayed on the plot. To enter footnote text, simply type the text in the text box provided.

Alignment Section: The width of the footnote text bounding box is calculated from the width of the longest line entered for the footnote. Choosing **Left**, **Center** or **Right** alignment will align the text in the text bounding box according to the calculated dimensions of the bounding box.

Appearance Section:

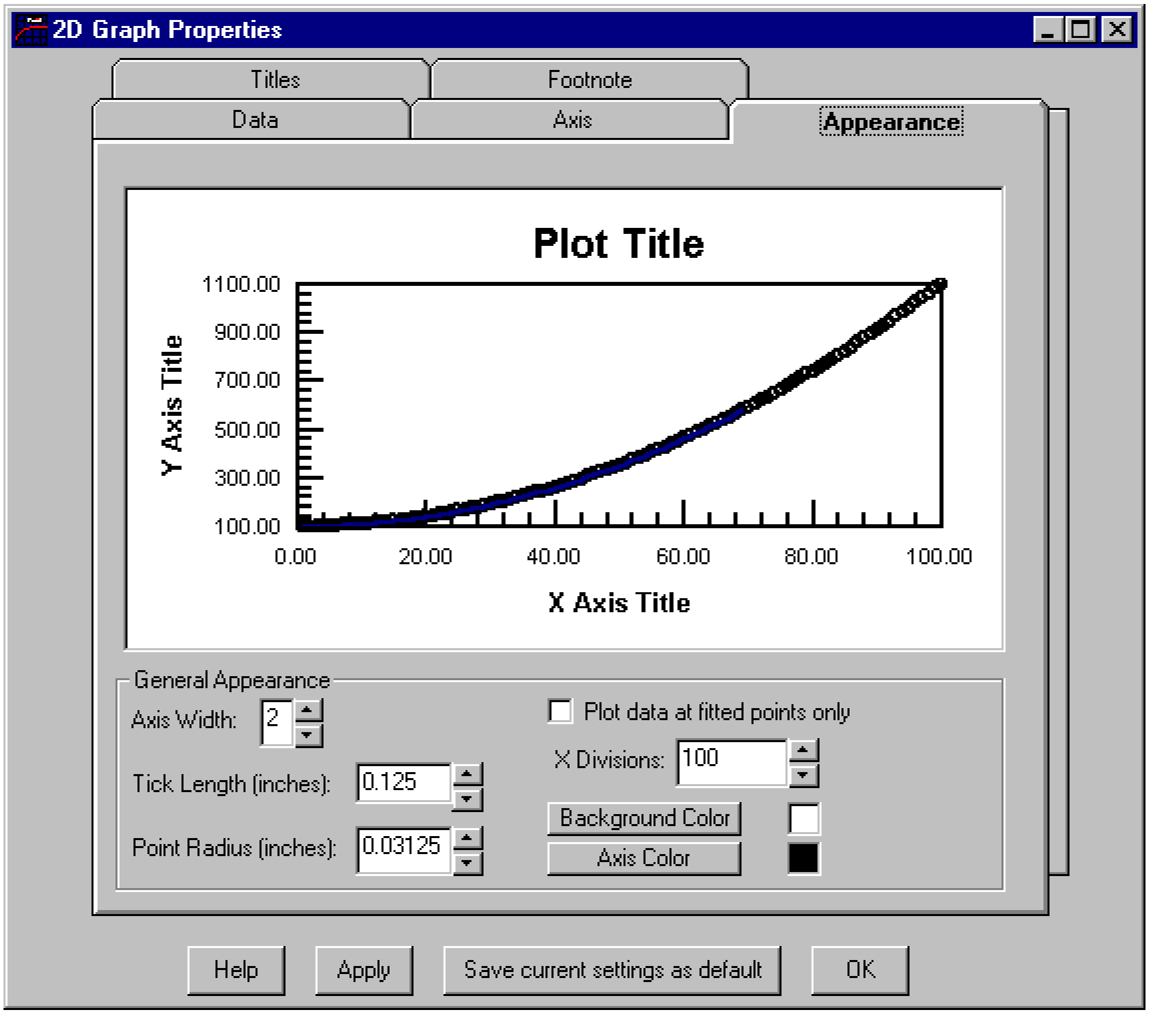
Show Rectangle: If this item is checked, the footnote text bounding box will be displayed.

Font: Allows the user to edit the Footnote font by changing the typeface, size, and other font attributes. Clicking on this button will bring up the Windows font dialog.

See Also:

2D Title Formatting
2D Data Formatting
2D Axis Formatting
2D Appearance
Saving 2D Default Settings

2D Appearance



This gives the user the ability to preview the plot for approval before exiting the Properties Window.

See Also:

2D Title Formatting
2D Data Formatting
2D Axis Formatting
2D Footnote Formatting
Saving 2D Default Settings

Saving 2D Default Plot Settings

By clicking **Save Current Settings As Default** in the plot properties dialog**,** data independent settings used for formatting a plot can be saved as default settings. These settings are:

1. Number Formats (Axis tab)
2. Log Scale or Normal Scale (Axis tab)
3. X and Y Axis Title Fonts (Axis tab)
4. X and Y Axis Label Fonts (Axis tab)
5. Ticks on Both Axis (Axis tab)
6. Plot Title Font (Titles tab)
7. Plot Legend Font (Data tab)
8. Background Color (Appearance tab)
9. Axis Color (Appearance tab)
10. Axis Width (Appearance tab)
11. Tick Length (Appearance tab)
12. Plot Data at Fitted Points Only (Appearance tab)
13. X Divisions (Appearance tab)
14. Discreet Point Radius (Appearance tab)
15. Footnote Font (Footnote Tab)

See Also:

2D Title Formatting
2D Data Formatting
2D Axis Formatting
2D Appearance
2D Footnote Formatting

Format Fit All (Plot Menu)

Resets the minimum and maximum values to display all data in the plot.

Note: This action will override and reset user entries in the Properties Window.

If the active window is a regression window, this menu choice will be unavailable.

See Also:

Formatting Plots
Zooming
Menu Commands

Format|Zoom In (Plot Menu)

Allows graphical zoom into particular region of the plot. Applies to 2D plots only.

To perform a Zoom operation:

1. Choose **Plot|Format|Zoom In.** The cursor will change to an 'up' arrow.
2. Select the first corner of the zoom box by clicking and releasing the left mouse button. The zoom box will size according to the mouse position as you move the mouse.
3. Select the second corner of the box by again clicking and releasing the left mouse button. The Plot will be re-scaled to the zoom box coordinates.
4. You can abort the zoom operation at any time by clicking the right mouse button.

Note: This action will override and reset user entries in the Properties Window.

If the active window is a regression window, this menu choice will be unavailable.

See Also:

Formatting Plots
Fit All
Menu Commands

Show Coordinates (Plot Menu)

Obtains numerical values graphically from the plot.   Applies to 2D plots only.

To perform this operation:

1. Select **Plot|Show Coordinates** from the menu. The cursor will change to a cross-hair, and an XY coordinate box will appear in the top right corner of the plot window.
2. Move the mouse to the desired location and click the left mouse button.
3. If the point selected is an arbitrary point in the background of the plot, an 'x' will be placed at the point where the mouse was clicked, and the X and Y coordinates will be displayed in the coordinate box.   If another point is picked, the 'x' will relocate to the new position, and the coordinates of the new position will be updated.   If the point selected is within a few pixels from a vertex point of a plotted line, the mouse will 'snap' to the vertex, and a box will appear around the selected point.   Once the box appears, you can trace the line by using the left and right arrows on the keyboard.   The left arrow will move the box left to the next vertex on the line, and the right arrow will move the box right to the next vertex on the line.   If there is more than one line being displayed and you have trouble snapping to the desired line, both vertex points may lie within the snap tolerance. If this happens, you can hide the unwanted line in the 'Data' tab of the Properties window.
4. To abort the show coordinate process at any time, click the right mouse button.

If the active window is a regression window, this menu choice will be unavailable.

See Also:

Formatting Plots
Menu Commands

Calculator (Plot Menu)

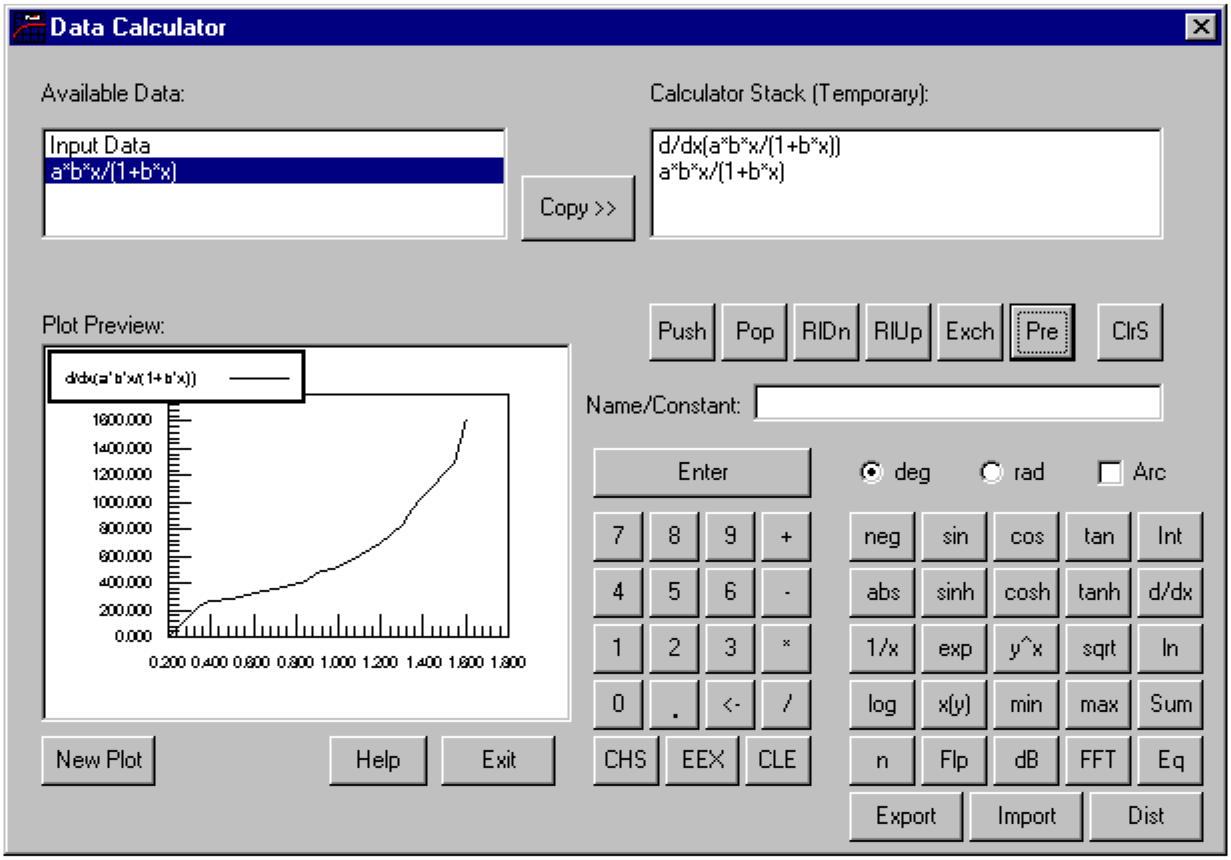
Shows the 2D Plot Calculator. Applies to 2D or single independent variable plots only.

The plot calculator allows you to manipulate data in the form of lines or curves, or scalar values. The Calculator can be used to modify data from an existing plot, or be used to create data for a new plot. The calculator is stack based, functioning like that of a Hewlett-Packard RPN calculator.

The general procedure for manipulating data in the calculator is as follows:

1. If the calculator is brought up from a regression window, there will be no data in the **Available Data** list. If the calculator is brought up from a plot window, all of the data from the plot will be visible in the **Available Data** list. To get data into the calculator without performing regression, you can import data directly into the calculator with the **Import** button, or first create a plot and bring up the calculator from the newly created plot window.
2. The **Available Data** list shows data copied from the plot window from which the calculator was launched. To manipulate data, you must first copy it to the calculator stack. To do this, select the data of interest in the **Available Data** list and click the **Copy** button. You can select any number of data items at any time from the list. When items are selected in the list, they will appear highlighted. To multi-select data listed consecutively, click and drag the mouse through the list. To select data that are not consecutively listed, hold down the Control key on the keyboard while clicking the mouse on individual data.
3. Scalar numbers are represented on the stack by their actual value, and curves are represented by their legend text.
4. Numeric constants or legend text can be typed into the **Name/Constant** textbox, or entered with the numeric keypad. Pressing the **Enter** button pushes the data or text in the text box to the top of the stack.
5. When a mathematical operator is pressed, data is 'popped' from the top of the stack, manipulated, then 'pushed' back on to the top of the stack.
6. Preview manipulations by clicking selecting data in the **Calculator Stack** and pressing the **Pre** (preview) button.
7. Create new plots from manipulations by clicking selecting data in the **Calculator Stack** and pressing the **New Plot** button.

Click on the graphics below to get the definition for the functionality of each button.



See Also:

Menu Commands

Available Data: If the calculator is launched from a plot window, the legend text for all of the data in the plot will show up in this list. The signals, or lines, can be copied to the temporary **Calculator Stack** by selecting them and clicking on the **Copy** button. It is necessary to copy the data to the calculator stack before it can be modified. If the Calculator is launched from a regression window, the available data list will be empty.

Copy: Clicking this button copies any selected items in the **Available Data** list and places them on the temporary **Calculator Stack**. If there is at least one item in the list with no selections and **Copy** is pressed, only the top-most line will be copied. It is necessary to copy the data to the calculator stack before it can be modified.

Calculator Stack: This is a list of data present on the Calculator Stack.. Data can be copied here from the **Available Data** list, or created in the calculator itself. Results of arithmetic manipulation in the calculator are automatically pushed back on to the stack when the operations are completed. The order of this list represents the order that the data occupies the stack. For example, unary operators (such as cos() or sin()) would operate on the top most element. Binary operators (such as + or -) would utilize the top two items in the stack. Scalar numbers are represented on the stack by their actual value, and curves are represented by their legend text.

Push: Stack Operator which pushes the element on the top of the stack back onto the stack, basically making a duplicate of itself. All other items are moved down one position.

Pop: Stack Operator which pops the element on the top of the stack off of the stack. Data popped from the stack is permanently removed from the stack. All other items are moved up one position.

RlDn (Roll Down): Stack Operator which rolls the stack down. For example, the top of the stack becomes the second element, the second element becomes the third, etc. The bottom of the stack would then become the top element. The combination of **RlDn**, **RlUp** and **Exch** can be used to position data as needed to operate on it.

RlUp (Roll Up): Stack Operator which rolls the stack up. For example, the second element on the stack becomes the top element, the third element becomes the second, etc. The top of the stack would then become the bottom element. The combination of **RlDn**, **RlUp** and **Exch** can be used to position data as needed to operate on it.

Exch (Exchange): Stack Operator which exchanges the top two elements on the stack. For example, the top element would become the second, and the second element would become the top of the stack. The combination of **RlDn**, **RlUp** and **Exch** can be used to position data as needed to operate on it.

Pre (Preview): Stack operator which refreshes the **Plot Preview** area with currently select data on the stack. If nothing is selected, the top element only of the stack is plotted in the Plot Preview area.

ClrS (Clear Stack): Stack Operator which clears the temporary calculator stack of all items.

Name/Constant: Either numerical values or text can be entered here. If a numerical value (Constant) is entered by either the keyboard or by using the digits keys on the calculator and the **Enter** is pressed, the scalar number will be pushed on the stack. If a string (Name) is typed and **Enter** is pressed, one of two things will happen. If the top of the stack contains data with a legend, then the legend will be replaced with the entered text. If the top of the stack contains a scalar, the text will be ignored.

Enter: Places numbers or text in the Name/Constant box onto the stack.

Digits 0-9 and decimal point: Pressing these keys will place the digits 0-9 in the Name/Constant box. Numbers can also be entered from the keyboard while the Name/Constant box has focus.

Delete: Deletes the rightmost digit or character in the Name/Constant box.

Chs (Change Sign): Changes the sign of the number or it's exponent in the Name/Constant box.

EEX (exponent): adds an exponent in the Name/Constant box to be used for powers of 10. This entry may also be type while the Name/Constant box has focus.

CLE (Clear): Clears all text or numerical data from the Name/Constant box.

+ (addition operator): Adds the top two entries on the stack, placing the result back on the stack. Corresponding to infix notation, this would mean: {Value1 = Pop(stack), Value2 = Pop(stack), Stack(top) = Value2 Operator Value1}

- (subtraction operator): Subtracts the top two entries on the stack, placing the result back on the stack. Corresponding to infix notation, this would mean: {Value1 = Pop(stack), Value2 = Pop(stack), Stack(top) = Value2 Operator Value1}

*** (multiplication operator):** Multiplies the top two entries on the stack, placing the result back on the stack. Corresponding to infix notation, this would mean: {Value1 = Pop(stack), Value2 = Pop(stack), Stack(top) = Value2 Operator Value1}

/ (division operator): Divides the top two entries on the stack, placing the result back on the stack. Corresponding to infix notation, this would mean: {Value1 = Pop(stack), Value2 = Pop(stack), Stack(top) = Value2 Operator Value1}

deg (degrees): For use with trigonometric functions. When selected, argument will be treated as degrees.

rad (radians): For use with trigonometric functions. When selected, argument will be treated as radians.

arc (inverse): For use with trigonometric functions. When selected, will perform the inverse of the function.

neg (negate): Negates the item on top of the stack. Can operate on scalars or lines

sin (sine): Takes the Sine of the item on top of the stack. Can operate on scalars or lines

cos (cosine): Takes the Sine of the item on top of the stack. Can operate on scalars or lines

tan (tangent): Takes the Tangent of the item on top of the stack. Can operate on scalars or lines

Int (integrate): Integrates the line on top of the stack. Operates on lines only

abs (absolute value): Takes the absolute value of the item on top of the stack. Can operate on scalars or lines

sinh (hyperbolic sine): Takes the Hyperbolic Sine of the item on top of the stack. Can operate on scalars or lines

cosh (hyperbolic cosine): Takes the Hyperbolic Cosine of the item on top of the stack. Can operate on scalars or lines

tanh (hyperbolic tangent): Takes the Hyperbolic Tangent of the item on top of the stack. Can operate on scalars or lines

d/dx (derivative): Takes the derivative of the line of the top of the stack. Operates on lines only

1/x (invert): Takes the inverse of the item on top of the stack. Can operate on scalors or lines

exp (exponential): Takes the exponential of the item on top of the stack. Can operate on scalors or lines

y^x (y to the power of x): Raises the item in the stack to the X power, placing the result back on the stack. Corresponding to infix notation, this would mean: {Value1 = Pop(stack), Value2 = Pop(stack), Stack(top) = Value2 ^ Value1} Operates with scalors or lines, top of the stack must be a scalar

sqrt (square root): Takes the square root of the item on top of the stack. Can operate on scalors or lines

ln (natural logarithm): Takes the natural logarithm of the item on top of the stack. Can operate on scalors or lines

log (base 10 logarithm): Takes the base 10 logarithm of the item on top of the stack. Can operate on scalors or lines

x(y): Makes the line on top of the stack a function of the line second in the stack. Operates on lines only.

min (minimum value): Finds the minimum X and Y values of the line on top of the stack. Operates on lines only, pushes Min Y first then Min X (Min X will be on top of stack).

max (maximum value): Finds the maximum X and Y values of the line on top of the stack. Operates on lines only, pushes Max Y first then Max X (Max X will be on top of stack).

sum (sum): Performs a statistical summation of the line on top of the stack. Operates on lines only

n (number of points): Returns the number of data points of the line on top of the stack. Operates on lines only

Flp (flip): Flips the X and Y data points. Operates on lines only

dB (dB): Takes 20*log(f(x)) of the item on top of the stack. Can operates on scalors or lines.

FFT (Fast Fourier Transform): Performs FFT analysis on the line on top of the stack. Returns magnitude and phase components on the stack. Operates on lines only.

Eq (equation): Brings up the equation editor. Evaluated equation is placed on top of the stack.

Export: Exports the data on top of the stack into a tab delimited file. Operates on lines only.

Import: Imports a delimited ASCII text file containing (X,Y) data pairs.

Dist (Distribution): Creates a Normal, or Gaussian distribution centered around the entered standard deviation and mean.

Plot Preview: Preview of plot generated by selecting item(s) on the stack and clicking the **Pre** stack operator button.

New Plot: Opens a new plot window generated by selecting item(s) on the stack. If nothing is selected, the top element only of the stack is plotted in the new window.

Exit: Exits the calculator. Any data in the temporary stack is removed.

Copy to Clipboard (Plot Menu)

Copies the current plot window to the Windows clipboard.

Copying as an Enhanced Metafile:
You can copy an enhanced metafile to the Windows Clipboard for pasting into another application, such as Microsoft Word or Microsoft PowerPoint. Make a plot window the active window, then select **Copy as Enhanced Metafile** from the **Plot** menu. This generates a device independent vector based picture which will retain its quality when resized. The image can be pasted into another application.

Copying as a Bitmap:
You can copy a bitmap of the image to the Windows Clipboard for pasting into another application if the application does not support enhanced metafiles. Make a plot window the active window, then select **Copy as Bitmap** from the **Plot** Menu. Mostly all presentation software support bitmaps.

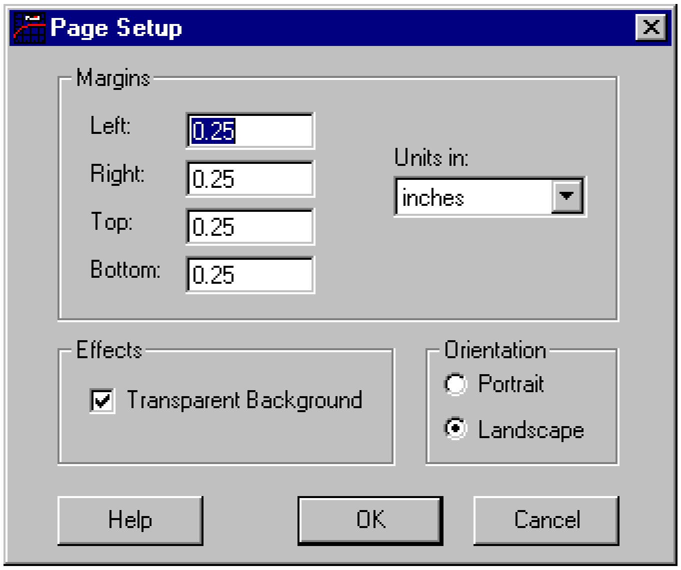
If the active window is a regression window, this menu choice will be unavailable.

See Also:

Saving Enhanced Metafiles to Disk
Printing
Menu Commands

Page Setup (Plot Menu)

Sets up default settings for printing plots.



Margins: When printing, DataFit will maximize the plot to fit the page with the margins you have specified. The smallest margin that can be specified is printer dependent. Consult your printer manual for specifications on printable regions.

Units: Specify the default units of measurement for the margin settings. You may select from inches (inches), mm (millimeters) or cm (centimeters).

Transparent Background: If selected, the background colors will be ignored when printing. This option is most useful with black and white printers printing in greyscale mode.

Orientation: Selects portrait or landscape mode for printing..

These settings are automatically saved unless **Cancel** is pressed.

If the active window is a regression window, this menu choice will be unavailable.

See Also:

Print (Plot Menu)
Menu Commands

Print (Plot Menu)

Prints hard copies of plots in the active window.

Note: Although the software should work with any Microsoft Windows supported printer, there may be problems with certain printers or printer drivers. If you have any problems printing to any particular printer, please contact the printer manufacturer and obtain the latest version of the printer driver. If this does not solve the problem, please contact us and give us information about the printer (Brand, Printer driver version number) as well as the behavior observed.

If the active window is a regression window, this menu choice will be unavailable.

See Also:

Page Setup (Plot Menu)
Printing the Results
Menu Commands

Entering Data

DataFit gives you the flexibility to enter the data for regression analysis or plotting a number of different ways.

	X1	X2	Y
1	-10	-10	28.4444444
2	-10	-7	36.6044444
3	-10	-4	41.8844444
4	-10	-1	44.2844444
5	-10	2	43.8044444
6	-10	5	40.4444444
7	-10	8	34.2044444
8	-7	-10	5.77777778
9	-7	-7	13.9377778
10	-7	-4	19.2177778
11	-7	-1	21.6177778
12	-7	2	21.1377778
13	-7	5	17.7777778
14	-7	8	11.5377778
[illegible]	[illegible]	[illegible]	[illegible]

Data can either be imported into the spreadsheet, pasted into the spreadsheet from another application, or typed in by the user. The spreadsheet behaves the same as commercial spreadsheet packages, such as Microsoft Excel.

If the data is to be entered manually, it can be entered by typing the numbers directly into the cell boxes. Pressing the carriage return after modifying a cell will move the active cell to the next row. Pressing the tab key will move the current cell to the next column. You may also use the arrow keys (left, right, up and down) to navigate about the spreadsheet, or click on a specific cell to make it the active cell.

Description of the spreadsheet column headers:

Single independent variable:

The column labeled **X** contains the data for the independent variable. The column labeled **Y** contains the data for the dependent variable. The column labeled **StDev** contains the individual standard deviations of the dependent variable. If the standard deviations are not known, this column should be excluded. If the standard deviation is known for the data points, it should be entered into the spreadsheet.

Multiple independent variable:

The column labeled **Xn** contains the data for the independent variables. The column labeled **Y** contains the data for the dependent variable. The column labeled **StDev** contains the individual standard deviations of the dependent variable. If the standard deviations are not known, this column should be excluded.   If the standard deviation is known for the data points, it should be entered into the spreadsheet.

See Also:

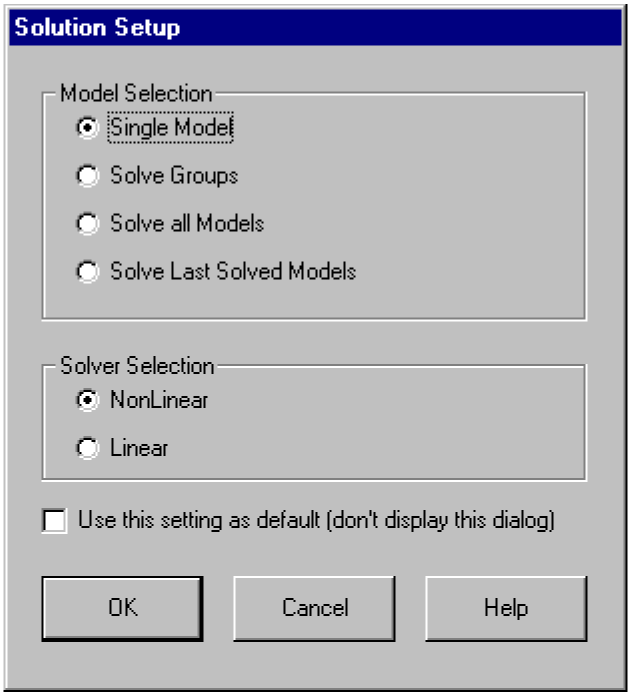
Overview of the DataFit Workplace
Copying and Pasting Data
Importing Data
Regression Theory
Viewing the Results
Interpreting the Results

Selecting Cells in the Spreadsheet

To select	Do this
A single cell	Click the cell, or press the arrow keys to move to the cell.
A range of cells	Click the first cell of the range, and then drag to the last.
Nonadjacent cells or cell ranges	Select the first cell or range of cells, and then hold down CTRL and select the other cells or ranges.
A large range of cells	Click the first cell in the range, and then hold down SHIFT and click the last cell in the range. You can scroll to make the last cell visible.
An entire row	Click the row heading.
An entire column	Click the column heading.
Adjacent rows or columns	Drag across the row or column headings. Or select the first row or column; then hold down SHIFT and select the last row or column.
Nonadjacent rows or columns	Select the first row or column, and then hold down CTRL and select the other rows or columns.
All cells of a worksheet	Click the button at the upper-left corner of the worksheet where the row and column headings intersect.
More or fewer cells	Hold down SHIFT and click the last cell you want to include in the new selection. The rectangular range between the active cell and the cell you click becomes the new selection.

Solution Setup

DataFit gives you the capability to solve model(s) a number of different ways. As models are added to the solution, either all from one solution run or from multiple runs, the models are sorted according to their goodness of fit.



Single Model: This option will next show the Single Model Regression Setup window. There, you will be able to select from the list of inherent and user defined models. You can also specify initial estimates and/or variable constants for the models.

Solve Groups: This option will next show the **Solve Groups** window. There, you will be able to select from inherent model groups or define your own solve group.

Solve All Models: This option will solve all of the models in the database.

Solve Last Solved Models: When data is modified, the solution is removed so that it is not possible to have a solution that doesn't match your data. DataFit remembers which models were previously solved, so you may just re-solve them.

Solver Selection: You are able to choose between Linear or Non-Linear solution methods for built in models (user defined models MUST use the nonlinear solver). For more information, see the help topic Regression Theory.

Use This Setting as Default: This option will save what you have specified in this window in the registry as a default solution setup. If you regularly perform the same simulations repeatedly, you may check this box to avoid seeing this window. For more information see the help topic Prompt for Solution Setup.

See Also:

Regression Theory (Nonlinear and Linear Models)
Built In Regression Models
User Defined Regression Models
Specifying Initial Estimates for Nonlinear Models

Built in 2D Regression Models

Model	Group	Description
a*x+b	Polynomial	First Order Polynomial
a*x^2+b*x+c	Polynomial	Second Order Polynomial
a*x^3+b*x^2+c*x+d	Polynomial	Third Order Polynomial
a*x^4+b*x^3+...+e	Polynomial	Fourth Order Polynomial
a*x^5+b*x^4+...+f	Polynomial	Fifth Order Polynomial
log(x-a)	Single Parameter Convex/Concave	
1/(1+a*x)	Single Parameter Convex/Concave	
exp(x-a)	Single Parameter Convex/Concave	
x^a	Single Parameter Convex/Concave	
a^(1/x)	Single Parameter Convex/Concave	Root Model
1/(x+a)	Single Parameter Convex/Concave	
1-1/(x^a)	Single Parameter Convex/Concave	
log(a+b*x)	Two Parameter Convex/Concave	
a*x^b	Two Parameter Convex/Concave	Power (Freundlich)
a*b^x	Two Parameter Convex/Concave	Modified Power
a*exp(b*x)	Two Parameter Convex/Concave	Exponential
a*exp(b/x)	Two Parameter Convex/Concave	Modified Exponential
exp(a+b*x)	Two Parameter Convex/Concave	
a*b*x/(1+b*x)	Two Parameter Convex/Concave	Rectangular Hyperbola
x/(a*x+b)	Two Parameter Convex/Concave	
1/(a+b*x)	Two Parameter Convex/Concave	Reciprocal Model
a/(1+b*x)	Two Parameter Convex/Concave	
a*(x-b)	Two Parameter Convex/Concave	
a*(1+x)^b	Two Parameter Convex/Concave	
a+b*log(x)	Two Parameter Convex/Concave	Logarithm Model
1/(a+b*log(x))	Two Parameter Convex/Concave	Reciprocal Logarithm Model
a*x^(b*x)	Two Parameter Convex/Concave	Geometric Model
a*x^(b/x)	Two Parameter Convex/Concave	Modified Geometric Model
a*x/(b+x)	Two Parameter Convex/Concave	Saturation Growth Model
a+b/x	Two Parameter Convex/Concave	Hyperbolic Model
a*b^x*x^c	Three Parameter Convex/Concave	Hoerl Model
a*b^(1/x)*x^c	Three Parameter Convex/Concave	Modified Hoerl Model
1/(a+b*x+c*x^2)	Three Parameter Convex/Concave	Reciprocal Quadratic (Holliday)
exp(a+b/x+c*log(x))	Three Parameter Convex/Concave	Vapor Pressure Model
a+b*x+c/x^2	Three Parameter Convex/Concave	Heat Capacity Model
a/(1+b*x+c*x^2)	Three Parameter Convex/Concave	
cos(x+a)	Single Parameter with Max and Min	Trigonometric
sin(x+a)	Single Parameter with Max and Min	Trigonometric II
1-exp(-a*x^2)	Single Parameter with Max and Min	
exp(-a*x^2)	Single Parameter with Max and Min	
a*cos(x)+b*sin(x)	Two Parameter with Max and Min	
x/(a+b*x+c*x^2)	Three Parameter with Max and Min	
a+b*cos(x)+c*sin(x)	Three Parameter with Max and Min	
exp(a+b*x+c*x^2)	Three Parameter with Max and Min	

x/(a+b*x+c*sqr(x))	Three Parameter with Max and Min	Gunary Model
a*x^b*exp(-c*x)	Three Parameter with Max and Min	
x^a*exp(b-c*x)	Three Parameter with Max and Min	
a*x^b*(1-x)^c	Three Parameter with Max and Min	Beta Distribution Model
a*exp((-(x-b)^2)/(2*c^2))	Three Parameter with Max and Min	Gaussian Distribution Model
1-exp(-x^a)	Single Parameter Sigmoidally Shaped	
exp(-x^a)	Single Parameter Sigmoidally Shaped	
1-exp(-a*x^b)	Two Parameter Sigmoidally Shaped	
1-exp(-a*b^x)	Two Parameter Sigmoidally Shaped	
exp(-exp(a-b*x))	Two Parameter Sigmoidally Shaped	

See Also:

User Defined Regression Models
Built in 3D Regression Models
Built in N Dimensional Regression Models

Built In 3D Regression Models

Model	Group
a+b*x1+c*x2	Three Parameter Polynomial
a+b*x1+c*log(x2)	Three Parameter Polynomial
a+b*x1+c/x2	Three Parameter Polynomial
a+b*log(x1)+c*x2	Three Parameter Polynomial
a+b*log(x1)+c*log(x2)	Three Parameter Polynomial
a+b*log(x1)+c/x2	Three Parameter Polynomial
a+b/x1+c*x2	Three Parameter Polynomial
a+b/x1+c*log(x2)	Three Parameter Polynomial
a+b/x1+c/x2	Three Parameter Polynomial
a+b*x1+c*x2+d*x2^2	Four Parameter Polynomial
a+b*x1+c*log(x2)+d*log(x2)^2	Four Parameter Polynomial
a+b*x1+c/x2+d/x2^2	Four Parameter Polynomial
a+b*x1+c*x1^2+d*x2	Four Parameter Polynomial
a+b*x1+c*x1^2+d*log(x2)	Four Parameter Polynomial
a+b*x1+c*x1^2+d/x2	Four Parameter Polynomial
a+b*log(x1)+c*x2+d*x2^2	Four Parameter Polynomial
a+b*log(x1)+c/x2+d/x2^2	Four Parameter Polynomial
a+b*log(x1)+c*log(x2)+d*log(x2)^2	Four Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*x2	Four Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x2)	Four Parameter Polynomial
a+b/x1+c*x2+d*x2^2	Four Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d/x2	Four Parameter Polynomial
a+b/x1+c*log(x2)+d*log(x2)^2	Four Parameter Polynomial
a+b/x1+c/x2+d/x2^2	Four Parameter Polynomial
a+b/x1+c/x1^2+d*x2	Four Parameter Polynomial
a+b/x1+c/x1^2+d*log(x2)	Four Parameter Polynomial
a+b/x1+c/x1^2+d/x2	Four Parameter Polynomial
a+b*x1+c*x2+d*x2^2+e*x2^3	Five Parameter Polynomial
a+b*x1+c*log(x2)+d*log(x2)^2+e*log(x2)^3	Five Parameter Polynomial
a+b*x1+c/x2+d/x2^2+e/x2^3	Five Parameter Polynomial
a+b*x1+c*x1^2+d*x2+e*x2^2	Five Parameter Polynomial
a+b*x1+c*x1^2+d*log(x2)+e*log(x2)^2	Five Parameter Polynomial
a+b*x1+c*x1^2+d/x2+e/x2^2	Five Parameter Polynomial
a+b*x1+c*x1^2+d*x1^3+e*x2	Five Parameter Polynomial
a+b*x1+c*x1^2+d*x1^3+e*log(x2)	Five Parameter Polynomial
a+b*x1+c*x1^2+d*x1^3+e/x2	Five Parameter Polynomial
a+b*log(x1)+c*x2+d*x2^2+e*x2^3	Five Parameter Polynomial
a+b*log(x1)+c*log(x2)+d*log(x2)^2+e*log(x2)^3	Five Parameter Polynomial
a+b*log(x1)+c/x2+d/x2^2+e/x2^3	Five Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*x2+e*x2^2	Five Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x2)+e*log(x2)^2	Five Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d/x2+e/x2^2	Five Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x1)^3+e*x2	Five Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x1)^3+e*log(x2)	Five Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x1)^3+e/x2	Five Parameter Polynomial
a+b/x1+c*x2+d*x2^2+e*x2^3	Five Parameter Polynomial
a+b/x1+c*log(x2)+d*log(x2)^2+e*log(x2)^3	Five Parameter Polynomial
a+b/x1+c/x2+d/x2^2+e/x2^3	Five Parameter Polynomial
a+b/x1+c/x1^2+d*x2+e*x2^2	Five Parameter Polynomial

a+b/x1+c/x1^2+d*log(x2)+e*log(x2)^2	Five Parameter Polynomial
a+b/x1+c/x1^2+d/x2+e/x2^2	Five Parameter Polynomial
a+b/x1+c/x1^2+d/x1^3+e*x2	Five Parameter Polynomial
a+b/x1+c/x1^2+d/x1^3+e*log(x2)	Five Parameter Polynomial
a+b/x1+c/x1^2+d/x1^3+e/x2	Five Parameter Polynomial
a+b*x1+c*x1^2+d*x2+e*x2^2+f*x2^3	Six Parameter Polynomial
a+b*x1+c*x1^2+d*log(x2)+e*log(x2)^2+f*log(x2)^3	Six Parameter Polynomial
a+b*x1+c*x1^2+d/x2+e/x2^2+f/x2^3	Six Parameter Polynomial
a+b*x1+c*x1^2+d*x1^3+e*x2+f*x2^2	Six Parameter Polynomial
a+b*x1+c*x1^2+d*x1^3+e*log(x2)+f*log(x2^2)	Six Parameter Polynomial
a+b*x1+c*x1^2+d*x1^3+e/x2+f/x2^2	Six Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*x2+e*x2^2+f*x2^3	Six Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x2)+e*log(x2)^2+f*log(x2)^3	Six Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d/x2+e/x2^2+f/x2^3	Six Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x1)^3+e*x2+f*x2^2	Six Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x1)^3+e*log(x2)+f*log(x2)^2	Six Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x1)^3+e/x2+f/x2^2	Six Parameter Polynomial
a+b/x1+c/x1^2+d*x2+e*x2^2+f*x2^3	Six Parameter Polynomial
a+b/x1+c/x1^2+d*log(x2)+e*log(x2)^2+f*log(x2)^3	Six Parameter Polynomial
a+b/x1+c/x1^2+d/x2+e/x2^2+f/x2^3	Six Parameter Polynomial
a+b/x1+c/x1^2+d/x1^3+e*x2+f*x2^2	Six Parameter Polynomial
a+b/x1+c/x1^2+d/x1^3+e*log(x2)+f*log(x2)^2	Six Parameter Polynomial
a+b/x1+c/x1^2+d/x1^3+e/x2+f/x2^2	Six Parameter Polynomial
a+b*x1+c*x1^2+d*x1^3+e*x2+f*x2^2+g*x2^3	Seven Parameter Polynomial
a+b*x1+c*x1^2+d*x1^3+e*log(x2)+f*log(x2^2)+g*log(x2)^3	Seven Parameter Polynomial
a+b*x1+c*x1^2+d*x1^3+e/x2+f/x2^2+g/x2^3	Seven Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x1)^3+e*x2+f*x2^2+g*x2^3	Seven Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x1)^3+e*log(x2)+f*log(x2)^2+g*log(x2)^3	Seven Parameter Polynomial
a+b*log(x1)+c*log(x1)^2+d*log(x1)^3+e/x2+f/x2^2+g/x2^3	Seven Parameter Polynomial
a+b/x1+c/x1^2+d/x1^3+e*x2+f*x2^2+g*x2^3	Seven Parameter Polynomial
a+b/x1+c/x1^2+d/x1^3+e*log(x2)+f*log(x2)^2+g*log(x2)^3	Seven Parameter Polynomial
a+b/x1+c/x1^2+d/x1^3+e/x2+f/x2^2+g/x2^3	Seven Parameter Polynomial
a+b*x1+c*x2+d*x1^2+e*x2^2+f*x1*x2	Six Parameter Taylor Series Polynomial
a+b*log(x1)+c*x2+d*log(x1)^2+e*x2^2+f*log(x1)*x2	Six Parameter Taylor Series Polynomial
a+b/x1+c*x2+d/x1^2+e*x2^2+f*x2/x1	Six Parameter Taylor Series Polynomial
a+b*x1+c*log(x2)+d*x1^2+e*log(x2)^2+f*x1*log(x2)	Six Parameter Taylor Series Polynomial
a+b*log(x1)+c*log(x2)+d*log(x1)^2+e*log(x2)^2+f*log(x1)*log(x2)	Six Parameter Taylor Series Polynomial
a+b/x1+c*log(x2)+d/x1^2+e*log(x2)^2+f*log(x2)/x1	Six Parameter Taylor Series Polynomial
a+b*x1+c/x2+d*x1^2+e/x2^2+f*x1/x2	Six Parameter Taylor Series Polynomial
a+b*log(x1)+c/x2+d*log(x1)^2+e/x2^2+f*log(x1)/x2	Six Parameter Taylor Series Polynomial
a+b/x1+c/x2+d/x1^2+e/x2^2+f/(x1*x2)	Six Parameter Taylor Series Polynomial

See Also:

User Defined Regression Models
Built in 2D Regression Models
Built in N Dimensional Regression Models

Built In N Dimensional Regression Models

Built In Multidimensional models with more than 2 independent variables are simple linear combinations.   You can, however, define your own more complicated models with up to 9 independent variables and 20 coefficients (yee-ha).

Model	Ind Vars.	Group
a*x1+b*x2+c*x3	3	3 Parameter Polynomial
a*x1+b*x2+c*x3+d	3	4 Parameter Polynomial
exp(a*x1+b*x2+c*x3+d)	3	4 Parameter Exp Polynomial
a*x1+b*x2+c*x3+d*x4	4	4 Parameter Polynomial
a*x1+b*x2+c*x3+d*x4+e	4	5 Parameter Polynomial
exp(a*x1+b*x2+c*x3+d*x4+e)	4	5 Parameter Exp Polynomial
a*x1+b*x2+c*x3+d*x4+e*x5	5	5 Parameter Polynomial
a*x1+b*x2+c*x3+d*x4+e*x5+f	5	6 Parameter Polynomial
exp(a*x1+b*x2+c*x3+d*x4+e*x5+f)	5	6 Parameter Exp Polynomial
a*x1+b*x2+c*x3+d*x4+e*x5+f*x6	6	6 Parameter Polynomial
a*x1+b*x2+c*x3+d*x4+e*x5+f*x6+g	6	7 Parameter Polynomial
exp(a*x1+b*x2+c*x3+d*x4+e*x5+f*x6+g)	6	7 Parameter Exp Polynomial
a*x1+b*x2+c*x3+d*x4+e*x5+f*x6+g*x7	7	7 Parameter Polynomial
a*x1+b*x2+c*x3+d*x4+e*x5+f*x6+g*x7+h	7	8 Parameter Polynomial
exp(a*x1+b*x2+c*x3+d*x4+e*x5+f*x6+g*x7+h)	7	8 Parameter Exp Polynomial
a*x1+b*x2+c*x3+d*x4+e*x5+f*x6+g*x7+h*x8	8	8 Parameter Polynomial
a*x1+b*x2+c*x3+d*x4+e*x5+f*x6+g*x7+h*x8+i	8	9 Parameter Polynomial
exp(a*x1+b*x2+c*x3+d*x4+e*x5+f*x6+g*x7+h*x8+I)	8	9 Parameter Exp Polynomial
a*x1+b*x2+c*x3+d*x4+e*x5+f*x6+g*x7+h*x8+i*x9	9	9 Parameter Polynomial
a*x1+b*x2+c*x3+d*x4+e*x5+f*x6+g*x7+h*x8+i*x9+j	9	10 Parameter Polynomial
exp(a*x1+b*x2+c*x3+d*x4+e*x5+f*x6+g*x7+h*x8+i*x9+j)	9	10 Parameter Exp Polynomial

Note: When plotting data or models with more than 2 independent variables, the plot will appear as a 2 dimensional plot.   The X axis of the plot will represent the point number, and the Y axis of the plot will represent the dependent variable.

See Also:

User Defined Regression Models
Built in 2D Regression Models
Built in 3D Regression Models

User Defined Regression Models

DataFit gives the user the option to add their own regression models. There is an unlimited number of user defined models that can be entered and the models are saved for future use. The user also has the option to specify rules for obtaining initial estimates for the models. This makes it possible to not be forced into specify initial estimates each time a user defined regression model is used. The user also has the ability to specify the coefficient derivatives.

User models may be specified 'on the fly' when solving in the Regression Setup window, or can be defined be selecting Define User Model... from the **Solve** menu.

Entering a model is very straightforward. All you need to do is simply type in the equation in terms of the independent variable 'x' and the variables, or parameters, being fitted for. The variables can be anything you want. The dependent variable 'y' cannot be entered into the equation. For example, the following models are valid:

a*log(x)+b*x^2	(Valid)
0.15*Area*(x-Fluid_Temp)	(Valid)

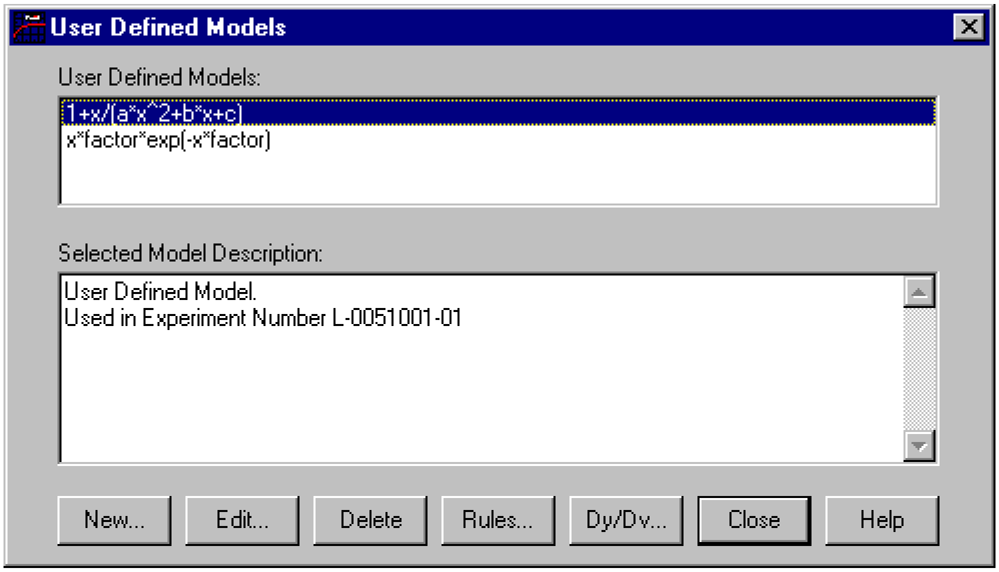
Notice that the 'y = ' does not appear on the left hand side of the equation. The following equation would **NOT** be a valid model:

y=a*log(x)+b*x^2	(Invalid)

The only other requirements are that the independent variable 'x' and at least one variable must appear in the equation. There are also a host of functions supported that the user may choose from. For information on supported variables and functions, see Supported Variables, Operators and Functions.

How to Enter a User Defined Regression Model

Select **Solve** - Define User Model... from the main menu. This will bring up the **User Defined Models** Window.



The User Defined Models list contains all of the models defined, if any, along with their entered descriptions. From this window, you may choose to add a **New** model, **Edit** an existing model, **Delete** a model or define initial estimate Rules for your model.

To Create a new model: Select **New**. In the **Add User Model** dialog, specify the model you want to add, and supply a description (optional) for the model. The description can be anything you want, for example, possibly a specific application type that it may be used for. To accept the model, press **OK**. If the model is valid, it will be entered into the database and automatically saved. **Cancel** aborts the operation.

To Edit an Existing Model: Click on the model in the list you want to edit, then select **Edit.** In the **Edit User Model** dialog, modify the model or description as necessary. To accept the new model, press **OK**. If the model is valid, it will be entered into the database and automatically saved. **Cancel** aborts the operation.

To Delete an Existing Model: Click on the model in the list you want to delete, then select **Delete**. You will be asked for confirmation, then the model will be removed from the database. Since solutions can be saved, there may be times when a user defined model no longer exists in the database. Upon reading the file, you will have the option of restoring the model.

See Also:

Built In Regression Models
Supported Variables, Operates and Functions

Specifying Rules for User Defined Models
Specifying Derivatives for User Defined Models

Supported Variables, Operators and Functions

The DataFit Expression evaluator, used for entering user defined regression models and also in the data calculator for plotting equations, supports the following **Variables**, **Operators** and **Functions.**

Note: *The expression evaluator used in the data calculator cannot accept variables, as there is no way to assign values to them. It does, however, accept all functions and operators listed with the exception of the Data Table Functions. The variables are used only when creating user defined models.*

Supported Variables:

Variable, or parameter names can be almost anything you want but must adhere to the following guidelines:

1. The variable must begin with an **alphabetic character**. (a-z, A-Z)
2. The variable cannot be a **reserved word,** meaning it cannot be a function shown below, or any other reserved keyword.
3. The variable names are **case insensitive** (VarSample is the same as varsample)
4. The alphabetical character **x must** be used as the independent variable, therefor it cannot be used as a variable parameter.
5. The dependent variable **y does not** appear in the equation.

Valid Variable Names	Invalid Variable Names
Test	1stTest (begins with a number)
Good_var	x (reserved for independent variable)
Var16	16Var (begins with a number)
LogVar	Log (reserved)

Supported Mathematical Operators:

Operator	Usage	Description
^	number1 ^ number2	Power
*	number1 * number2	Multiplication
/	number1 / number2	Division
\	number1 \ number2	Integer Division
mod	number1 mod number2	Modulus
+	number1 + number2	Addition
-	number1 - number2	Subtraction
-	-number1	Negation
(	(number1)	Parenthesis
)	(number1)	Parenthesis

Supported Boolean Operators:

Operator	Usage	Description
=	number1 = number2	Equal To
<	number1 < number2	Less Than
>	number > number2	Greater Than
<>	number1 <> number2	Not Equal To
and	number1 and number2	Logical And
or	number1 or number2	Logical Or
xor	number1 xor number2	Exclusive Or
eqv	number1 eqv number2	Equivalence
imp	number1 imp number2	Implication
not	not expression	Not

Supported Trigonometric Functions:

Function	Usage	Description
cos	cos(number)	Cosine
sin	sin(number)	Sine
tan	tan(number)	Tangent
arcsin	arcsin(number)	Inverse Sine
arccos	arccos(number)	Inverse Cosine
arctan	arctan(number)	Inverse tangent
sec	sec(number)	Secant
cosec	cosec(number)	Cosecant
cotan	cotan(number)	Cotangent
arcsec	arcsec(number)	Inverse Secant
arccosec	arccosec(number)	Inverse Cosecant
arccotan	arccotan(number)	Inverse Cotangent
hsin	hsin(number)	Hyperbolic Sine
hcos	hcos(number)	Hyperbolic Cosine
htan	htan(number)	Hyperbolic Tangent
hsec	hsec(number)	Hyperbolic Secant
hcosec	hcosec(number)	Hyperbolic Cosecant
hcotan	hcotan(number)	Hyperbolic Cotangent
harcsin	harcsin(number)	Inverse Hyperbolic Sine
harccos	harccos(number)	Inverse Hyperbolic Cosine
harctan	harctan(number)	Inverse Hyperbolic Tangent
harcsec	harcsec(number)	Inverse Hyperbolic Secant
harccosec	harccosec(number)	Inverse Hyperbolic Cosecant
harccotan	harccotan(number)	Inverse Hyperbolic Cotangent
rtod	rtod(radians)	Radians to Degrees
dtor	dtor(degrees)	Degrees to Radians

Supported Statistical Functions:

Note: Functions shown with more than one argument are shown with the arguments separated by a comma (typical for US locale settings). This character should actually be the List Separator defined in the Regional Settings in the Windows Control Panel. Functions inserted using the function template will reflect these local settings.

Function	Usage	Description
erf	erf(x)	Error Function
erfc	erfc(x)	Error Function Compliment
fact	fact(n)	Factorial
factln	factln(n)	Natural Logarithm Factorial
gamma	gamma(x)	Gamma Function
gammaln	gammaln(x)	Natural Logarithm Gamma Function
psi	psi(n)	Psi (Digamma) Function
igamma	igamma(a,x)	Incomplete Gamma Function
igammac	igammac(a,x)	Incomplete Gamma Function Compliment
beta	beta(z,w)	Beta Function
legendre	legendre(l,m,x)	Legendre Polynomial
binomial	binomial(k,n,p)	Cumulative Binomial Probability Distribution
ibeta	ibeta(a,b,x)	Incomplete Beta Function
poisson	poisson(k,n)	Cumulative Poisson Probability Function
fdist	fdist(v1,v2,f)	F-Distribution Probability Function
student	student(t,v)	Student's Distribution Probability Function
chi2	chi2(x2, v)	Chi-Square Probability Function
chi2c	chi2c(x2,v)	Chi-Square Compliment Probability Function

Supported Data Table Values:

Function	Usage	Description
xmin	xmin	Minimum X Value
xmax	xmax	Maximum X Value
xmean	xmean	Average X Value
xstd	xstd	X Standard Deviation
xatymin	xatymin	X Value at Minimum Y Value
xatymax	xatymax	X Value at Maximum Y Value
xrange	xrange	Abs(Maximum X Value - Minimum X Value)
ymin	ymin	Minimum Y Value
ymax	ymax	Maximum Y Value
ymean	ymean	Average Y Value
ystd	ystd	Y Standard Deviation
yatxmin	yatxmin	Y Value at Minimum X Value
yatxmax	yatxmax	Y Value at Maximun X Value
yrange	yrange	Abs(Maximum Y Value - Minimum Y Value)

Note: For multiple independent variable models, any of the above keywords which depend on a particular column of the independent variable x must have the column number specified after the 'x'. For example, consider a project with 3 independent variables. The operator xmin would be specified as x1min, x2min or x3min, whichever is appropriate. Similarly, yatxmin would be specified as yatx1min, yatx2min or yatx3min, whichever is appropriate. The operators ymin, ymax, ymean, ystd and yrange are not a function of the number of independent variables, therefore they would remain unchanged.

Supported General Functions:

Note: Functions shown with more than one argument are shown with the arguments separated by a comma (typical for US locale settings). This character should actually be the List Separator defined in the Regional Settings in the Windows Control Panel. Functions inserted using the function template will reflect these local settings.

Function	Usage	Description
if	if(Cond, TrueExp, FalseExp)	If Condition = True then TrueExp Else FalseExp
abs	abs(number)	Absolute Value
exp	exp(number)	Exponential
fix	fix(number)	Fix - similar to int
int	int(number)	Integer
log	log(number)	Natural log
ln	ln(number)	Natural log
log10	log10(number)	Log base 10
rnd	rnd(number)	Random Number
sgn	sgn(number)	Sign of a number
sqr	sqr(number)	Square Root
floor	floor(number)	Integer Below number
ceil	ceil(number)	Integer Above number
max	max(number1, number2)	Maxmimum of number1 or number1
min	min(number1, number2)	Minimun of number1 or number 2
mag	mag(number1, number2)	Vector Magnitude of number1 and number 2
pi	pi	The constant 3.14159…..

Supported Bessel Functions:

Note: Functions shown with more than one argument are shown with the arguments separated by a comma (typical for US locale settings). This character should actually be the List Separator defined in the Regional Settings in the Windows Control Panel. Functions inserted using the function template will reflect these local settings.

Function	Usage	Description
J0	J0(x)	Integer Order Bessel Function J0(x)

Y0	Y0(x)	Integer Order Bessel Function Y0(x)
J1	J1(x)	Integer Order Bessel Function J1(x)
Y1	Y1(x)	Integer Order Bessel Function Y1(x)
Jn	Jn(n,x)	Integer Order Bessel Function Jn(x)
Yn	Yn(n,x)	Integer Order Bessel Function Yn(x)
I0	I0(x)	Integer Order Modified Bessel Function I0(x)
K0	K0(x)	Integer Order Modified Bessel Function K0(x)
I1	I1(x)	Integer Order Modified Bessel Function I1(x)
K1	K1(x)	Integer Order Modified Bessel Function K1(x)
In	In(x)	Integer Order Modified Bessel Function In(x)
Kn	Kn(n,x)	Integer Order Modified Bessel Function Kn(x)
Jnu	Jnu(nu,x)	Fractional Order Bessel Function J*v*
Ynu	Ynu(nu,x)	Fractional Order Bessel Function Y*v*
DJnu	DJnu(nu,x)	Fractional Order Bessel First Derivative J'*v*
DYnu	DYnu(nu,x)	Fractional Order Bessel First Derivative Y'*v*
Inu	Inu(nu,x)	Fractional Order Modified Bessel Function Iv
Knu	Knu(nu,x)	Fractional Order Modified Bessel Function Kv
DInu	DInu(nu,x)	Fractional Order Modified Bessel First Derivative I'v
DKnu	DKnu(nu,x)	Fractional Order Modified Bessel First Derivative K'v
AiryA	AiryA(x)	Airy Function Ai(x)
AiryB	AiryB(x)	Airy Function Bi(x)
DAiryA	DAiryA(x)	Airy Function First Derivative Ai'(x)
DAiryB	DAiryB(x)	Airy Function First Derivative Bi'(x)
SphJn	SphJn(n,x)	Spherical Bessel Function Jn(x)
SphYn	SpjYn(n,x)	Spherical Bessel Function Yn(x)
DSphJn	DSphJn(n,x)	Spherical Bessel Function First Derivative J'n(x)
DSphYn	DSphYn(n,x)	Spherical Bessel Function First Derivative Y'n(x)

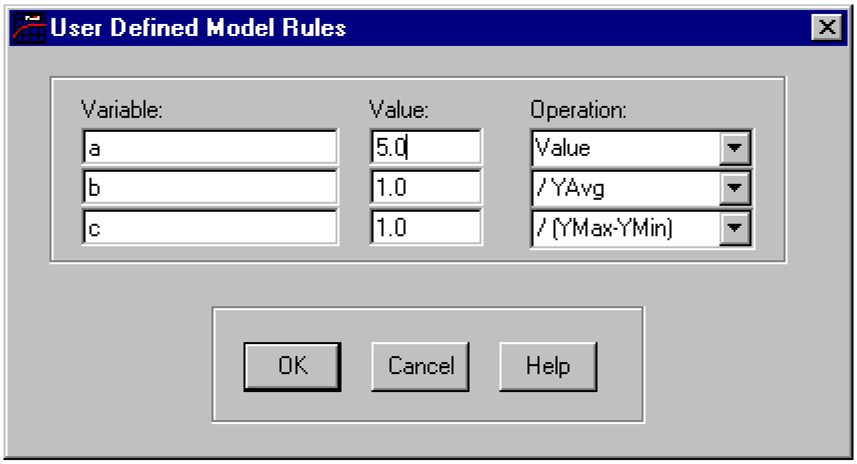
See Also:

Data Calculator
Built In Regression Models
User Defined Regression Models

Specifying Rules for User Defined Models

DataFit allows the user to define rules for obtaining initial estimates for user defined models. Once Rules have been defined, it is no longer necessary to specify initial estimates for the non-linear regression model each time it is solved.

To define Rules for your non-linear model, select **Rules...** from the **User Defined Models** Window after you have entered your model.



You will see a listing of each variable in the model. For each variable, you may specify any of the following rules:

1. If, for a particular variable, the Operation column is set to "Value", the initial estimate for that variable will be a constant specified in the **Value** column in the same row. For example, in the above window, the variable 'a' will have an initial estimate of 5.0.
2. If, for a particular variable, the Operation column is set to any of the other available options (see below), the initial estimate for that variable will be the constant specified in the **Value** column, and operated on by the expression in the **Operation** column. For example, in the above, window, the variable 'b' will have an initial estimate of (1.0 / Yavg). There are many similar operators:

Value
/ Ymin
/ YMax
/ YAvg
/ (YMax-YMin)
* YMin
* YMax
* YAvg
* (YMax-YMin)
/ XMin
/ XMax
/ XAvg

/ (XMax-XMin)
* XMin
* XMax
* XAvg
* (XMax-XMin)
/ N
* N

Where:

Ymin is the minimum value of the dependent variable
Ymax is the maximum value of the dependent variable
Yavg is the average value of the dependent variable
Xmin is the minimum value of the independent variable
Xmax is the maximum value of the independent variable
Xavg is the average value of the independent variable
N is the total number of data points.

See Also:

Specifying Initial Estimates
User Defined Models

Specifying Derivatives for User Defined Models

Regression models built in to DataFit calculate the coefficient derivatives analytically. This is done for two reasons:

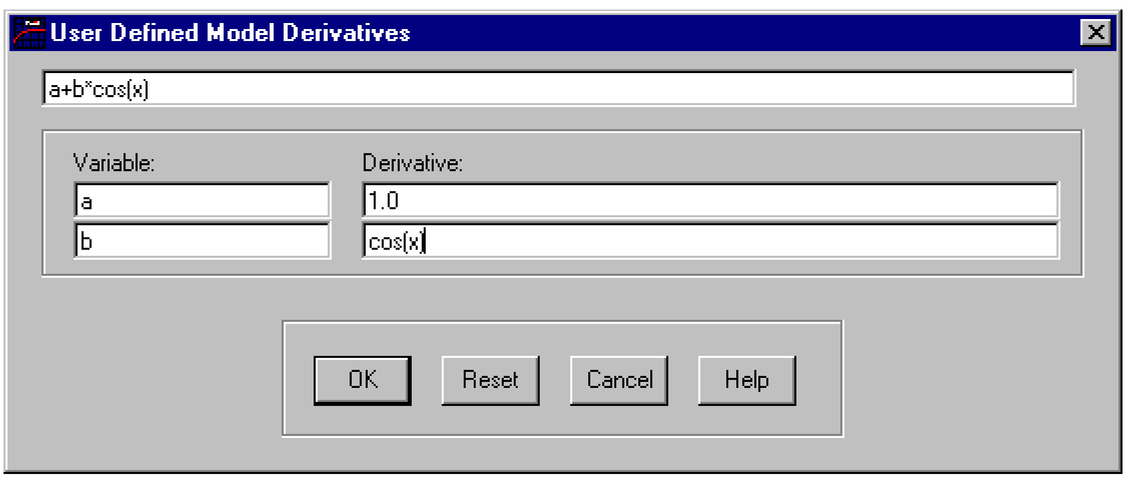
1. The derivatives are exact.
2. The solution process is much faster.

When solving a user defined model, the coefficient derivative must be computed numerically, unless the user defines them. This step is not necessary in most cases, but may sometimes help convergence as well as processing speed of the user defined model.

*Note: It is **NOT** normally necessary to specify analytical derivatives for user defined models. However, there are times when a particular coefficient may be very small, and the equation result is very large. These cases sometimes require many iterations while calculating the derivative numerically, and may push the limits of machine accuracy. For more information on how derivatives are calculated numerically, see the help topic Regression Theory.*

To specify analytical derivatives for user defined models, select **Dy/Dv…** from the **User Defined Models** Window. You will see a listing for each variable in the equation, for which you can specify the derivative.

For example, suppose you are fitting the user defined model $a + b\cos(x)$. The **User Defined Model Derivative** window for this model will appear as below:



For the variable **a:** $\frac{D(y)}{D(a)} = \frac{D(a + b\cos(x))}{D(a)} = 1.0$

For the variable **b:** $\frac{D(y)}{D(b)} = \frac{D(a + b\cos(x))}{D(b)} = \cos(x)$

Remember, you are taking the derivatives of the equation with respect to the variable

coefficients, NOT the independent variable(s) X.

These derivatives will be retained as long as the model remains in the database.

See Also:

Specifying Initial Estimates
User Defined Models

Model Groups

One of the features of DataFit is the ability to solve groups of models which possess similar characteristics. The models built in to DataFit are grouped together first by the general shape of their curve, secondly by the number of parameters. All user defined models are placed in a group by themselves. There is an additional group, a user defined group, which lets the user combine models of his or her own choosing.

The groups built into the software are:

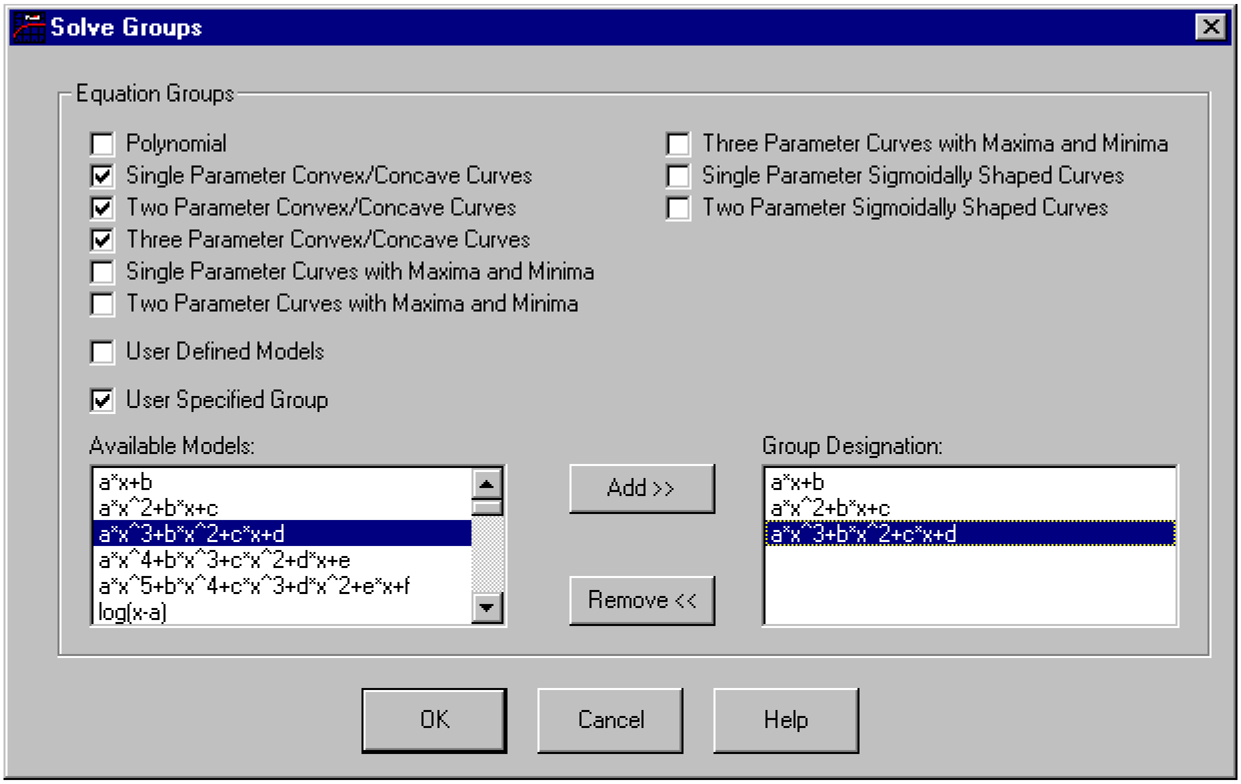
2D Models	3D Models
Polynomial	Three Parameter Polynomial
Single Parameter Convex/Concave Curves	Four Parameter Polynomial
Two Parameter Convex/Concave Curves	Five Parameter Polynomial
Three Parameter Convex/Concave Curves	Six Parameter Polynomial
Single Parameter Curves with Maxima and Minima	Seven Parameter Polynomial
Two Parameter Curves with Maxima and Minima	Six Parameter Taylor Series
Polynomial	
Three Parameter Curves with Maxima and Minima	User Defined Models
Single Parameter Sigmoidally Shaped Curves	
Two Parameter Sigmoidally Shaped Curves	
User Defined Models	

User Defined Groups:

You can create user defined groups in two ways:

1. Create an model group from the list of currently solved models. In the regression window, reduce the **Available Solution** list (once solutions are obtained) to only the models you want in the solve group, then click on **Create Solve Group**. The group will be created consisting of these models and automatically saved

2. You can group models to your liking in the **Solve Groups** window. To view the **Solve Groups** window, select **Solve Groups** in the Solution Setup window. To define you own group from the list of available models, select the model you want to add in the list on the left (**Available Models**) and click **Add>>.** This will place the models in the list on the right **(Group Designation).** To remove a model from the **Group Designation** list, select it in the list and click **Remove<<.** Unless you press cancel, the new group designation will be saved when you exit the window. The **Solve Groups** window is shown below:



See Also:

Built In Regression Models
User Defined Regression Models
Solution Setup
Solving a Single Model

Regression Theory

It may be best to start this section with some basic terminology.

Regression models:
These are a set of scientific, engineering and statistical **equations** which can be used to model a collection of data. For example, consider the following commonly used model to describe exponential growth:

$$y = ae^{(bx)}$$

The model contains two **parameters**, or **variables**, a and b, as well as the independent variable x. The dependent variable y is shown here for clarity, but is assumed to be present in DataFit. **Regression models** may also be referred to as **equations**. DataFit currently has 54 built in 2D regression models and 90 3D regression models, as well as the capability to add an unlimited number of user defined models.

Variables:
These are the 'unknowns' being fitted for in a particular **regression model**. Variables may also be referred to as **coefficients** or **parameters**. DataFit allows fitting models containing up to 20 different variables.

The motivation behind performing regression analysis is that one has a collection of data and wants to summarize it by fitting it to a model that will accurately describe the data. The models have adjustable parameters, or variables, that can be 'adjusted' to fit the data. The model parameters may come from derived scientific or statistical theory that the data is supposed to satisfy, and regression analysis can turn the few sampled data points into a smooth continuous function that may be used analytically or utilized by a computer program to return expected values at certain values of the independent variable. The user may decide to fit all of the variables, or constrain some of them in order to satisfy a known condition.

The basic idea in regression analysis is to choose a method of measuring the agreement between your data and a regression model with a particular choice of variables. This measurement of agreement is called the **merit function**, and is arranged so that small values represent close agreement between the collected data and the regression model. The variables are then adjusted iteratively in order to minimize the merit function. Once the merit function has been minimized, it is possible to determine how well the model describes the data.

There are more issues to consider in addition to just finding the optimal model parameters:

1. Which model do you choose? Usually the model is known prior to performing the regression, but there are times when it may not be. DataFit gives you a method of investigating a collection of models and assists you in choosing the best one.
2. How well does the selected model describe the data? There should be a way to numerically determine the goodness of fit. It is sometimes not good enough just

'eyeballing' the plot of model vs. data.

3. Are there measurement errors involved? It is very rare for a model to exactly match your measurements, so there should be a way to model the measurement errors and determine whether or not the model is statistically valid.
4. How accurate are the optimized parameters? There should be a way to statistically determine the likelihood of errors in the optimized parameters.

There are two widely used and accepted methods for performing regression analysis. The most common and easiest to implement is the linear **Least Squares** method.

Linear Regression Modeling

This method fits a set of data points (xi, yi) to a function that is a linear combination of any number of functions of the independent variable x. Consider the following polynomial function as an example:

$$y(x) = a_1 + a_2 x + a_3 x^2 + ... + a_M x^{(M-1)}$$

This function represents a polynomial of degree M-1. This method does not limit you to only polynomial functions. The general form for a Least Squares linear regression model is:

$$y(x) = \sum_{k=1}^{M} a_k f_k(x)$$

where $f_k(x)$ is any arbitrary function of x. In regression modeling, the term 'linear' does not mean that the function of x itself is linear (in other words, a straight line), but that the models dependence on its parameters
a_k is linear.

The merit function we choose to minimize for the Least Squares method is the following:

$$\chi^2 = \sum_{i=1}^{n} \left[\frac{y_i - \sum_{k=1}^{M} a_k f_k(x_i)}{\sigma_i} \right]^2$$

where σ_i is the measurement error, or standard deviation of the *i*th data point. Note, however, that some models which appear nonlinear may be re-arranged as to appear linear. For example, the equation

$$y = ax^b$$

may be 'linearized' by taking the natural log of both sides of the equation and re-arranging it:

$$\log(y) = \log(ax^b) = \log(a) + \log(x^b) = \log(a) + b\log(x)$$

With this good news comes some bad news. The fitting algorithm and merit function is now operating on log(*yi*) as opposed to *yi*, which may in some cases have a significant effect on the accuracy of the estimated parameters. To circumvent this and other issues, we turn to **nonlinear regression modeling**.

There are several different techniques available to minimize the merit function for Linear Least Squares models. The technique used in DataFit is Singular Value Decomposition because of its exceptional ability to handle singular matrices common in Least Squares solutions.

Nonlinear Regression Modeling

Similar to **Linear Regression**, the goal of nonlinear regression is to determine the best fit parameters for a model by minimizing a chosen **merit function**. Where nonlinear regression differs is that the model has a nonlinear dependence on the unknown parameters, and the process of merit function minimization is an iterative approach. The process is to start with some initial estimates and incorporate algorithms to improve the estimates iteratively. The new estimates then become a starting point for the next iteration. These iterations continue until the merit function effectively stops decreasing.

The nonlinear model to be fitted can be represented by:

$$y = y(x;a)$$

The merit function minimized in performing nonlinear regression is the following:

$$\chi^2(a) = \sum_{i=1}^{N} \left[\frac{y_i - y(x_i;a)}{\sigma_i} \right]^2$$

Nonlinear regression iterations proceed as follows:

1. Obtain initial estimates for all of the variables being fitted for in the model. These initial estimates can be obtained from linear regression, rules, or by examining the curve generated by the data points. For models built into DataFit, linear regression is used to obtain the initial estimates. For user defined models, either rules need to be created or the user must specify the initial estimates.
2. Using the initial estimates, compute the merit function.
3. Use an algorithm to adjust the variables in order to improve the fit of the model to the data points. DataFit utilizes the **Levenberg-Marquardt** method. Models built into DataFit use analytical derivatives during the optimization process, user defined models use numerical derivatives unless the user specifies the analytical derivatives.
4. Again, compute the merit function and compare it to the previous iteration.
5. Repeat steps 3 and 4 until there is essentially no change in the merit function, then cease the iterations.
6. Calculate the goodness of fit statistics.

Why is this a better method than **linear regression**? To start with, it is a much more general procedure. There are a very limited number of models that can be expressed in linear form without transforming the data. Also, remember that transforming the data means that the fitting routine will be minimizing the merit function on the transformed data, not the actual data. This makes nonlinear regression more accurate. Nonlinear regression can also be applied to essentially any equation that defines the independent variable Y as a function of the independent variable(s) X and at least one coefficient. This is what gives you the capability of defining your own models.

Calculating Derivatives

Most of the overhead associated with the **Levenberg-Marquardt** algorithm lies with calculating derivatives. The derivative of the model with respect to every parameter being fitted must be calculated at every data point a number of times during the solution process. It is easy to see how this can be time consuming, especially if there are a large number of data points. For models built in to DataFit, the derivatives are calculated analytically. This is the best method, as the result is exact and there is no iterating involved in calculating the derivative itself. User defined models whose derivatives are defined by the user are also calculated this way. If the derivatives are not defined for a user defined model, the derivatives are calculated iteratively in the following manner:

1. Evaluate the function, offsetting the coefficient variable by some (rather significant) small positive number: $f(x+h)$
2. Again, evaluate the function, offsetting the coefficient variable by the same small number negated: $f(x-h)$
3. Evaluate the derivative approximation by $f'(x) = \frac{f(x+h) - f(x-h)}{2h}$
4. Estimate the extrapolation error.
5. Decrease *h*, and repeat steps 1 through 4. When the error reaches an acceptable level, stop and return the approximated derivative.

Weighting of Data by Uncertainty

Some data obtained in an experiment may be more or less accurate than other data, for many reasons. The apparatus used may be more accurate in certain ranges than others, some data may have been recorded incorrectly, et. In these cases, it may be desirable to give more significance, or “weight” to data that is known to be more accurate. In addition, weighting may be used to bring the selected model closer to certain data points, even thought the Residual Sum of Squares may be worsened.

As shown above, the merit function minimized in performing nonlinear regression is the following:

$$\chi^2(a) = \sum_{i=1}^{N} \left[\frac{y_i - y(x_i;a)}{\sigma_i} \right]^2$$, where

σ_i is the standard deviation of the *ith* data point. If the value chosen for

s_i is constant for all data points, no weighting is performed as each data point has equal impact on the merit function. This is what is done in the following cases:

1. You chose not to display the standard deviation column when a <u>New</u> project is created.
2. You specify all of the standard deviation points equally (the same value).

With weighting, data points with larger standard deviations, or outliers, will have less impact on the merit function. Consider the following two data sets and plots, one weighted, one not weighted:

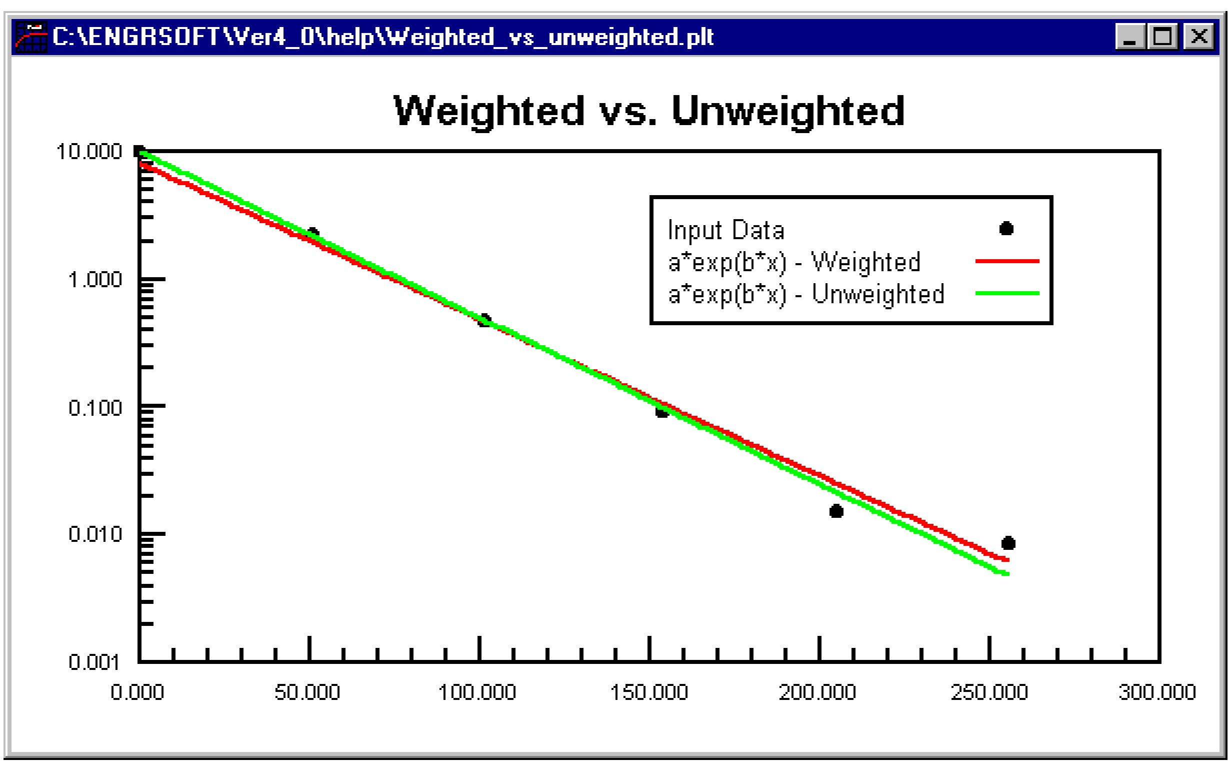
<u>Weighted</u>

X	Y	StDev
0	1.0	0.997
51	2.18	0.523
102	0.46	0.081
154	0.092	0.014
205	0.015	0.002
256	0.0084	0.0005

<u>UnWeighted</u>

X	Y
0.0	1.0
51.0	2.18
102.0	0.46
154	0.092
205.0	0.015
256	0.0005

The following plot shows the difference in the two nonlinear models:



Specifying Initial Estimates for Nonlinear Models

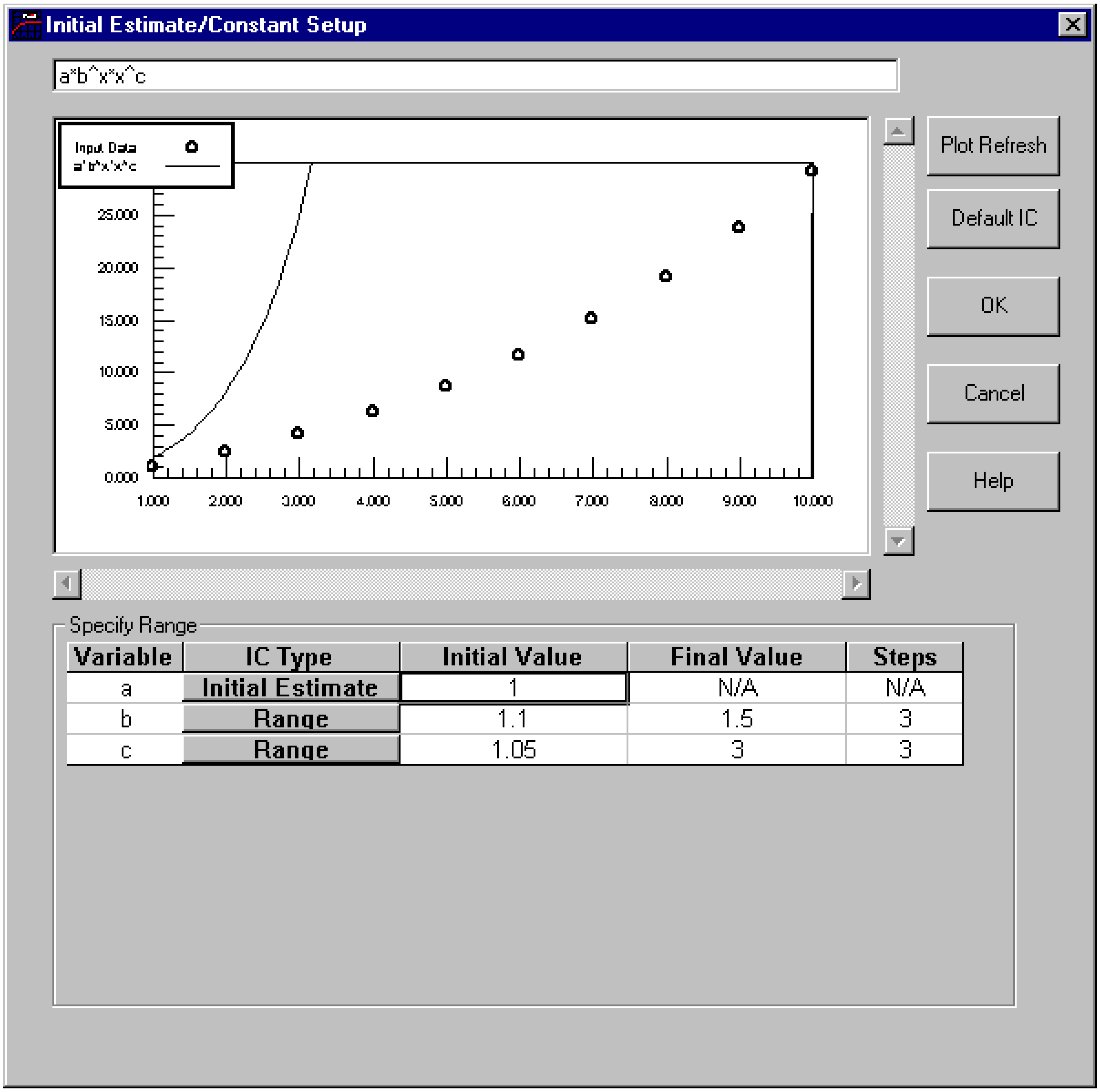
Since Nonlinear regression is an iterative procedure, it is necessary that the solution algorithm start with estimated values for each variable being fitted for in the model.   If the data clearly follows a curve, the solver will generally converge with any initial estimates, unless the initial estimates are way off.   If, however, the data is very 'scattered' or the model you are selecting has characteristics that differ from the data (the model may not describe the data well), the initial estimates must be somewhat close to the actual values.

DataFit automatically calculates the initial estimates for all of the built in models.   The software can also automatically calculate the initial estimates for user defined models if Rules are defined.

You also have the option of 'fixing', or not fitting for certain variables. Specifying initial estimates and constants takes place in the **Initial Estimate/Constant Setup** Window.   In order to specify initial estimates, fixing variables or sweeping variables, you must be solving a Single Model with the **Nonlinear** Solver.   The linear solver fits for all parameters and does not require initial estimates, and solving equation groups and/or all of the equations uses automatic initial value estimation.

To choose a model to solve and specify initial estimates, follow this procedure:

1. Select **Regression…** from the **Solve** menu.
2. In the Solution Setup window, select Single Model and select the **Nonlinear** solver, then click on **OK**.
3. In the Single Model Regression Setup window, select the model you want to fit, check the **Specify IC's/Constants** checkbox and click on **Specify...**   This brings up the **Initial Estimate/Constant Setup** window.



Each of the variables present in the model is listed, along with the least squares initial estimate of its value. There are three types of initial estimates **(IC Types)** you may specify for each variable:

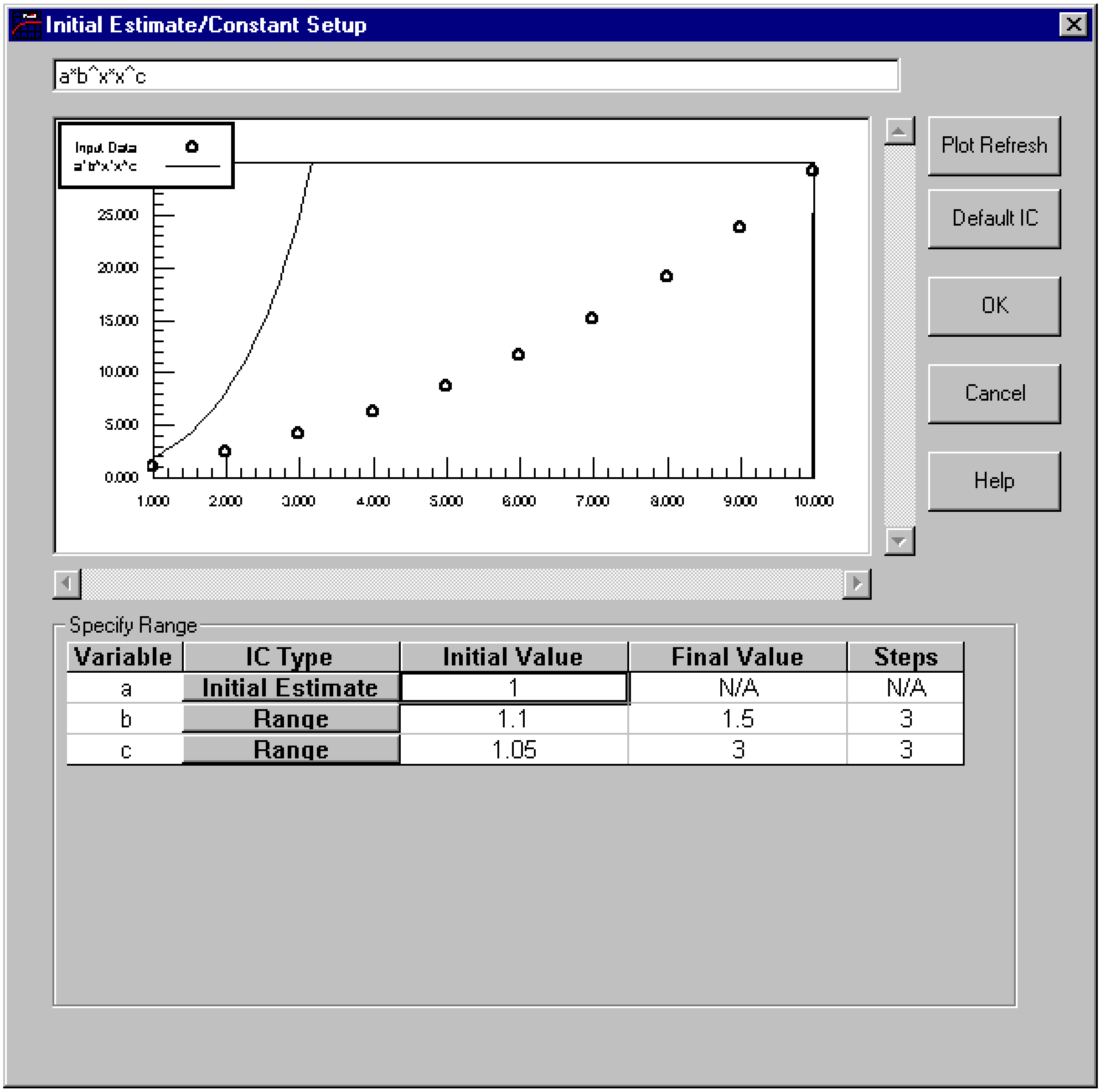
1. **Initial Estimate:** The value in this box will be used for the initial estimate of the variable, and will be adjusted during the fitting process. The **Final Value** and **Steps** cells will be inactive.
2. **Constant:** The value in this box will be held constant during the fitting process (not fitted). The **Final Value** and **Steps** cells will be inactive.
3. **Range:** The solver will solve the model with initial estimates determined from **Initial Value**, **Final Value** and **Steps**. Details of the best result will be present when interpreting the results, and goodness of fit information will be presented for each initial estimate

*Note: The **Range** option is useful for checking for the presence of a local minimum. For more information, see Interpreting the Results.*

You can toggle between these choices by clicking on the button in the **IC Type** column, and it will iterate through the above available choices. To change the initial estimate for any variable, edit the number in the corresponding text box. You can use the graph plotted to visually inspect either the computer generated initial estimates, or any initial estimates you modify. After making any modifications, you can make the plot reflect the current settings by clicking **Update**. If you want to revert to computer generated initial estimates, click **Default IC**.

*Note: The plot preview reflects values entered in the **Initial Value** fields.*

Consider the following example of initial estimates for the model a*b^x*x^c:



In this example:

- Variable ‘a’ will begin with an initial estimate of 1.0
- Variable ‘b’ will be varied from 1.1 to 1.5 in 3 steps
- Variable ‘c’ will be varied from 1.05 to 3.0 in 3 steps.

The solver will automatically perform the solutions with these enumerated initial conditions, reporting the best fit results along with an enumerated summary:

Solution #	Variable ‘a’	Variable ‘b’	Variable ‘c’
1	1.0	1.1	1.05
2	1.0	1.3	1.05
3	1.0	1.5	1.05
4	1.0	1.1	2.025

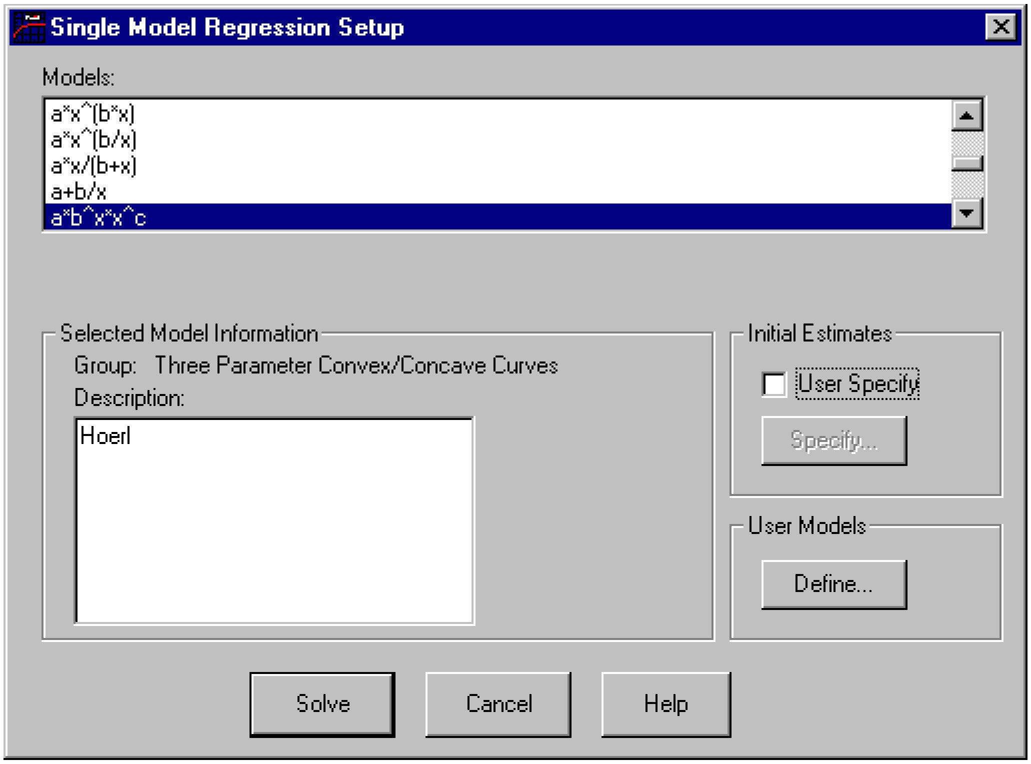
5	1.0	1.3	2.025
6	1.0	1.5	2.025
7	1.0	1.1	3.0
8	1.0	1.3	3.0
9	1.0	1.5	3.0

See Also:

Regression Theory
User Defined Regression Models
Interpreting the Results.

Single Model Regression Setup

If you choose to solve a single model in the Solution Setup window, you are able to select the model of your choice from a list of all models, both built in and user defined. Below is the **Single Model Regression Setup** window.



At the top of the window is the model list. All of the models, including user defined models (the user defined models are shown only if you specified the nonlinear solver), are shown in the list. Pick the model you want to fit by clicking on it. You can also use the up and down arrow keys to navigate the list. Notice as you navigate the list, the model Group and description are updated to give you information about the selected model.

Note: The software remembers the last selected single model and will select it by default.

You may specify the initial estimates for the model yourself by clicking on checking the **User Specify** checkbox and clicking the **Specify...** button. This will bring up the Initial Estimate/Constant window. This step is not typically necessary, unless there is trouble with nonlinear convergence, or you want to hold certain variables constant for the regression. The **User Specify** button is disabled if the linear solver is chosen in the Solution Setup window.

You can also define your own user defined model here in exactly the same way you can in the Solve menu. The new model you create will be immediately ready to be solved.

To solve the selected model, just click on the **Solve** button. **Cancel** will return you to the regression window. Once the model has been solved, it will be sorted according to best fit and placed in the **Available Solution** list.

See Also:

Regression Theory
User Defined Regression Models
Interpreting the Results.

Interpolation Theory

Interpolation should not, in general, be used for data modeling. This is why they are treated a bit differently than regression models in DataFit. There are, however, instances where these methods may be useful. For instance, interpolation plays a significant role in the numerical solution of differential equations

Interpolation is the process of estimating a missing functional value by taking the weighted average of values of neighboring points. The user may know the value of a function *f(x)* at points *x1, x2, ...xN* and want an analytic expression that will enable the evaluation of *f(x)* at an arbitrary point. If the X value lies within the range of tabulated values, this process is called **interpolation**. If the value of X lies outside the range of tabulated values, this process is called **extrapolation**. DataFit performs interpolation using three different methods.

1. Polynomial Interpolation
2. Rational Function Interpolation
3. Cubic Spline Interpolation

Viewing the Results

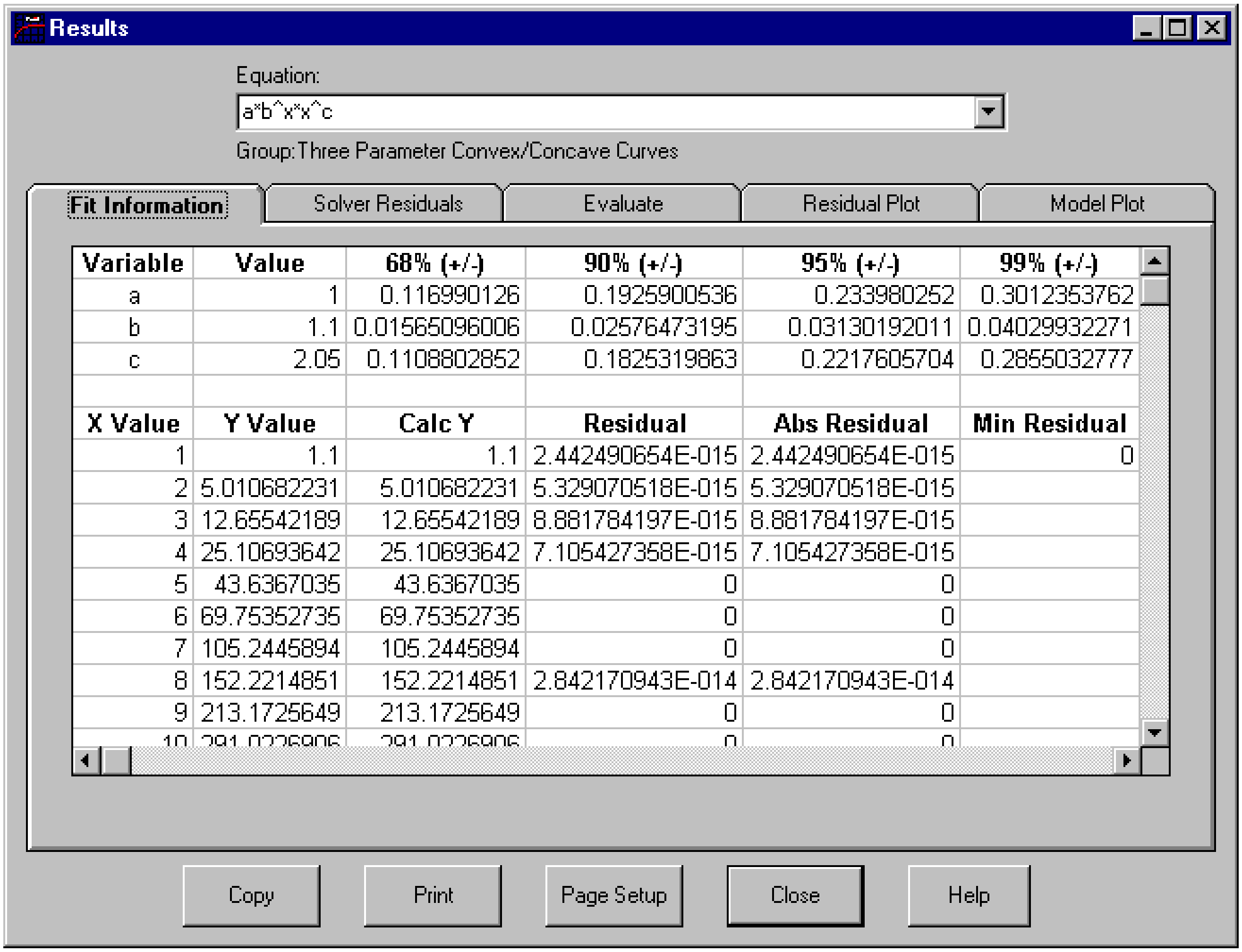
Once a solution has been obtained, the results may be viewed by clicking on **Results...** in a regression window. The results are shown in a tabbed dialog with information about the coefficients and the goodness of fit. Also available is a table of calculated vs. estimated values, and a method of evaluating the fitted equation at any value of x.

Viewing the Fit Information
Viewing the Solver Residuals
Evaluating the Function
Viewing the Fitted Residuals
Interpreting the Results
Regression Theory

See Also:

Printing the Results

Viewing the Fit Information:



The following results are shown:

1. Values for the fitted variables in the model.
2. The 68%, 90%, 95% and 99% confidence intervals for the fitted variables.
3. A table of entered and estimated values for all entered data points.
4. Residual table which shows the vertical difference between the actual and estimated values at all data points.
5. Percent Error table, which shows the percent error of the estimated dependent variable value compared to the actual values.
5. Absolute Residual table which shows the absolute values of the vertical differences between the actual and estimated values for all data points.
6. Minimum Residual **(Min Residual).**
7. Maximum Residual **(Max Residual)**
8. Residual Sum of Squares **(RSS)** which is the sum of the squares of the vertical differences between the actual and estimated values for all data points.
9. Residual Standard Deviation **(RSD)** which is the Standard Deviation of the vertical

differences between the actual and estimated values.

10 Correlation Coefficient, or **R2**

11. Standard Error of the Estimate **(Std Err).**

12. Summary of the solutions obtained by enumerating the ranges for initial estimates (if specified).

To see how to interpret the goodness of fit, see the help topic Interpreting the Results

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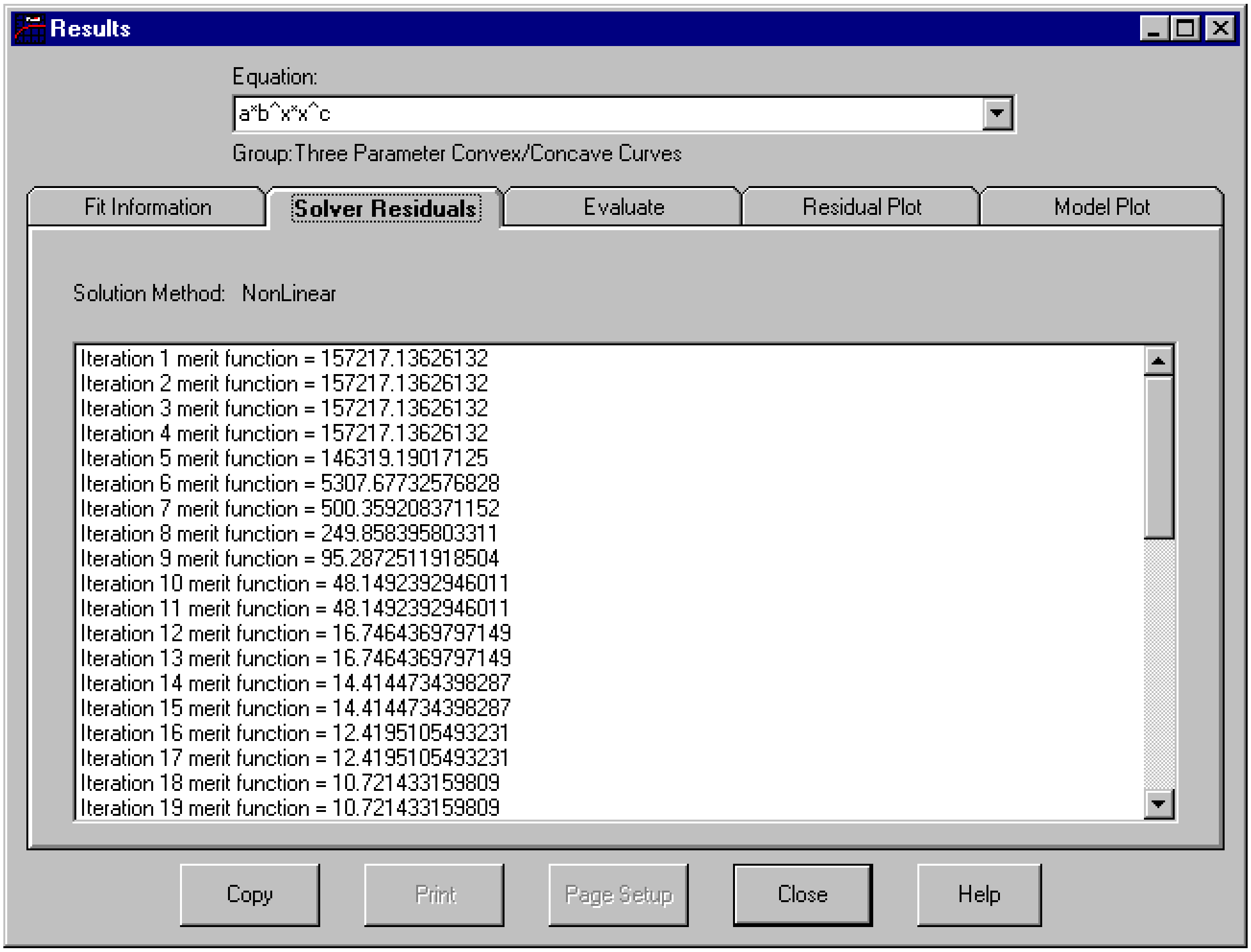
See Also:

Viewing the Fit Information
Viewing the Solver Residuals
Evaluating the Function
Viewing the Fitted Residuals
Interpreting the Results
Regression Theory

Viewing the Solver Residuals:



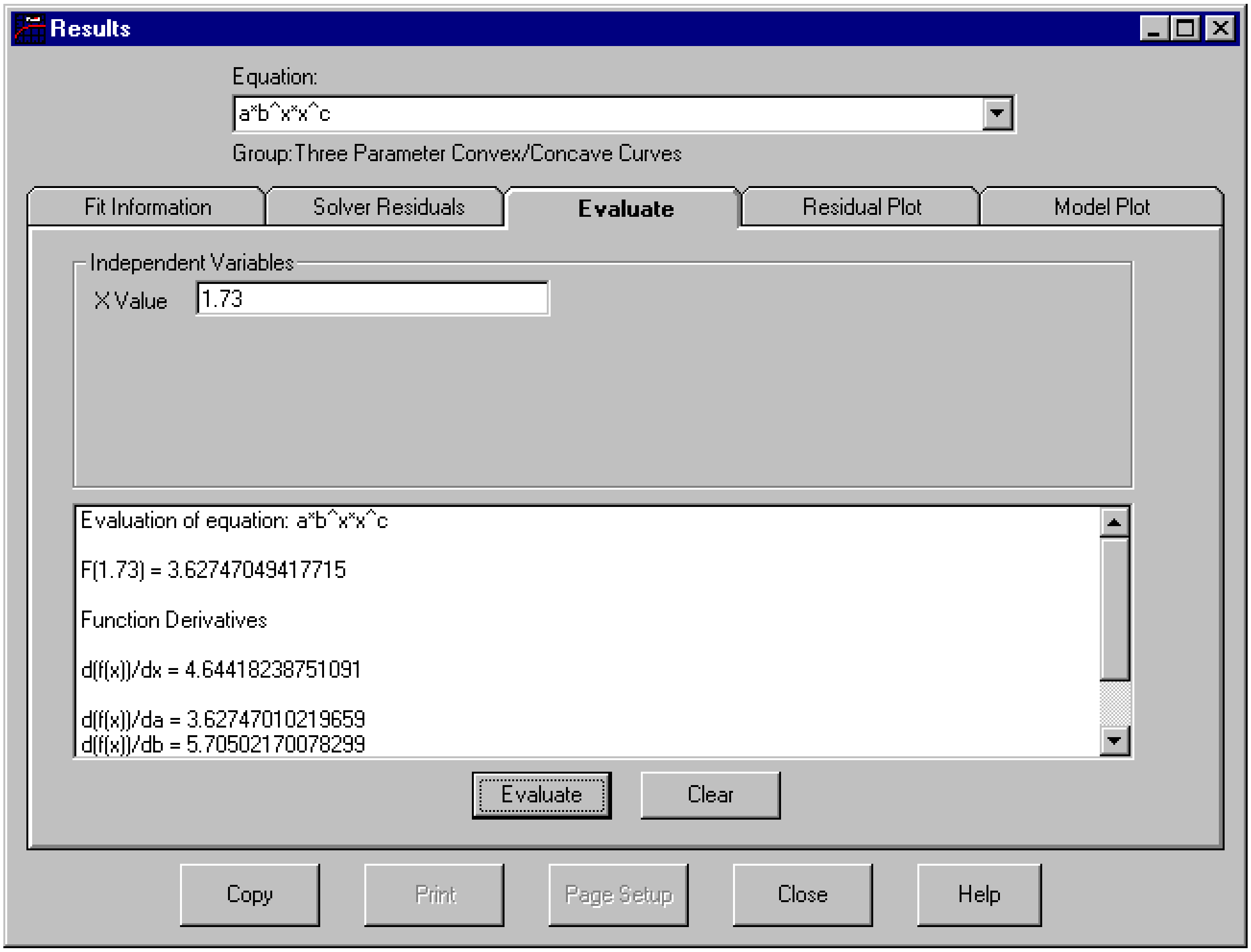
Shows the solution method (linear or nonlinear) and solver residuals (if nonlinear regression is specified).

For more information on Solver Residuals, see the help topic Interpreting the Results.

See Also:

Viewing the Fit Information
Evaluating the Function
Viewing the Fitted Residuals
Interpreting the Results
Regression Theory

Evaluating the Function



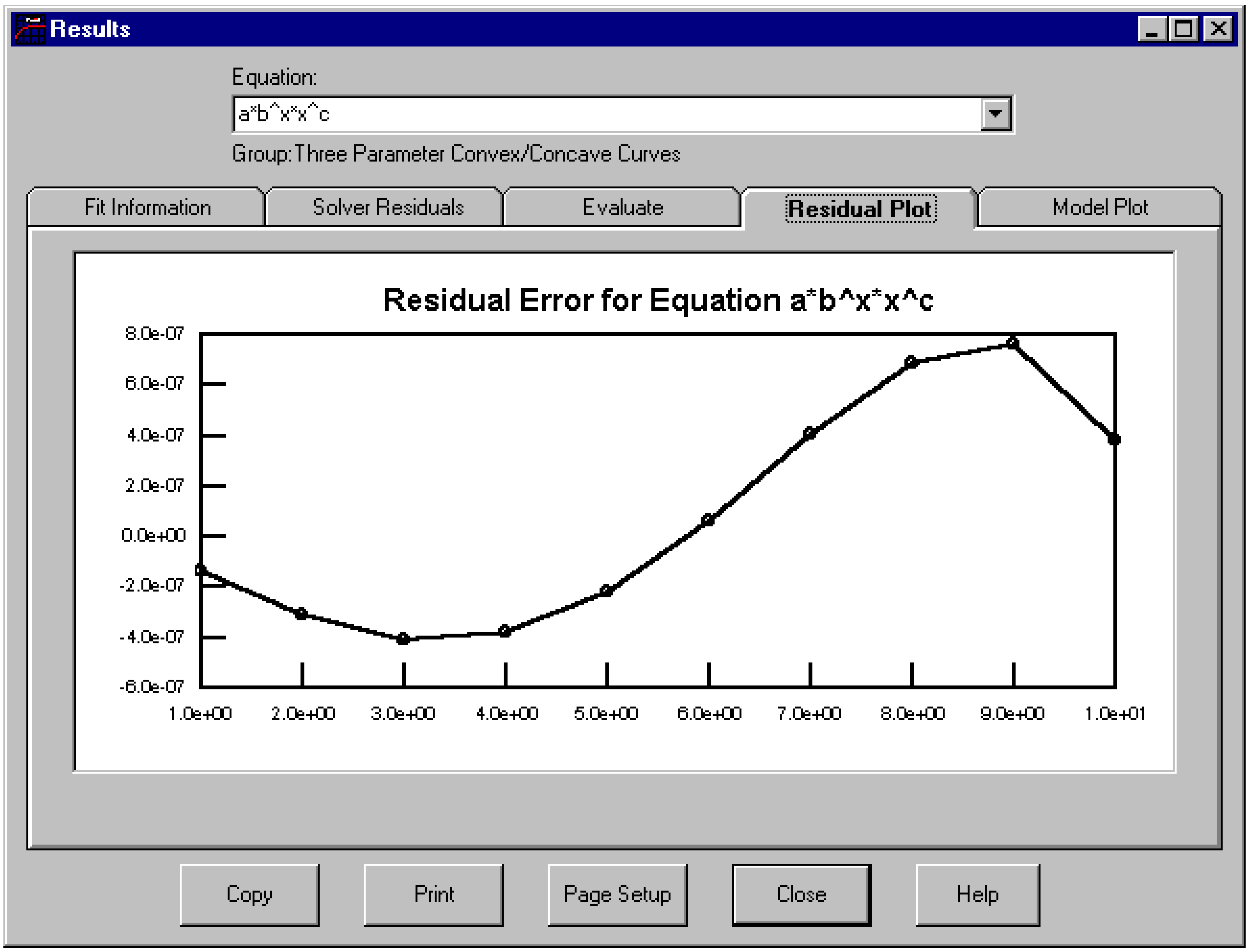
This feature enables you to evaluate the fitted equation at any value of the independent variable X. It also provides derivatives of the function at the specified X value for each parameter, or variable, in the model.

See Also:

Viewing the Fit Information
Viewing the Solver Residuals
Evaluating the Function
Viewing the Residuals
Interpreting the Results
Regression Theory

Viewing the Residual Plot

The fitted residuals are the differences between the entered data points and the curve generated from the fitted model. The Residual Plot is a plot of the residuals for each data point in the data set. An example residual plot is shown below:



See Also:

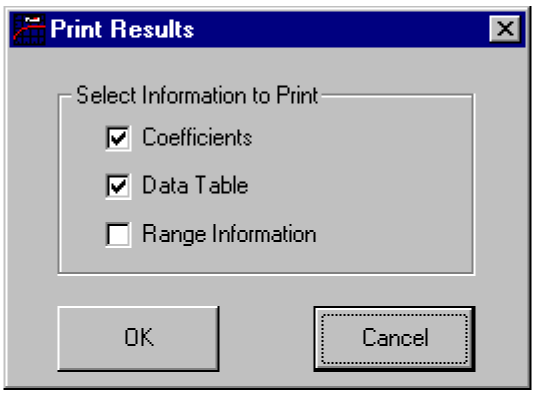
Viewing the Fit Information
Viewing the Solver Residuals
Evaluating the Function
Viewing the Residuals
Interpreting the Results
Regression Theory

Printing the Results

The solution data and residual plots can be printed while viewing the Results.

To print the solution data:

1. Select the equation you want to print from the drop down list at the top of the Results window.
2. Click the **Fit Information** tab to make it the active tab.
3. Click the **Print** button and select the information you want to print from the **Print Results** dialog shown below:



Coefficients: Prints the value for each coefficient as well as the confidence intervals.
Data Table: Prints the entered vs. calculated data and goodness of fit information.
Range Information: Prints the summary of the enumerated initial condition range solution data.

To print the residual plot:

1. Select the equation you want to print from the drop down list at the top of the Results window.
2. Click the **Residual Plot** tab to make it the active tab.
3. Click the **Print** button.

*Note: You can only print solution information for one equation at a time. Make sure you have the equation you want selected in the drop down list before clicking on the **Print** button.*

See Also:

Viewing the Fit Infomation
Viewing the Solver Residuals
Evaluating the Function
Viewing the Residuals
Interpreting the Results
Regression Theory

Interpreting the Results

When determining the goodness of fit of the model(s), the following points should be examined:

1. Check the solution convergence. Each iterative step of the nonlinear solver returns the best estimate found so far in the solution process. After each iteration, the merit function is compared to that from the previous iteration. Since the solver returns the best estimates reached so far, the newly computed merit function will either be better (lower) or unchanged. So as to not run on indefinitely, we stop the process if the difference in the merit function between iterations reaches a reasonable specified Regression Tolerance, a Maximum Number of Iterations, or a Maximum Number of Unchanged Iterations. By viewing the Solution Log or the Solution itself, you can see which of the limits ceased the iterations for a particular model. If the solution reached the **Maximum Number of Iterations**, you may check to see if the merit function was steadily decreasing and increase the allowable number of iterations. The default values are typically adequate, but DataFit gives you the capability to alter them to your possibly special needs.
2. Check to see how well the model describes the actual data. This information can be obtained by the following calculated parameters.
   a) **Residuals** are the vertical differences between the curve created by the fitted function and the actual data point. If the residual is positive, the estimated value lies below the actual data point. If the residual is negative, the estimated value lies above the actual data point. The residuals should be randomly scattered around zero. If there are groups of residuals with like signs, it is probable that another functional approximation exists that would better describe the data.
   b) **The % Error** is the percentage of error in the estimated dependent variable value as compared to the actual value. An error percentage of 0% means that the estimated value is equal to the actual value. The larger the percent error (positively or negatively), the farther away the estimated data point is from the actual point.
   c) **The Residual Sum of Squares (RSS)**, is the sum of the squares of the differences between the entered data and the curve generated from the fitted model. A perfect fit would yield a residual sum of squares of 0.0.
   d) The **Residual Standard Deviation (RSD)**, is the standard deviation of the differences between the entered data and the curve generated from the fitted model. This gives you an idea about how scattered the residuals are around the average.
   e) The **Correlation Coefficient (R2)**, is a measure of the correlation between the dependent and independent variables for the fitted approximation. The value of R2 is typically between 0.0 and 1.0. A value of 1.0 indicates perfect correlation, a value of 0.0 indicates no correlation. If the functional approximation is extremely poor, the value of R2 may lie outside of this range.
   f) The **Standard Error of the Estimate (Std Err)**, is a measure of the amount

of error in the functional approximation. As the standard error approaches 0.0, you can be more certain that the functional approximation accurately describes the data. A perfect fit would yield a standard error of 0.0.

g) Finally, you can observe a plot of actual vs. estimated data.

3. Check to see if the results are scientifically or statistically meaningful. Does the fitted value of any of the variables violate a possible physical reality? For example, suppose you are fitting a model in which one of the parameters represents electrical resistance and returns a negative value. This probably means that the model you selected is not the correct one.
4. Look at the **confidence intervals**. The confidence intervals for each variable are reported to you in the **Results** window for at levels of 68%, 90%, 95% and 99%. Confidence intervals are a means of determining the probability that the fitted variable lies within a certain range. For example, for a 99% confidence interval, you can be approximately 99% sure that the reported value lies within the calculated range. If the confidence is very wide, the fit is not unique, meaning that different values chosen for the variables would result in nearly as good a result. Data containing a lot of scattering, or not collecting a sufficient amount of data would cause the confidence intervals to be excessive, however the most common reason is fitting the data to a model with variable redundancy. In the equation $y = \log(a * b * x)$, the variables a and b are indistinguishable. There is no way for the algorithm to determine how to distribute a value (the product of a and b) between these two variables. Also, entering large standard deviations in the spreadsheet would cause the confidence intervals to be wide.
5. It is possible to converge on a **false minimum** in the merit function. This is a problem inherent in any iterative optimization procedure. Nonlinear regression will assure that once a solution has been obtained, small changes in the variables will worsen the fit. It is rare but possible, however, that some large change may actually converge to a better fit. This problem is rare, except in cases where the data is widely scattered, there were too few data points collected or the model chosen is completely wrong for the data. Determining good initial estimates is important, which is why they are calculated for you in DataFit when performing nonlinear regression. If you think you may have possibly reached a false minimum, you may use the **Range** feature when specifying the initial estimates. This feature will solve the model with a range of initial estimates, returning the best fit parameters from the enumerated initial conditions specified.

See Also:

Regression Theory (Nonlinear and Linear Models)
Built In Regression Models
User Defined Regression Models
Specifying Initial Estimates for Nonlinear Models
Viewing the Results
Printing the Results

Registering DataFit

This software is being distributed as Shareware. You may evaluate it free of charge for 30 days. If, after the 30 day evaluation period, you choose to continue using the software, you **must** register it. This program relies on your support for continued development. When you register DataFit, you will receive a code that enables additional features in the software and become eligible for priority support. You will also be able to obtain free upgrades of the program through our Web page with which you can use your current registration code, until the next major release.

Registrations are taken through Kagi Payment Service, which accepts **cash, checks, money orders, VISA, Master Card, American Express, Discover, Diners Club and First Virtual.**

You can register the software in any of the following ways:

1. Register by Fax, Email (electronic mail) or Postal. Use the **Register** program provided with the software to make payments. We use **KAGI Payment** service, which accepts different payment methods, including checks, mail orders, credit cards and invoices. You can run the register program with any of the following methods:

    a) From the DataFit **Help** menu, click on **Register DataFit** and choose **Email, Fax or Postal** from the menu. This will run the register program which gives you explicit instructions on how to make your payment.
    b) Click the Windows Start button, and then point to Programs. Click on the **Engineered Software** folder, then click the **Register** program. Again, this will run the register program which gives you explicit instructions on how to make your payment.
    c) From the **Windows Explorer**, Double Click the **Program Files** folder, then double click the **DataFit** folder. Once the DataFit folder is opened, double click on **Register.exe.** As before, this will run the register program which gives you explicit instructions on how to make your payment.

    PLEASE INCLUDE THE REGISTRATION FORM WITH YOUR PAYMENT.

2. Register from the World Wide Web. You can register online with the following methods.

    a) From the DataFit **Help** menu, click on **Register DataFit** and choose **Register Online**. If a default web browser is properly registered on your system, this will launch it and connect you directly to the Kagi Online Payment Service. There you will be given explicit instruction on how to make your payment.
    b) Point your web browser to **http://order.kagi.com/?JA**. This is the URL for the Kagi Online Payment Service. Again, you will be given explicit instruction on how to make your payment.

3. Register by Telephone

Call Kagi Payment Service at (510) 658-5244, 24 hours a day, 7 days a week. You can register DataFit over the phone with a credit card. **DO NOT CALL THIS NUMBER FOR DATAFIT TECHNICAL SUPPORT. THIS PHONE NUMBER IS FOR REGISTRATIONS ONLY!**

Also, please specify the following to insure you are registering the license you really want. This will insure that you get the correct registration codes without any additional delays.

a) Specify that you want the product **DataFit**, and the **Author Code** for DataFit is **JADV**.
b) Specify a **Single User License**, **Site License** or **Word License** (see below for a description for each).
c) Specify one of the following **Program Codes**, depending on which license you want:

License Type	**Program Code**
2D License	DataFit_2D
3D License	DataFit_3D
2D/3D License	DataFit_2D_and_3D

4. If you live in the US or Canada you may also mail us your check or money order **(US ONLY)** directly, payable to **John A. Gilmore**, at the following postal address:

Engineered Software
C/O John A. Gilmore
23 Tomey Road
Oakdale, PA 15071
USA

PLEASE INCLUDE THE REGISTRATION FORM WITH YOUR PAYMENT.

License Cost:

New Users:

License Type	Product	Price (per copy)
Single User License	DataFit 2D **or** 3D	$50.00
Single User License	DataFit 2D **and** 3D	$80.00
Site License	DataFit 2D **or** 3D	$200.00
Site License	DataFit 2D **and** 3D	$320.00
World License	DataFit 2D **or** 3D	$2000.00
World License	DataFit 2D **and** 3D	$2200.00

Note: Single User License are for use by a single person, for personal use only. Site License is for use by anyone at a company or organization at a single location. World License is for

use by anyone at a company or organization at any location.

Upgrades from previous versions 2.x (upgrades from versions 3.x and 4.0 are free). **YOU MUST HAVE A CURRENT LICENSE:**

License Type	Product	Price (per copy)
Single User License	DataFit 2D	$20.00
Site License	DataFit 2D	$80.00
World License	DataFit 2D	$800.00

Universities using the software for classroom instruction may contact us for reduced rates on individual student licenses.

Note: 2D license enables the use of DataFit for solving single independent variable regression models. 3D license enables the use of DataFit to solve regression models with 2 to 9 independent variables. The purchase of the combination 2D and 3D license enables the use of DataFit to it's fullest capability.

See Also:

Entering Your Registration Numbers
Obtaining Technical Support

Entering Your Registration Numbers

Once you register DataFit, you can permanently enter your registration codes sent to you into the software.   This will remove all of the nag screens, and show the users name who registered in the **About** box. To enter your registration codes, complete the following steps:

1. From the DataFit **Help** menu, choose **Enter Licenses**.
2. Click *ONLY* the check boxes for the appropriate license(s) you've purchased.
3. Fill in the **Register To** and **Registration Code** fields with the information provided to you after you registered, being sure to spell your name (including capital and small letters, spaces and punctuation) *EXACTLY* how it appears from the information provided to you.
1. Once you have entered the correct information, click on **OK**. This procedure will only need to be completed once.

NOTE: If your evaluation has expired, you may possibly obtain a temporary license to continue your evaluation.   Temporary licenses will be considered on a case by case basis.

See Also:

Registering DataFit
Obtaining Technical Support

Obtaining a Temporary License

You may possibly obtain a temporary license to continue your evaluation under very limited circumstances. However, if you are a registered user who would like to evaluate the additional capabilities of DataFit that you did not purchase, please feel free to contact technical support and we'll be glad to give you additional time.   Otherwise, requests will be considered on a case by case basis.

See Also:

Registering DataFit
Obtaining Technical Support

Obtaining Technical Support

You can receive technical support whether you are a registered user or not, however registered users receive priority response. You can obtain technical support in any of the following ways:

1) Email your question or problem via email to **johng@kagi.com**. Email typically receives the quickest response.

2) Fax your question or problem at any time to: **(412) 693-0320. DO NOT FAX ORDERS OR REGISTRATION FORMS TO THIS NUMBER. THIS NUMBER IS FOR DATAFIT TECHNICAL SUPPORT ONLY!** This number is Fax support only.

3) You can mail your question or problem to the following postal address:

    Engineered Software
    C/O John A. Gilmore
    23 Tomey Road
    Oakdale, PA 15071
    USA

See Also:

Registering DataFit
Association of Shareware Professionals

About Engineered Software

The program DataFit is being maintained and updated on a daily basis. We are very serious about providing and maintaining useful, accurate and user friendly programs. Many of the newer features of DataFit are there because of user feedback, so please do not hesitate to contact us and give us your input. We can't guarantee that every request will be honored, but we will do our best.

You can keep abreast of new releases and new features of DataFit on our Web Page. The URL is:

http://www.kagi.com/authors/johng/

You can email us at the following email address:

johng@kagi.com

You can send us a Fax to **(412) 693-0320**, or you can send us a letter via good old U.S. mail at the following address:

Engineered Software
C/O John A. Gilmore
23 Tomey Road
Oakdale, PA 15071

See Also:

Association of Shareware Professionals

Association of Shareware Professionals

We are proud to be a member of the Association of Shareware Professionals (ASP). You can visit the ASP Home Page at **http://asp-shareware.org/**.

Ombudsman Statement:

DataFit is produced by a member of the Association of Shareware Professionals (ASP). The ASP wants to make sure that the shareware principle works for you. If you are unable to resolve a shareware-related problem with an ASP member by contacting the member directly, ASP may be able to help. The ASP Ombudsman can help you resolve a dispute or problem with an ASP member, but does not provide technical support for members' products. Please write to the ASP Ombudsman at 545 Grover Road, Muskegon, MI 49442 USA, FAX 616-788-2765 or send a CompuServe message via CompuServe Mail to ASP Ombudsman 70007,3536.

See Also:

Registering DataFit

Exporting Programs

Exporting a **BASIC** Function
Exporting a **C** Function

Creating Plots

There are two methods of creating plots, depending on whether or not you are performing regression analysis:

1. Plotting data without performing regression analysis

Data may be plotted without performing regression analysis. Data can either be imported into the spreadsheet, pasted into the spreadsheet from another application, or typed in by the user. Once the data is entered, simply select New from the Plot Menu. The data from the spreadsheet will appear in the new plot window.

Data can also be plotted from the Data Calculator without performing regression analysis. From the **Plot** menu, select **Calculator**. Once the **Calculator** appears, select **Import**. You will be prompted for a filename containing ASCII delimited text. Once the file has been read, it will appear on top of the **Calculator Stack**. Click on **New Plot**, and the data will appear in the new plot window. You may also plot an equation directly from the **calculator**. Click on **Eq** (for Equation) and enter a valid expression for the function you wish to plot. The equation will appear on top of the **Calculator Stack**. Once again, click on **New Plot** in the calculator and the equation will be plotted.

2. Plotting data from regression analysis

Once a solution is obtained, plots can be created by selecting items in the **Available Solutions** list and selecting New from the Plot Menu. The data from the spreadsheet, as well as the solution data selected, will appear in the new plot window.

Solution data can also be transferred to the **Data Calculator** where it may be manipulated by performing mathematical operations on it. It may then be plotted from the calculator as described above.

See Also:

Overview of the DataFit Workplace
Formatting Plots
Calculator
Entering Data
Copying and Pasting Data

Warranty and Disclaimer

Limited Warranty:

a. The licensor warrants that it has the right to license the use of the licensed product(s).
b. The Licensor warrants that the licensed product(s) will substantially perform as described in the product's documentation, provided that the licensed product(s) is installed properly on an IBM compatible computer running an unmodified copy of Microsoft Windows NT, version 3.51 or greater, or Microsoft Windows '95.
c. This limited warranty is in lieu of all other warranties, expressed or implied, including, without limitation, warranties of merchantability and fitness for a particular purpose.

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DataFit Tutorials

The tutorials are step by step instructions on how to use some of the most common features in DataFit.   This is not an exhaustive button pushing exercise, but should get you well on your way to using DataFit to its full capability.   The body of the tutorial contains links to specific topics in the help file. If you traverse a link, click on the **Back** button in the Help Viewer to return to where you left to continue with the tutorial.

Choose the tutorial you would like to complete:

> The 2D Tutorial shows how to use DataFit to solve nonlinear models with one independent variable.
>
> The 3D Tutorial shows how to use DataFit to solve nonlinear models with two independent variables.
>
> Comparing fits from 2 data sets in the same graph shows you how to combine and compare the results of two (or more) sets of data.

Comparing Fits from 2 Data Sets in the Same Graph

This is a fairly simple tutorial, but this question gets asked a lot. It is not broken up into steps like the other tutorials, and assumes that you know (in general) how to solve regression models in DataFit.

We will use the following two data sets for this simple second order polynomial example.

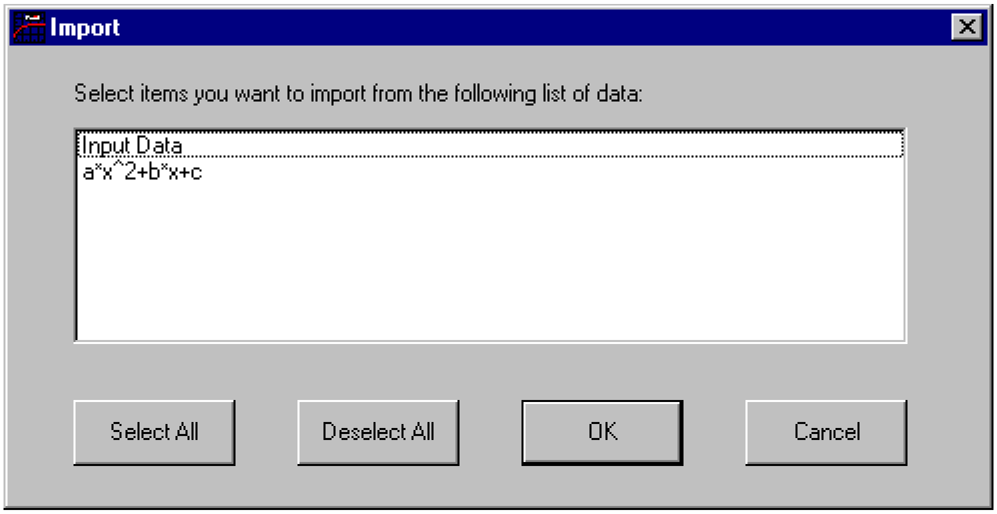
X	Y set 1	Y set 2
1	6.18	5.95
2	11.2	11.0
3	17.95	18.1
4	27.11	26.89

1. Create a new project by choosing **File|New**. This will bring up the **New Project** Window. Choose **Single Independent Variable** under the **New Project Type** area. Under **Spreadsheet Setup**, make sure that **Show Standard Deviation** is left unchecked. The **Number of Independent Variables** box will be disabled. Click on **OK**. The new project window will appear.
2. Enter the X and the first Y data set into the spreadsheet.
3. Choose **Regression...** from the **Solve** menu. This will bring up the **Solution Setup** window.

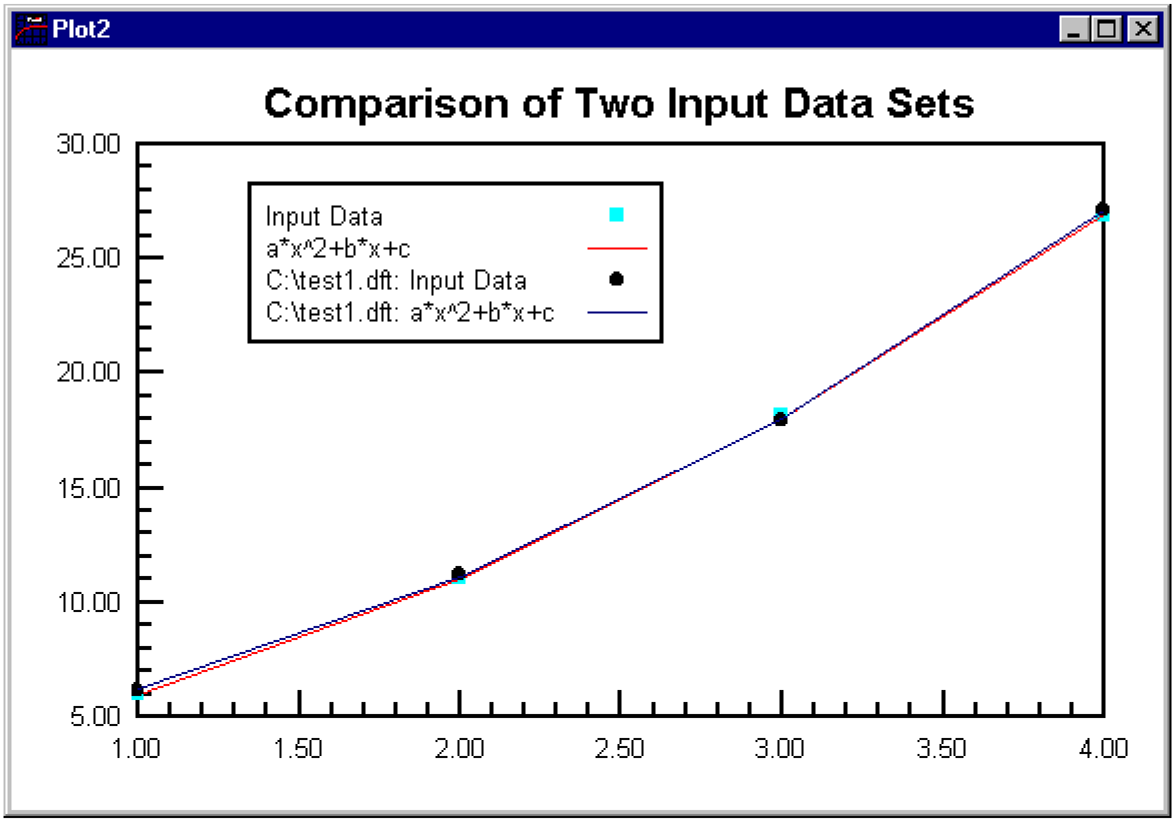
Note: If a different window other than the Solution Setup window comes up, you have unchecked Prompt for Solution Setup in the ***Solve*** *menu. This allows repeated analysis to be performed without prompting the user each time for the type of analysis. If you do not see the Solution Setup window as shown above, press* ***Cancel*** *from the current window, re-check Prompt for Solution Setup (by clicking on it, the check mark will re-appear), and start again at step (a) above.*

4. In the **Model Selection** area of the **Solution Setup** window, choose **Single Model**. This will allow you to choose a single model from the list of all models.
5. In the **Solver Selection** area, choose the **Nonlinear** solver. This will tell the solver to perform nonlinear regression on the data.
6. Choose **OK**.
7. In the **Single Model Regression Setup** window, choose the equation "a*x^2+b*x+c" by clicking on it, then click the solve button.
8. Once the solution is complete, choose **File|Save** and name the file "test1.dft".
9. Repeat steps 1 through 7 for the second Y data set. You can save this file as well if you wish.
10. In the regression window containing data set 2 (this should be the active window at this point), click on the second order polynomial in the list (it should become highlighted) and select **Plot|New** from the menu. This will bring up a plot of the second data set.

11. Now, it's time to import the first data set. With the plot you just created as the active window, choose **Plot|Import.** Make sure the **File Type** in the **File Open Dialog** is a DataFit Solution File (*.dft) and find and open the file you saved earlier as "test1.dft".
12. You will be shown a list of input data and equations that were solved in this project. Since only one model was solved, there are only two items in the list, as shown in the following image. You can select any of all of the items in the list. Since we are comparing two different models, select both items in the list.



13. The newly imported data will show up in the current plot window. By default, the file name will be attached to the default legends, so that you can differentiate the curves and data. Remember, you can change the legend text to whatever you want.
14. The plot window should now look like the following:



Note: You can import solution files other plot files, and/or raw data into the current plot window by importing them as shown in this tutorial. You are not just limited to 2 data sets as you can import as many as you want. This feature is also useful for regressions performed after breaking up the input data. Suppose you had a curve with a very complex shape that cannot be modeled with a single equation, you could break the data up into regions, solve them, and import all of the "region" solutions into a single plot.

DataFit 2D Tutorial

Step 1 - Getting Started
Step 2 - Entering the Data
Step 3 (optional) - Plotting the Input Data
Step 4 - Regression Setup
Step 5 - Viewing the Results Numerically
Step 6 - Viewing the Results Graphically
Step 7 (optional) - Formatting Plots
Step 8 (optional) - Working with the Data Calculator
Step 9 (optional) - Presentation Graphics

DataFit 3D Tutorial

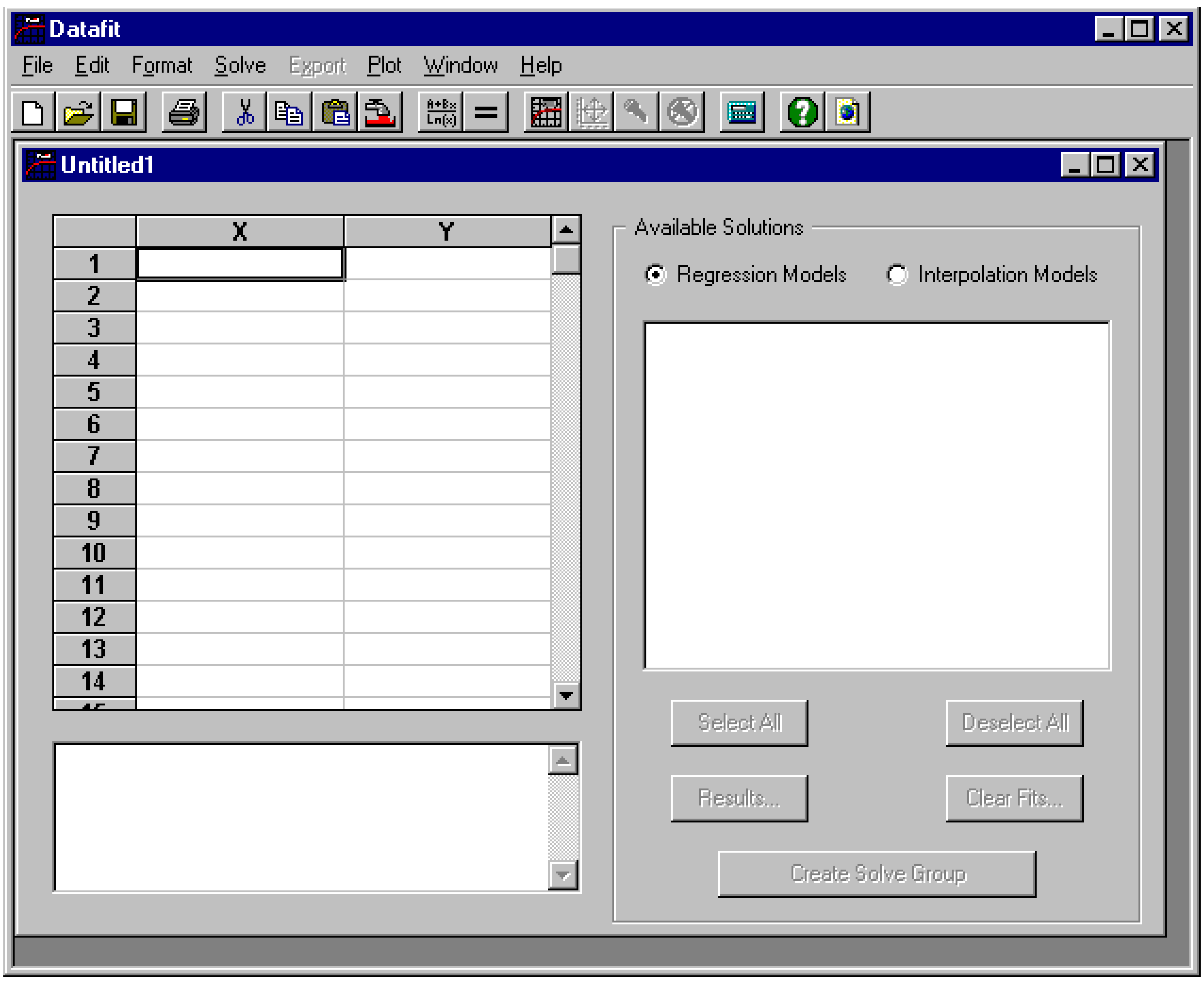
Step 1 - Getting Started
Step 2 - Entering the Data
Step 3 (optional) - Plotting the Input Data
Step 4 - Defining a User Model
Step 5 - Regression Setup
Step 6 - Viewing the Results Numerically
Step 7 - Viewing the Results Graphically
Step 8 (optional) - Formatting Plots
Step 10 (optional) - Presentation Graphics

Step 1 - Getting Started (2D Tutorial)

To begin the 2D tutorial, follow this procedure:

1. Choose **File|New**. This will bring up the **New Project** Window.
2. Choose **Single Independent Variable** under the **New Project Type** area.
3. Under **Spreadsheet Setup**, make sure that **Show Standard Deviation** is left unchecked. The **Number of Independent Variables** box will be disabled.
4. Click on **OK**. The new project window will appear.

Your screen should look like the following image:



On to Step 2 - Entering the Data

Step 2 - Entering the Data (2D Tutorial)

Data can be entered into the DataFit spreadsheet a number of ways. The user can type the data in directly, import the data from a file, or cut and paste the data into the spreadsheet. The data for this example is in the file Tutor2D.dat, and is shown below:

X	Y
0.2	45
0.35	20
0.35	80
0.4	60
0.5	135
0.6	120
0.7	200
0.85	220
0.85	290
0.9	300
1	375
1.1	460
1.2	400
1.2	500
1.3	520
1.35	580
1.4	640
1.4	700
1.55	850
1.6	910

*Note: The first column labeled **X** will contain the data for the independent variable. The second column, labeled **Y**, will contain the data for the dependent variable If you select **Show Standard Deviation Column** in the **New Project** window, you would also see a third column labeled **StDev** This column in the spreadsheet represents the standard deviation of the measured Y data. If your measurement error is known, or you would like to weight the data, you would enter this data into the **StDev** column. This data can be entered in the same manner as the X and Y data. There are also features in the software which let you fill ranges of cells with functional sweeps, linear sweeps or constant values, which is typically the case for standard deviation data. For more information on this, see the help topic <u>Fill (Edit Menu).</u>*

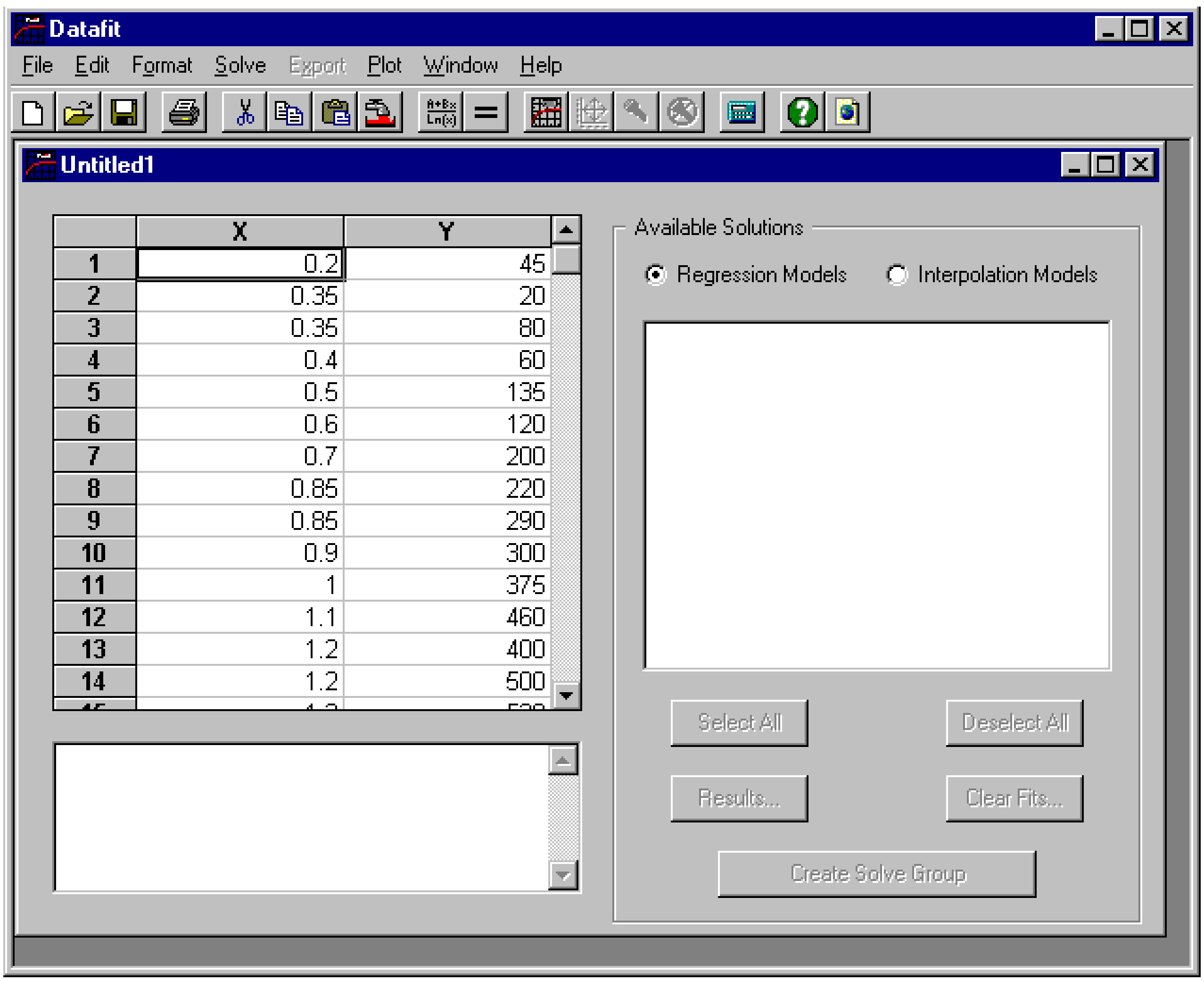
1. You can type this data in, or better yet, import it into the spreadsheet. Choose **File|Import**, and open the file Tutor2D.dat.
2. In Step 1 of the **Import Wizard**, leave **Start Importing at Row** set at 1, and just click the **Next** button.
3. In Step 2 of the **Import Wizard**, click **Tab Delimited** so that it is checked. The

data should appear in two columns. Click the **Finish** button.

4. The data should appear in the spreadsheet as shown below.

Note: When typing in data, the Enter key moves the current cell to the next row, while the Tab key moves the current cell to the next column. This makes it easy to enter data either by row, or by column. There are also features in the software which let you fill ranges of cells with functional sweeps, linear sweeps or constant values, which may be helpful in hand entering data. For more information on this, see the help topic Fill (Edit Menu).

Your screen should look like the following image:

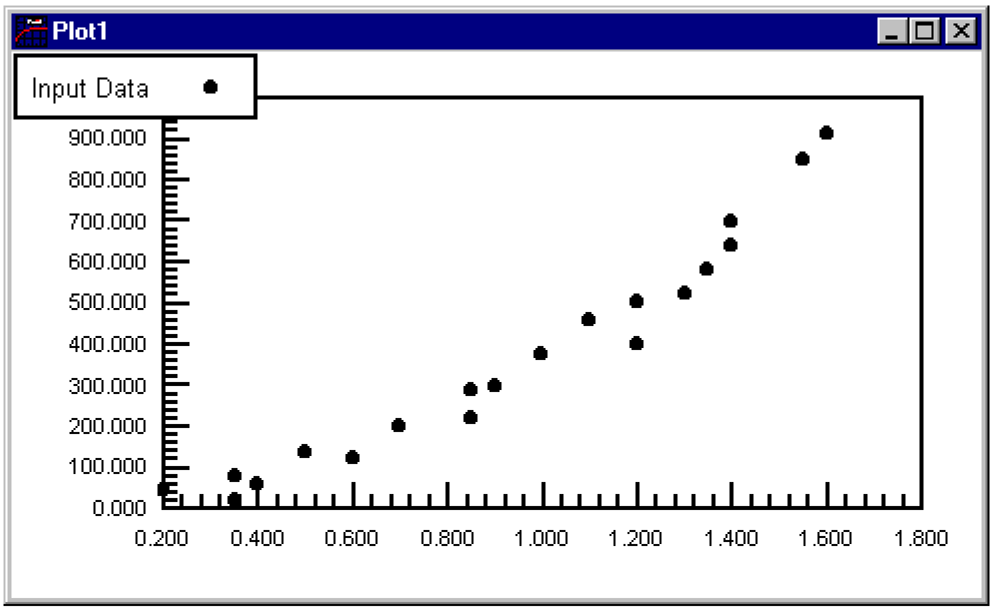


On to Step 3 (optional) - Plotting the Input Data
On to Step 4 - Solution Setup

Step 3 (optional) - Plotting the Input Data (2D Tutorial)

Data can be plotted from the spreadsheet and/or fitted models at any time. Since we have not performed any regression analysis yet, we can plot only the entered data.

1. Choose **New** from the DataFit **Plot** menu. A plot window will appear, showing the entered data as discreet points (markers). The unformatted plot should appear as shown below.



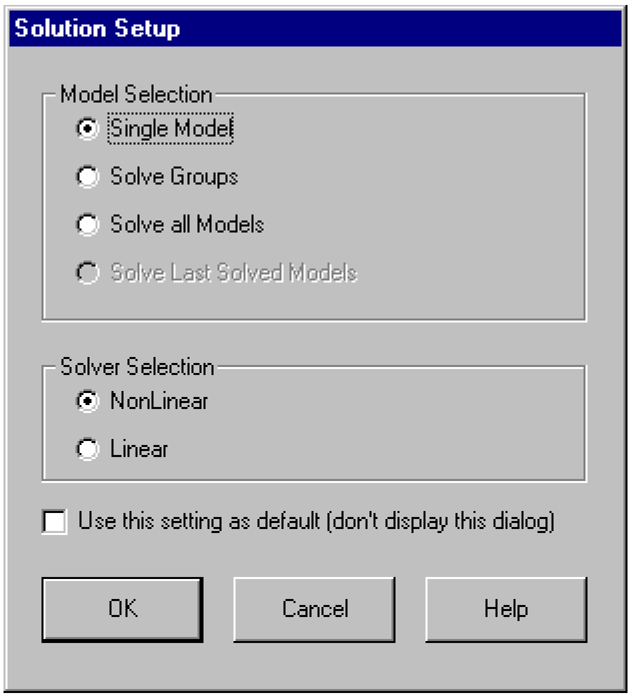
Note: Plots can be completely formatted to your taste, including fonts, titles, legends, line styles, et. If you are interested only in plotting data, you can skip on to Step 7 - Formatting Plots.

On to Step 4 - Regression Setup
On to Step 7 - Formatting Plots

Step 4 - Regression Setup (2D Tutorial)

Now we can move on to doing the regression setup. If you completed step 3, make sure the regression window is the active window.

1. Choose **Regression...** from the **Solve** menu. This will bring up the **Solution Setup** window as shown below.



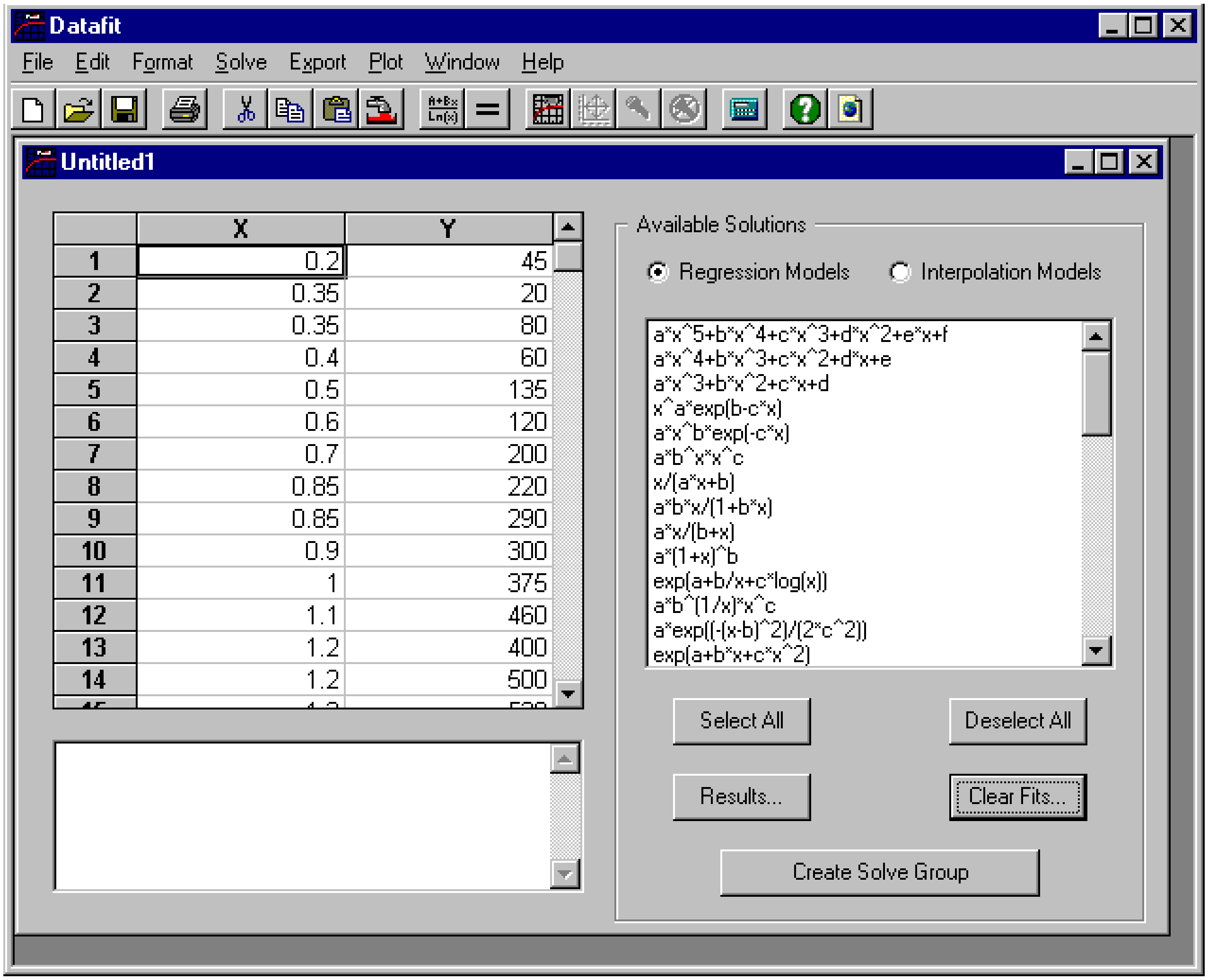
*Note: If a different window other than the Solution Setup window comes up, you have unchecked Prompt for Solution Setup in the **Solve** menu. This allows repeated analysis to be performed without prompting the user each time for the type of analysis. If you do not see the Solution Setup window as shown above, press **Cancel** from the current window, re-check Prompt for Solution Setup (by clicking on it, the check mark will re-appear), and start again at step (a) above.*

2. In the **Model Selection** area of the **Solution Setup** window, choose **Solve all Models**. This will tell the solver to solve all of the built in and user defined models automatically.
3. In the **Solver Selection** area, choose the **Nonlinear** solver. This will tell the solver to perform nonlinear regression on the data.
4. Choose **OK**. The solver will commence solving all of the models. A progress indicator will become visible in order to show the solution progress. You will be informed when the solution process has completed.

Note: For more information on solution methods, see the help topic Regression Theory

(Nonlinear and Linear Models).

5. When you are returned to the regression window after the solution process has completed, the window will appear as shown below. All of the models which solved successfully will appear in the **Available Solutions** area, sorted in order of best fit to worst fit.



6. At this point in time, you may want to save the solution.

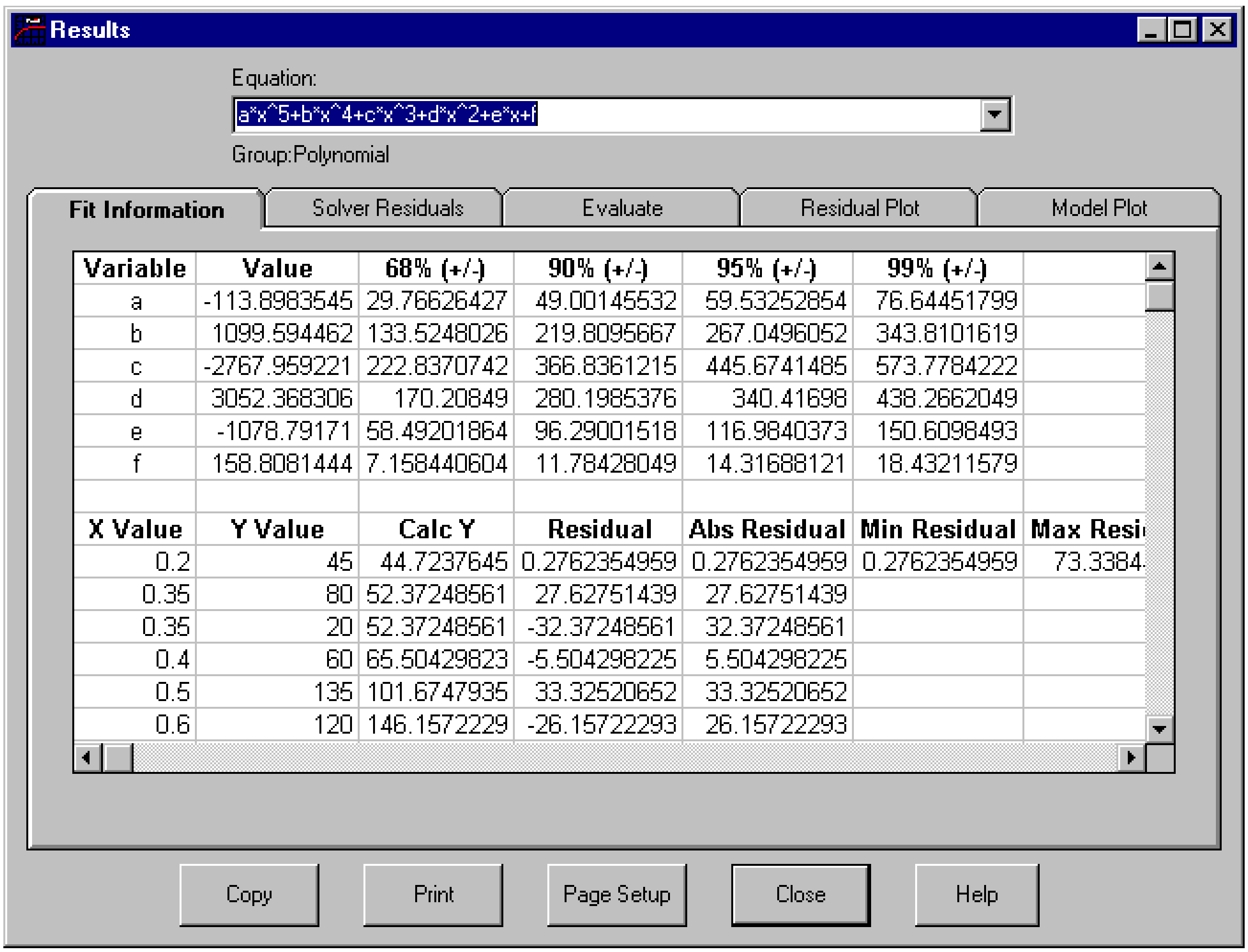
On to Step 5 - Viewing the Results Numerically
On to Step 6 - Viewing the Results Graphically

Step 5 - Viewing the Results Numerically (2D Tutorial)

Results can be viewed both graphically and numerically.

Note: If you are interested only in viewing the results graphically, you can skip on to <u>*Step 6 - Viewing the Results Graphically*</u>.

1. Click on **Results...** in the **Available Solutions** area. This will bring up the **Results** window as shown below.



2. At the top of the **Results** window, there is a Drop Down list box which contains all of the solved models, again listed in order of goodness of fit. By default, either the best fit results are shown, or the first model selected in the **Available Solutions** list is shown.. To change the model you wish to investigate, click of the drop down list and select a different model.
3. The **Results** window is broken up into five different Tabbed dialogs. To switch between the different Tabs, click on the appropriate Tab at the top (on the text).

a) **Fit Information:** Shows the calculated coefficients for each variable, or parameter, in the model. This Tab also shows the confidence intervals for each parameter, as well as the Residual Sum of Squares (RSS), Residual Standard Deviation (RSD), Correlation Coefficient (R^2), Standard Error (StdErr) and a table of entered vs. estimated data. If ranges were set up as initial conditions, each enumerated solution from the range setup will be listed.
b) **Solver Residuals:** Shows the Merit Function for each Nonlinear iteration.
c) **Evaluate:** This allows you to evaluate the equation at any value of the independent variable(s) X. It also calculated the derivatives for each variable, or parameter, at the entered value(s) of X.
) **Residual Plot:** Shows a plot of the residuals (Entered Y - Calculated Y) for each point in the data set.
e) **Model Plot:** Shows a plot of the solved model along with the input data for previewing.

Note: For more information on interpreting the results, see the help topic Interpreting the Results.

On to Step 6 - Viewing the Results Graphically

Step 6 - Viewing the Results Graphically (2D Tutorial)

Plots can be created of the entered data and include any of the fitted models.

1. For this example, we are not interested in the polynomial models. Clear them from the solution by selecting the first three polynomials that appear in the **Available Solutions** area by clicking the mouse on them. Choose Clear Fits. Since models were selected in the list, **Clear Selected Fits** is the default choice. Select **OK**, and return to the main window.

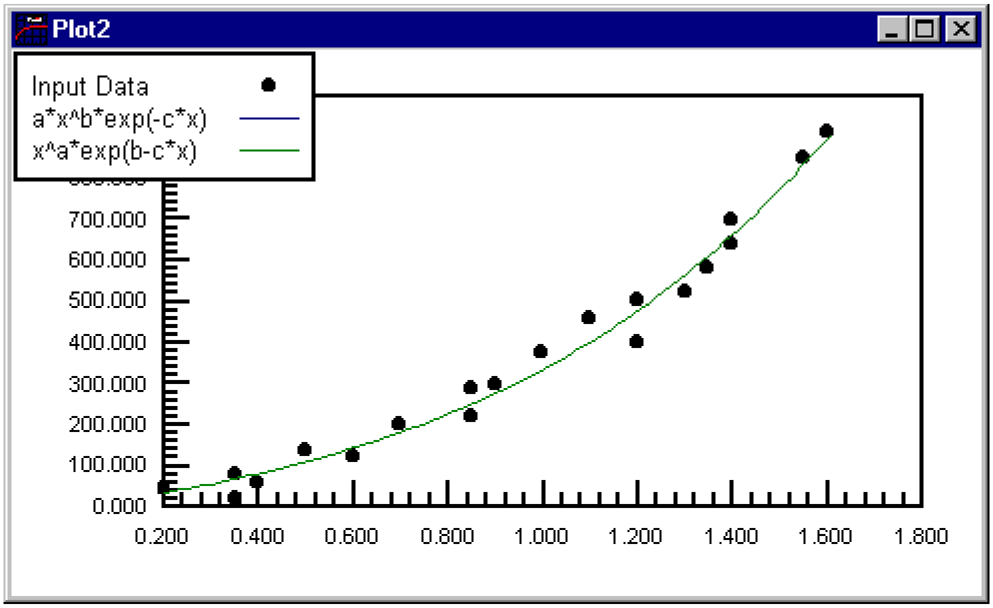
Note: When items are selected in the list, they will appear highlighted. To multi-select models listed consecutively, click and drag the mouse through the list. To select models that are not consecutively listed, hold down the Control key on the keyboard while clicking the mouse on individual models.

2. In the **Available Solutions** area, select the models you wish to plot from the list by clicking on them. For this example, plot the two best fitting models (once the polynomials have been removed) by selecting the first two models listed.

Note: Avoid plotting all of the solved models at once, especially if there a number of them, as there will be too much information on the plot to decipher, and it may take some time to generate the plot if there is a large amount of entered data points..

3. Select **New** from the **Plot** menu. The resulting plot of the entered data and the two best fitting models will appear. By default, the entered data will appear as discreet data points (markers only), while the equations will appear as continuous lines. The resulting plot should look like the following.

*Note: If you want to plot only the entered data, Click on **Deselect All** in the **Available Solutions** area to de-select all of the models in the list. With no models selected, only the entered data will be plotted.*



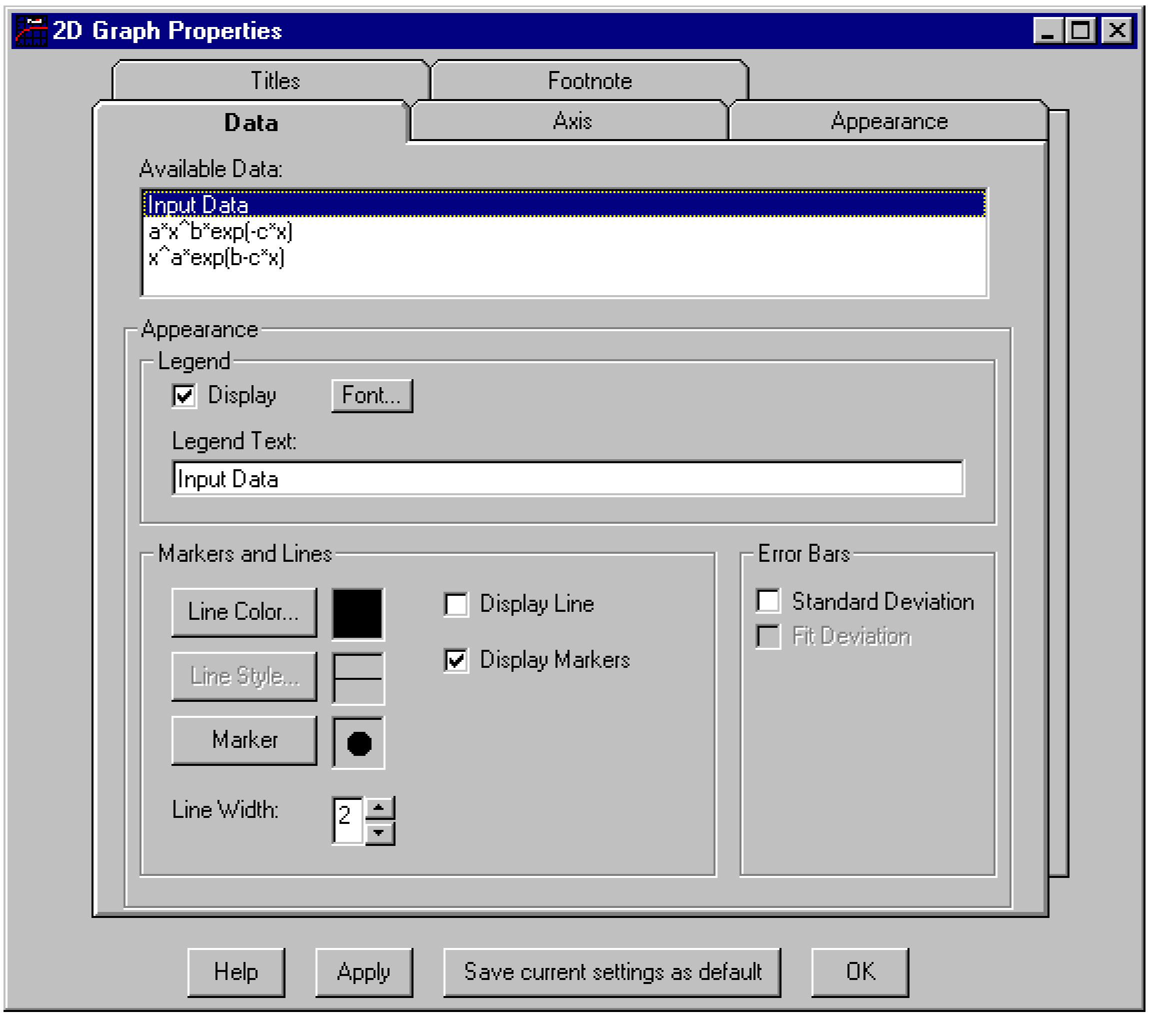
On to Step 7 (optional) - Formatting Plots
On to Step 8 (optional) - Working with the Data Calculator
On to Step 9 (Optional) - Presentation Graphics

Step 7 (optional) - Formatting Plots (2D Tutorial)

Plots can be formatted in a number of ways. In this example, you will customize the look of the plot by adding titles, footnote text, and editing the legend.

1. With the plot generated in the previous step as the active window, choose **Format Properties...** from the **Plot** menu. This will bring up the Graph Properties window.

Note: The Graph Properties window is broken up into different Tabbed dialogs. To switch between the different Tabs, click on the appropriate Tab at the top (on the text).

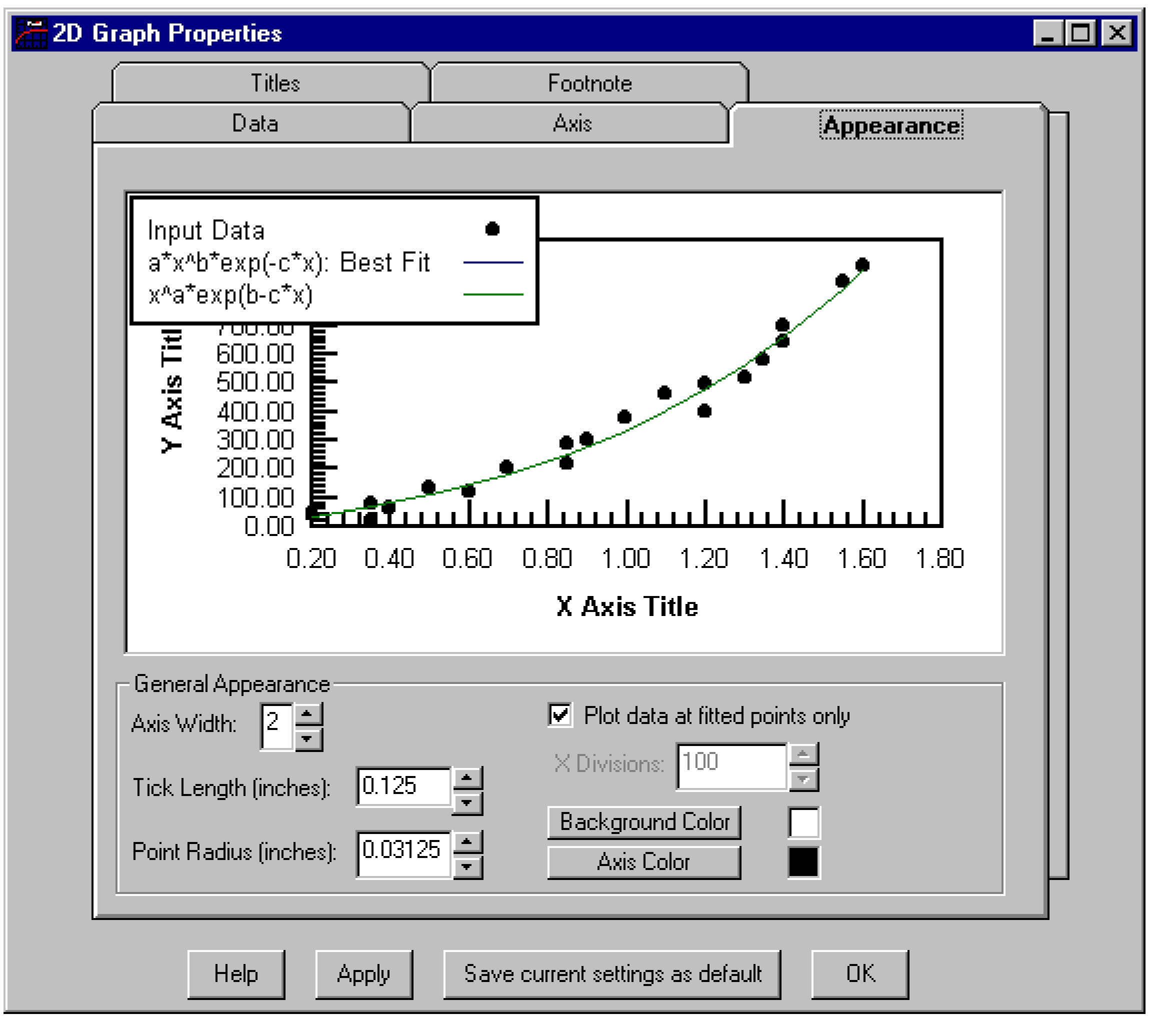


2. First, add a Title to the X Axis. Click on the **Titles** tab to make it the active tab. In the **X Axis Title** area, click on the text box and type in the X axis title you wish to appear on the plot.

*Note: You can change the font appearance, size and color of any text font appearing on a plot by clicking on the **Font...** button next to the text box.*

3. Repeat the same process for the Y Axis. In the **Y Axis Title** area, click on the text box and type in the Y axis title you wish to appear on the plot.
4. Click on the **Data** tab to make it the active tab. The legend text for each line in the plot is displayed in the **Available Data** list. Click on the first equation listed (below Input Data), and all of the line information pertaining to that equation will appear.
5. In the **Appearance** area, click in the text box containing the legend text. Next to the equation, type "Best Fit".
6. Now, let's preview the changes we've made so far. Click on the **Apply** button at the bottom of the window. This will apply the changes we've made to the plot. Then, click on the **Appearance** Tab and the plot should look similar to the following.

*Note: The **Apply** button cycles through all of the tab's settings and applies all of the changes simultaneously.*



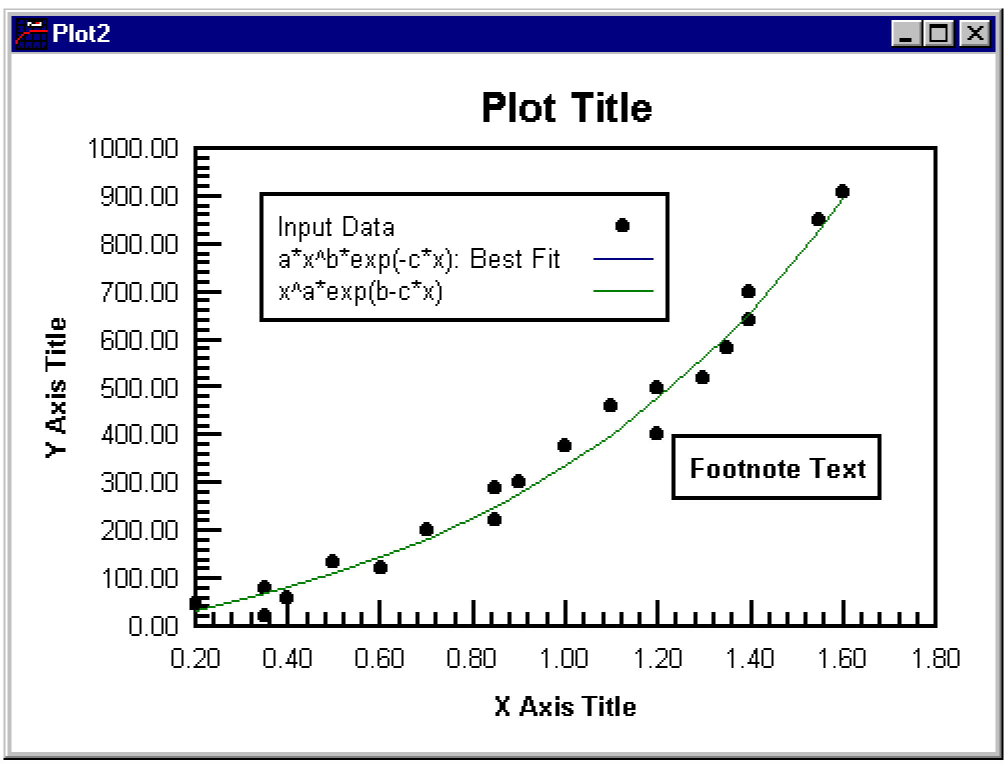
7. Add a title to the plot by clicking again on the **Titles** tab. Enter the Plot Title the same way you did for the X and Y axis titles.
8. Add a footnote to the plot by clicking on the **Footnote** tab. Check the **Display Footnote** check box by clicking on it. Type "Footnote Text" in the text box. Leave the **Alignment** option set to **Center**, and **Show Rectangle** checked.

Note: As you can see, there are many formatting options for plots, however this tutorial will just give you a general idea of how the formatting works and will not cover each option in detail. For more information on formatting plots, see the help topic Formatting Plots.

9. Exit the Graph Properties window by clicking **OK**, and you will be returned to the plot window.

Note: If you made changes and did not apply them as we just did in step (g), you will be prompted to apply or ignore uncommitted changes. For more information on formatting plots, see the help topic Formatting Plots.

10. You can move the legend and footnote text around on the plot by clicking within its border. While holding the left mouse button down, drag the text object and place it wherever you like. The final plot should look similar to the following:



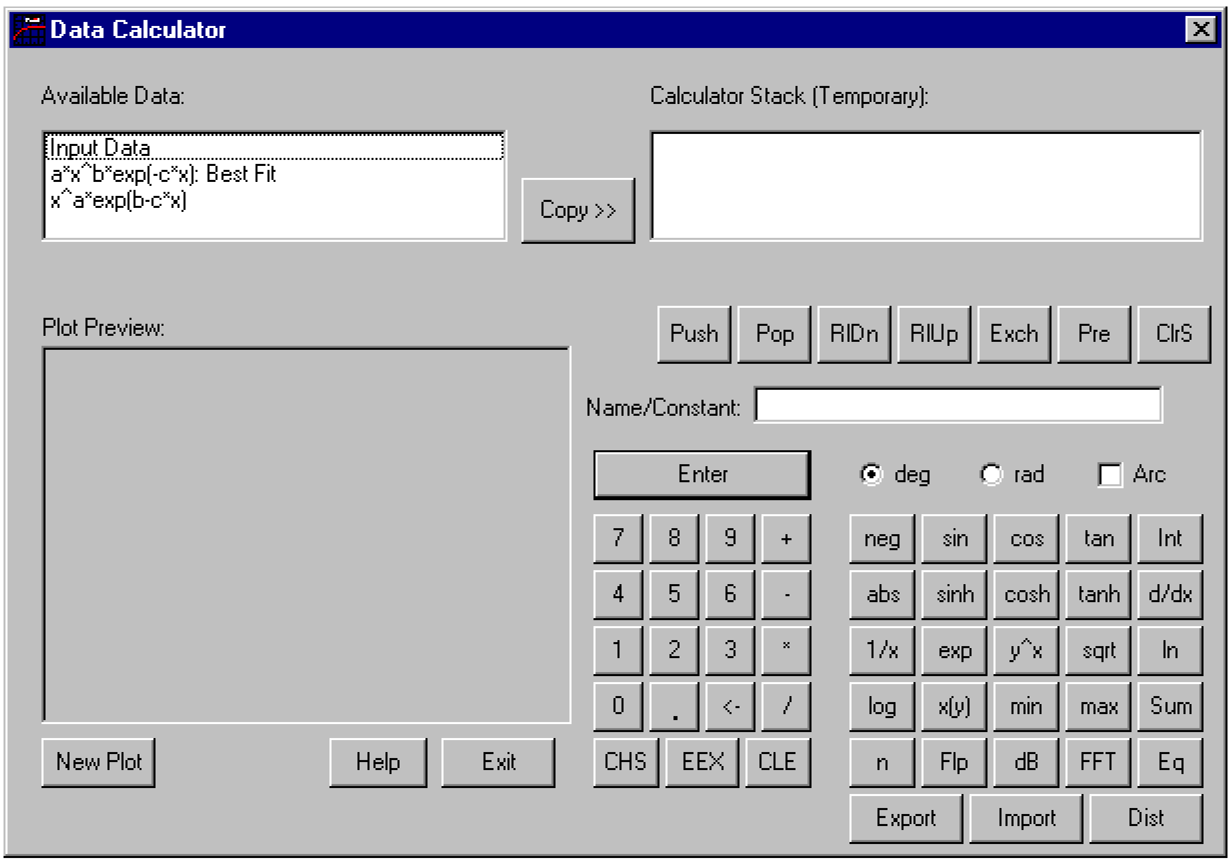
On to Step 8 (optional) - Working with the Data Calculator
On to Step 9 (optional) - Presentation Graphics

Step 8 (optional) - Working with the Data Calculator (2D Tutorial)

The Data Calculator allows you to perform numerical manipulation of raw data, or fitted models.

1. With a plot window the current window, choose **Calculator** from the **Plot** menu. The calculator will appear as shown below.

Note: If the calculator is brought up from a regression window, there will be no data in the ***Available Data*** *list. If the calculator is brought up from a plot window, all of the data from the plot will be visible in the* ***Available Data*** *list. To get data into the calculator without performing regression, you can import data directly into the calculator, or first create a plot and bring up the calculator from the newly created plot window.*

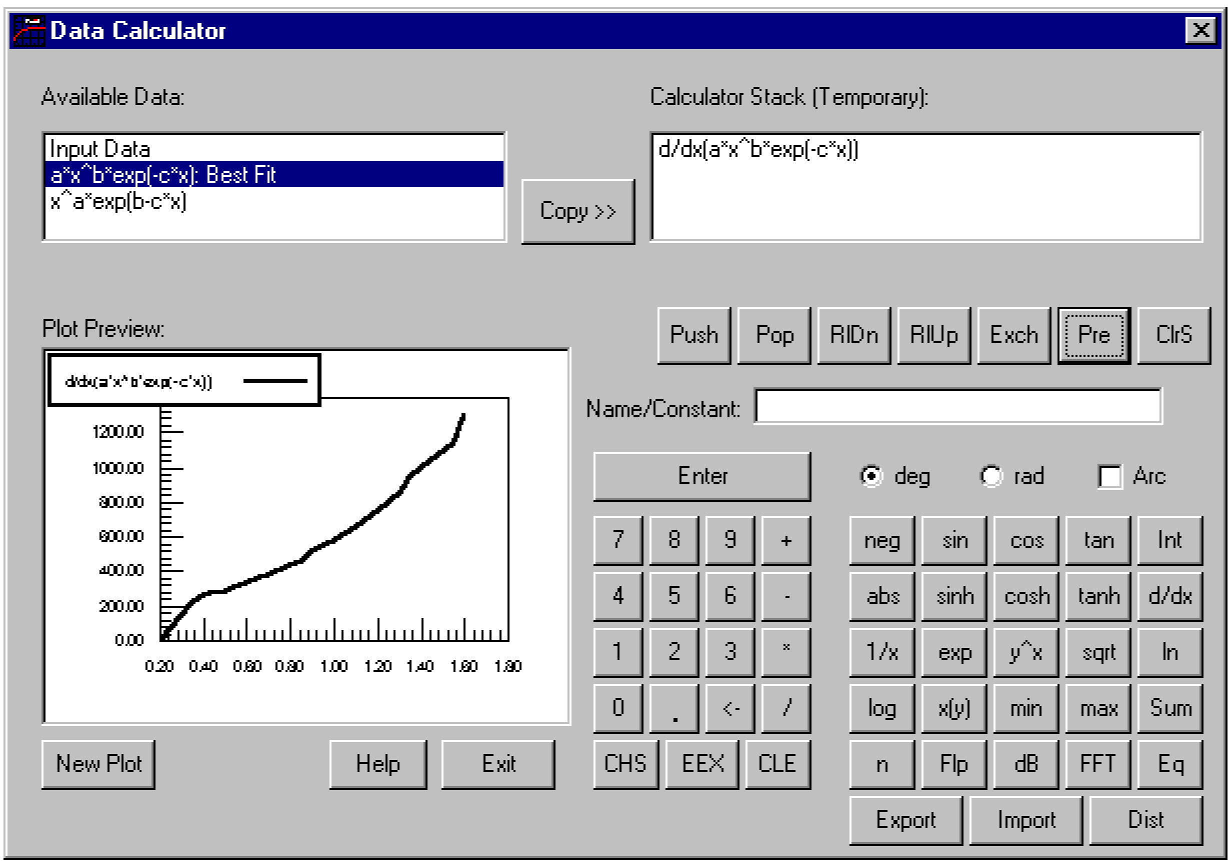


2. The **Available Data** list shows data copied from the plot window from which the calculator was launched. To manipulate data, you must first copy it to the calculator stack. To do this, select the data of interest in the **Available Data** list and click the **Copy** button. You can select any number of data items from the list. For this example, select the Best Fit model. Once you have clicked the Copy button, the Best Fit model will appear in the **Calculator Stack.**

Note: When items are selected in the list, they will appear highlighted. To multi-select data listed consecutively, click and drag the mouse through the list. To select data that are not consecutively listed, hold down the Control key on the keyboard while clicking the mouse on individual data.

3. For this example, let's take the derivative of the Best Fit model. Click on the **d/dx** button (bottom right corner of the calculator window, second row of buttons on the far right). The calculator 'pops' the data from the stack, performs the derivative operation on the Y data, then 'pushes' the result back on the stack. You can preview manipulated data by clicking on the **Pre** button (directly beneath the **Calculator Stack** list, second button from the right). The calculator should appear as shown below.

Note: The calculator is a stacked based, RPN notation calculator (similar to an HP hand held calculator). You can perform a number of various common manipulations on the data. For a detailed description of the functionality of each of the buttons, see the help topic *Data Calculator.*



4. Create a new plot window from the calculator by clicking on the **New Plot** button (bottom left corner of the calculator). Any data that is selected in the Calculator Stack will be copied to the new plot window. The calculator will close, and the new plot window will appear.

Note: Any data that is left in the ***Calculator Stack*** *will be lost, unless it is included in the new plot, or exported to a file. Any data that was used and manipulated in the calculator will remain the property of the plot window from which the calculator was launched and will remain unaltered.*

On to Step 9 (optional) - Presentation Graphics

Step 9 (optional) - Presentation Graphics (2D Tutorial)

DataFit has the capability of creating plots to be used for quality presentations. There a few different ways of creating presentation graphics.

1. You can copy an enhanced metafile to the Windows Clipboard for pasting into another application, such as Microsoft Word or Microsoft Powerpoint. Make a plot window the active window, then select **Copy as Enhanced Metafile** from the **Plot** menu. This generates a device independent vector based picture which will retain its quality when resized. The image can be pasted into another application.
2. You can create an enhanced metafile and save it to disk. This generates a device independent vector based picture which will retain its quality when resized. Make a plot window the active window, then select **Save As...** from the **Plot** menu. Choose Enhanced Metafile as the file format, and give the file the default enhanced metafile file extension '*.emf'. The file can then be read by presentation software which supports enhanced metafiles.
3. You can copy a bitmap of the image to the Windows Clipboard for pasting into another application if the application does not support enhanced metafiles. Make a plot window the active window, then select **Copy as Bitmap** from the **Plot** Menu. Mostly all presentation software support bitmaps.

Note: For more information on enhanced metafiles, see the help topic Save, Save As... (File Menu), or consult the documentation provided with the presentation software.

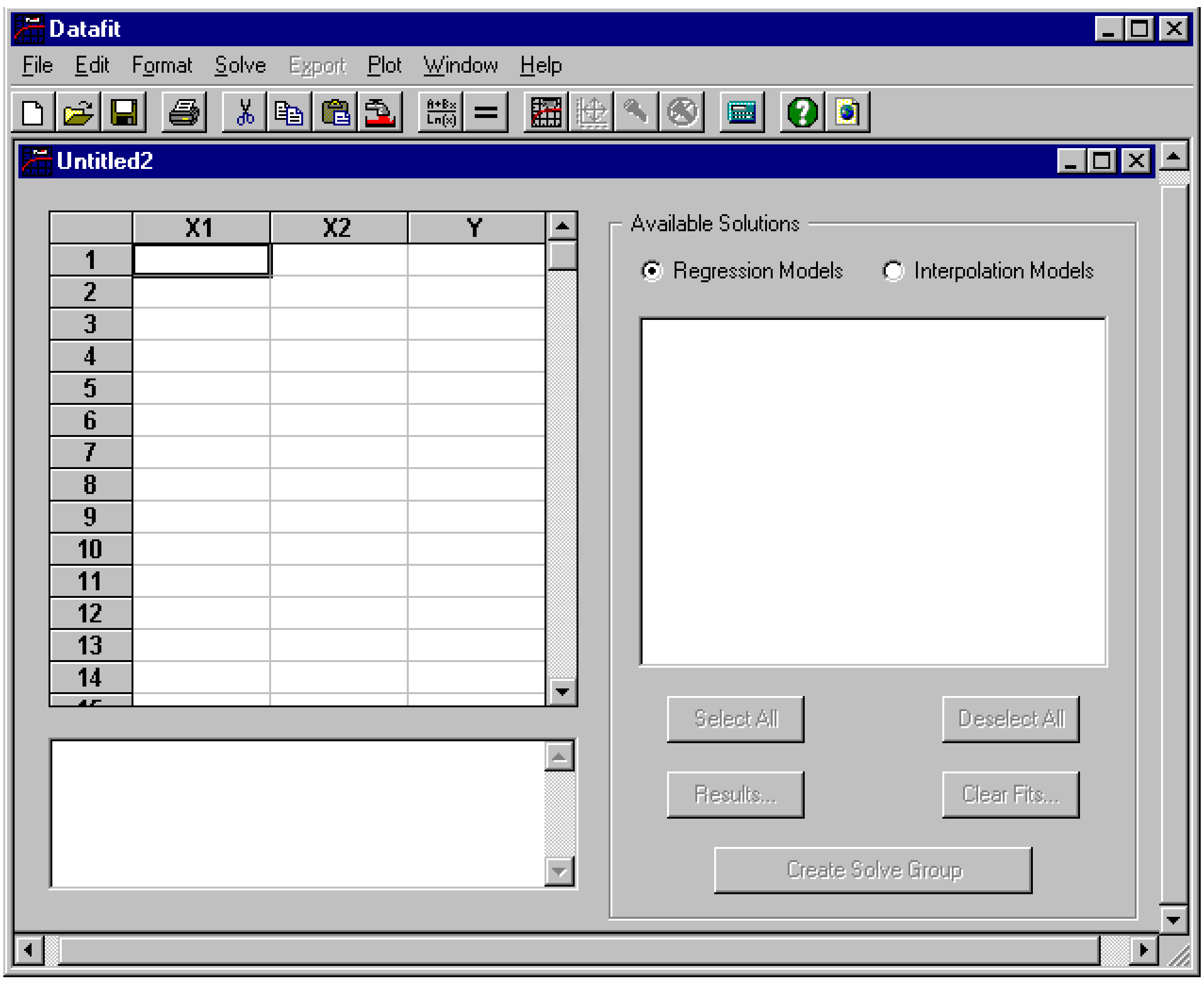
Return to Beginning

Step 1 - Getting Started (3D Tutorial)

To begin the 3D tutorial, follow this procedure:

1. Choose **File|New**. This will bring up the **New Project** Window.
2. Choose **Multiple Independent Variable** under the **New Project Type** area.
3. Under **Spreadsheet Setup**, make sure that **Show Standard Deviation** is left unchecked, and the **Number of Independent Variables** is set to 2.
4. Click on **OK**. The new project window will appear.

This is all you need to do to begin the tutorial. Step 2 begins with entering the data into the spreadsheet. So far, your screen should look like the following:



On to Step 2 - Entering the Data

Step 2 - Entering the Data (3D Tutorial)

Data can be entered into the DataFit spreadsheet a number of ways. The user can type the data in directly, import the data from a file, or cut and paste the data into the spreadsheet. The data for this example is in the file Tutor3D.dat, and is shown below:

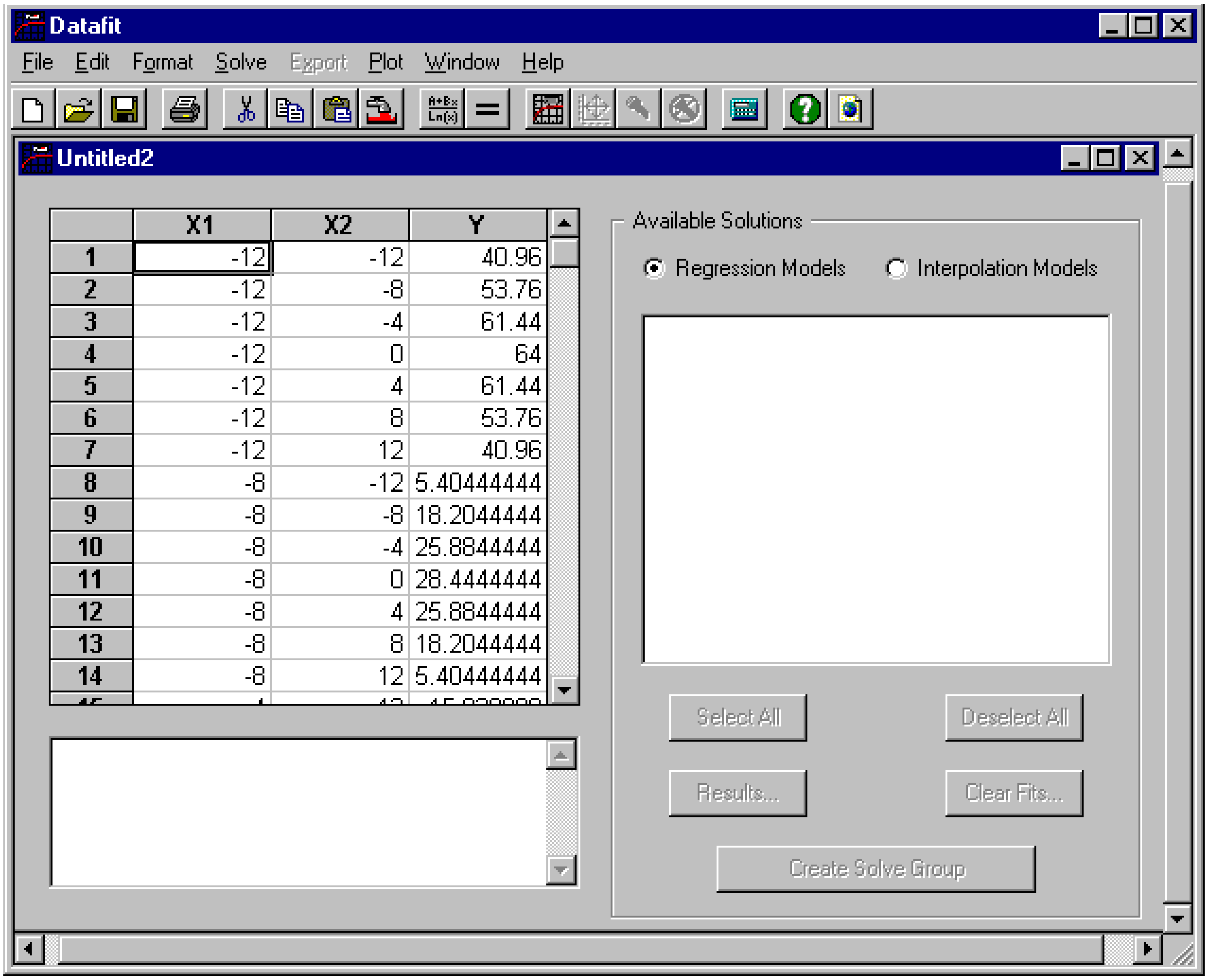
X1	X2	Y
-12	-12	40.96
-12	-8	53.76
-12	-4	61.44
-12	0	64
-12	4	61.44
-12	8	53.76
-12	12	40.96
-8	-12	5.404444444
-8	-8	18.20444444
-8	-4	25.88444444
-8	0	28.44444444
-8	4	25.88444444
-8	8	18.20444444
-8	12	5.404444444
-4	-12	-15.92888889
-4	-8	-3.128888889
-4	-4	4.551111111
-4	0	7.111111111
-4	4	4.551111111
-4	8	-3.128888889
-4	12	-15.92888889
0	-12	-23.04
0	-8	-10.24
0	-4	-2.56
0	0	0
0	4	-2.56
0	8	-10.24
0	12	-23.04
4	-12	-15.92888889
4	-8	-3.128888889
4	-4	4.551111111
4	0	7.111111111
4	4	4.551111111
4	8	-3.128888889
4	12	-15.92888889
8	-12	5.404444444
8	-8	18.20444444

8	-4	25.88444444
8	0	28.44444444
8	4	25.88444444
8	8	18.20444444
8	12	5.404444444
12	-12	40.96
12	-8	53.76
12	-4	61.44
12	0	64
12	4	61.44
12	8	53.76
12	12	40.96

*Note: The first column labeled **X1** will contain the data for the first independent variable. The second column, labeled **X2**, will contain the data for the second independent variable. The third column, labeled **Y**, will contain the data for the dependent variable If you select **Show Standard Deviation Column** in the **New Project** window, you would also see a fourth column labeled **StDev** This column in the spreadsheet represents the standard deviation of the measured Y data. If your measurement error is known, or you would like to weight the data, you would enter this data into the **StDev** column. This data can be entered in the same manner as the X and Y data. There are also features in the software which let you fill ranges of cells with functional sweeps, linear sweeps or constant values, which is typically the case for standard deviation data. For more information on this, see the help topic Fill (Edit Menu).*

1. You can type this data in, or better yet, import it into the spreadsheet. Choose File|Import, and open the file Tutor3D.dat.
2. In Step 1 of the **Import Wizard**, leave **Start Importing at Row** set at 1, and just click the **Next** button.
3. In Step 2 of the **Import Wizard**, click **Tab Delimited** so that it is checked. The data should appear in three columns. Click the **Finish** button.
4. The data should appear in the spreadsheet as shown below.

Note: When typing in data, the Enter key moves the current cell to the next row, while the Tab key moves the current cell to the next column. This makes it easy to enter data either by row, or by column. There are also features in the software which let you fill ranges of cells with functional sweeps, linear sweeps or constant values, which may be helpful in hand entering data. For more information on this, see the help topic Fill (Edit Menu).

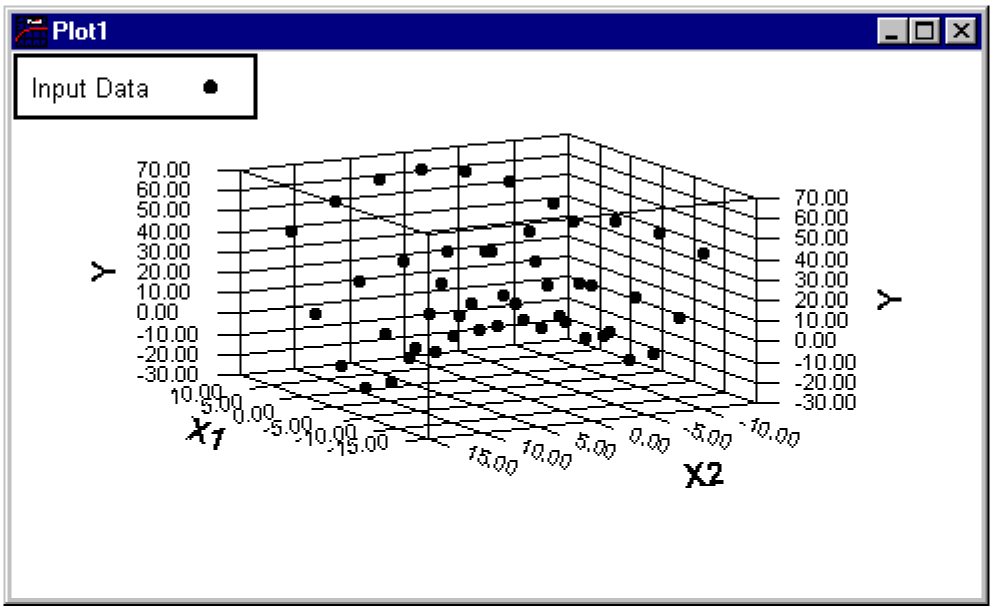


On to Step 3 (optional) - Plotting the Input Data
On to Step 4 - Defining a User Model

Step 3 (optional) - Plotting the Input Data (3D Tutorial)

Data can be plotted from the spreadsheet and/or fitted models at any time. Since we have not performed any regression analysis yet, we can plot only the entered data.

1. Choose **New** from the DataFit **Plot** menu. A plot window will appear, showing the entered data as discreet points (markers). The plot should appear as shown below.



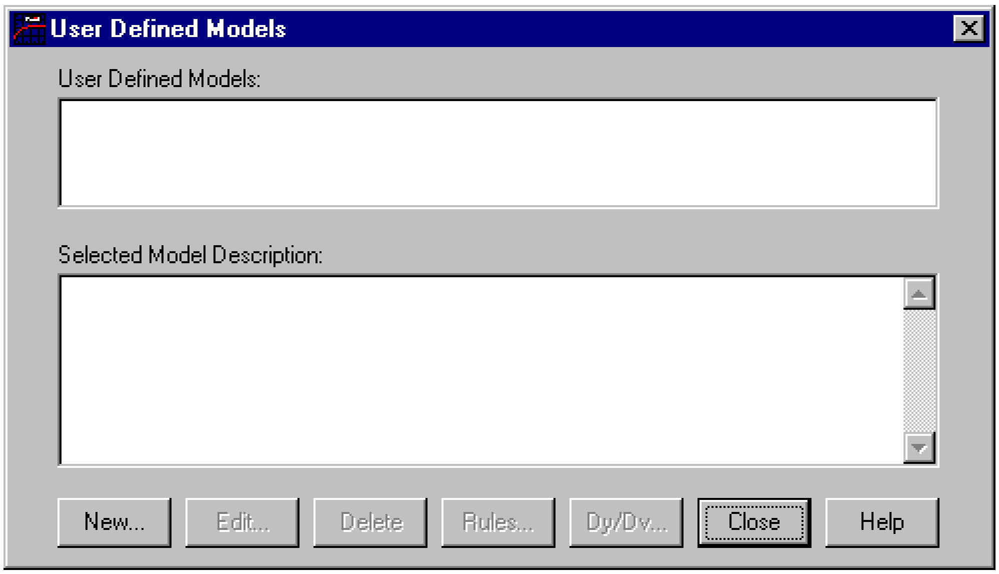
Note: Plots can be completely formatted to your taste, including fonts, titles, legends, line styles, et. If you are interested only in plotting data, you can skip on to <u>Step 7 - Formatting Plots</u>.

<u>On to Step 4 - Defining a User Model</u>
<u>On to Step 7 - Formatting Plots</u>

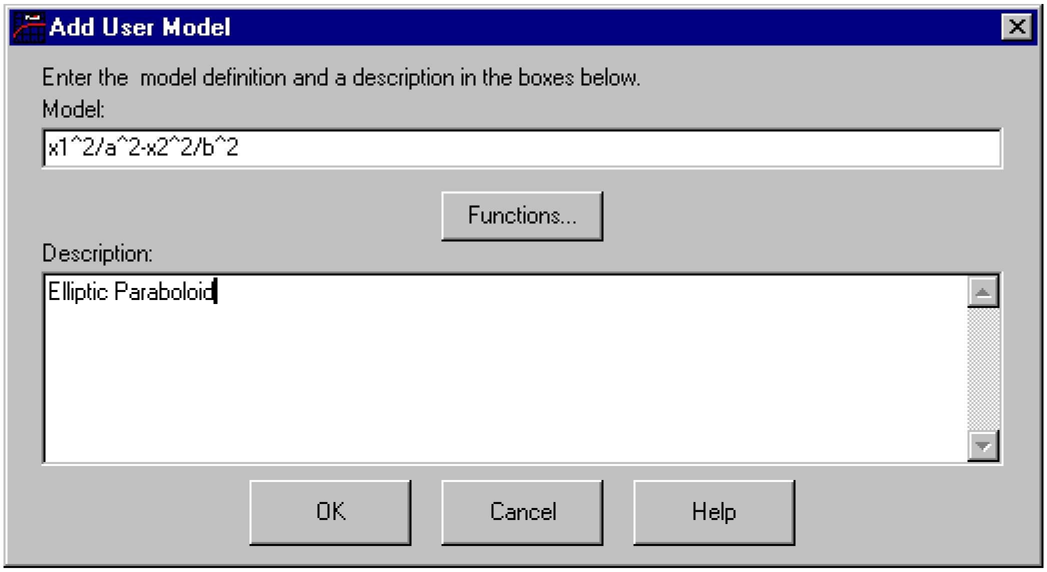
Step 4 - Defining a User Model (3D Tutorial)

There are over 100 3D models built into DataFit, however this tutorial will show you how to define a User Defined Model. You can define as many user defined models as you like, at any time, and they will be saved in an equation database for future use.

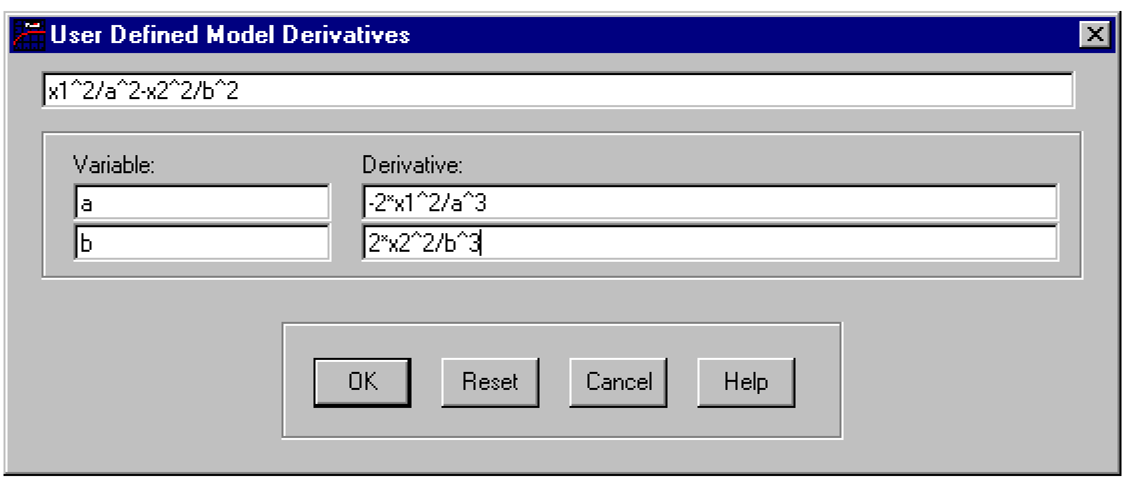
1. If you plotted the input data, either close the plot window or bring the regression window to the front by clicking on it or choosing it under the **Window** menu.
2. In the **Solve** Menu, Choose **Define User Model**. The **User Defined Model** window will appear as shown below.



3. In the **User Defined Model** window, Click **New**. This will bring up the **Add User Model** window to allow you to edit and define your model.
4. In the **Model** text box, type in the following equation: x1^2/a^2 - x2^2/b^2. This model defines an elliptic paraboloid, which you can type into the **Description** text box. The **Add User Model** window should appear as shown below:



5. Choose **OK** to close the window. The equation will be automatically saved and entered into the database.
6. (*OPTIONAL*) Once you are back to the Define User Model window, make sure the model you just entered is selected in the list and choose **Dy/Dv**. This will bring up the **User Defined Model Derivatives** window to allow you to define the derivatives for the variables in the equation. Enter the derivatives for each variable as shown in the following table:
   - The derivative of the equation with respect to variable a is: -2.0*x1^2/a^3
   - The derivative of the equation with respect to variable b is: 2.0*x2^2/b^3



7. Choose **OK**, you will be returned to the **Define User Model** window.
8. Choose **Close** in the **Define User Model** window, you will be returned to the DataFit main window.

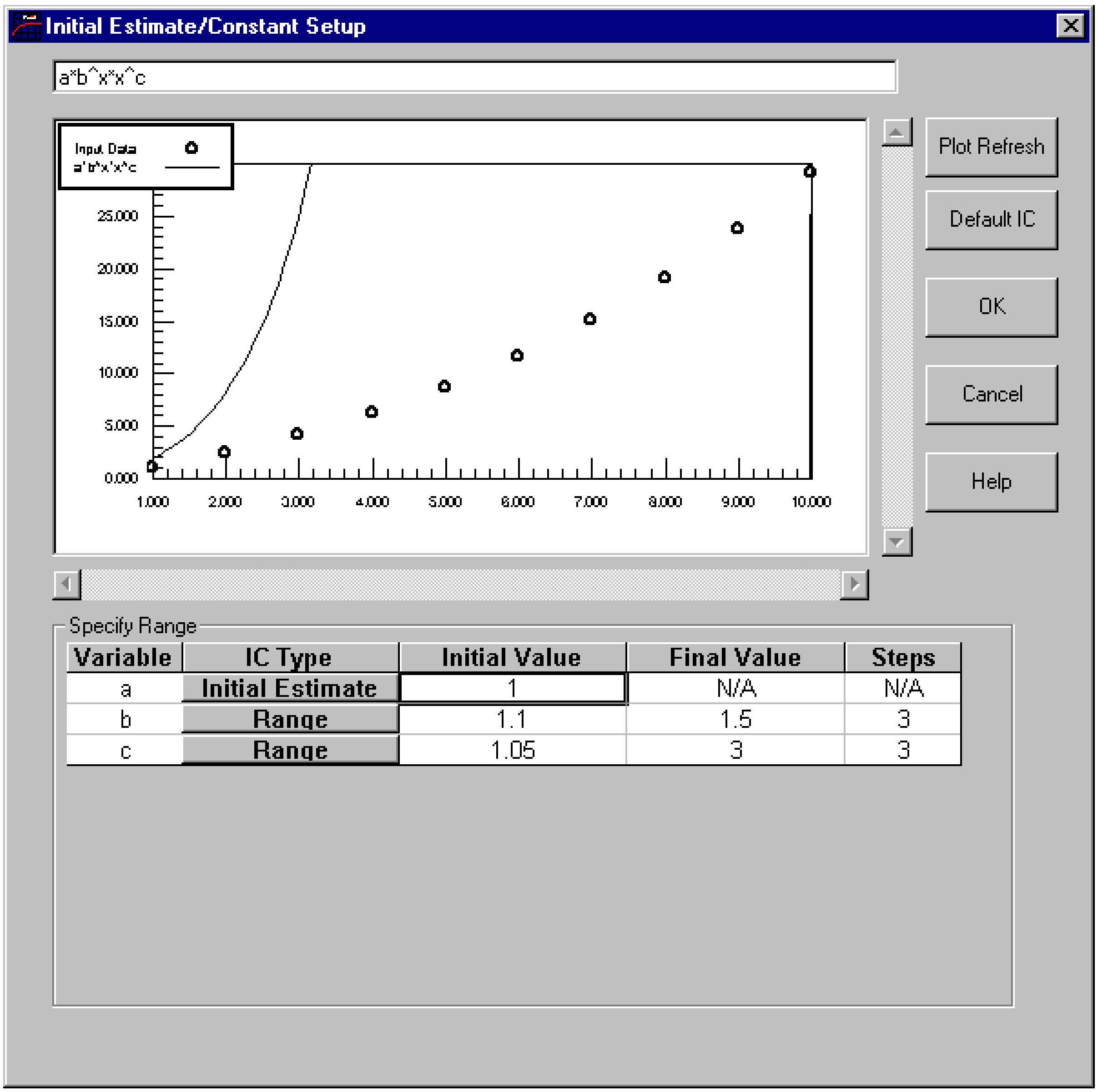
Note: It is not necessary to specify the derivatives for user defined models. If they are not *defined, they will be calculated numerically during the solution process. However, the benefits of specifying the derivatives for user defined models is explained in the Regression Theory section.*

On to Step 5 - Regression Setup
On to Step 6 - Viewing the Results Numerically

Step 5 - Regression Setup (3D Tutorial)

Now we can move on to doing the regression setup.

1. Choose **Regression...** from the **Solve** menu. This will bring up the **Solution Setup** window as shown below.



*Note: If a different window other than the Solution Setup window comes up, you have unchecked <u>Prompt for Solution Setup</u> in the **Solve** menu. This allows repeated analysis to be performed without prompting the user each time for the type of analysis. If you do not see the Solution Setup window as shown above, press **Cancel** from the current window, re-check <u>Prompt</u>*

for Solution Setup (by clicking on it, the check mark will re-appear), and start again at step 1 above.

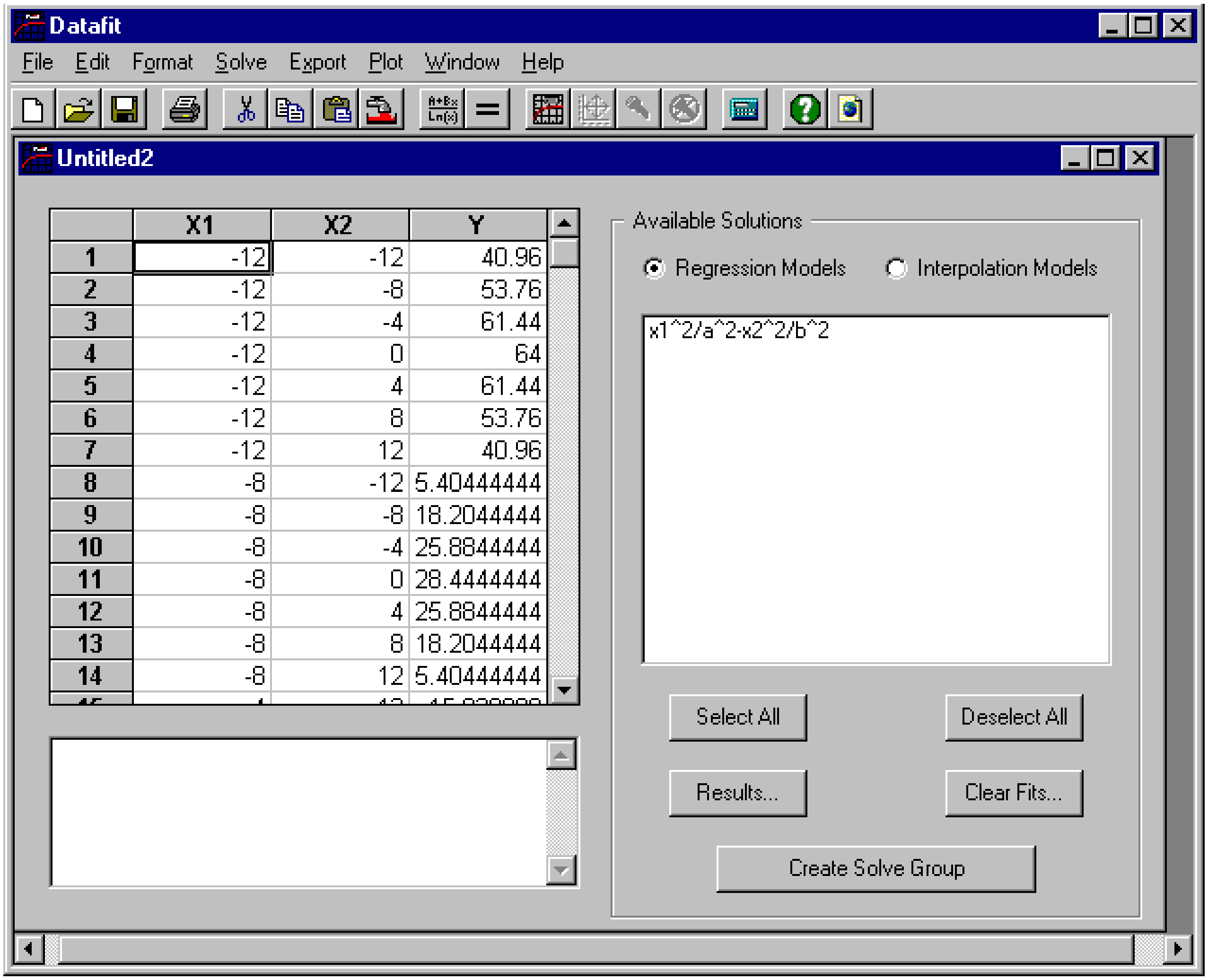
2. In the **Model Selection** area of the Solution Setup window, choose **Solve Single Model**. This allow you to choose any model from the database.
3. In the **Solver Selection** area, choose the **Nonlinear** solver. This will tell the solver to perform nonlinear regression on the data.
4. Choose **OK**. The **Solve Single Model** window will appear. The new model you just entered will be last in the list. Use the scroll bars to scroll the list until the equation x1^2/a^2-x2^2/b^2 is visible. Click on the equation so that it is highlighted in the list.

Note: Initial Estimates are calculated automatically for models built into DataFit. In general, you should specify initial estimates or rules for user defined models. For this example problem, the default initial estimates are adequate, so this step will be skipped.

5. Click the **Solve** button. The solver will begin performing the nonlinear regression, you will be notified when the solution process has completed.

Note: For more information on solution methods, see the help topic Regression Theory (Nonlinear and Linear Models). Also,

6. When you are returned to the regression window after the solution process has completed, the window will appear as shown below. All of the models which solved successfully will appear in the **Available Solutions** area, sorted in order of best fit to worst fit.



7. At this point in time, you may want to save the solution.

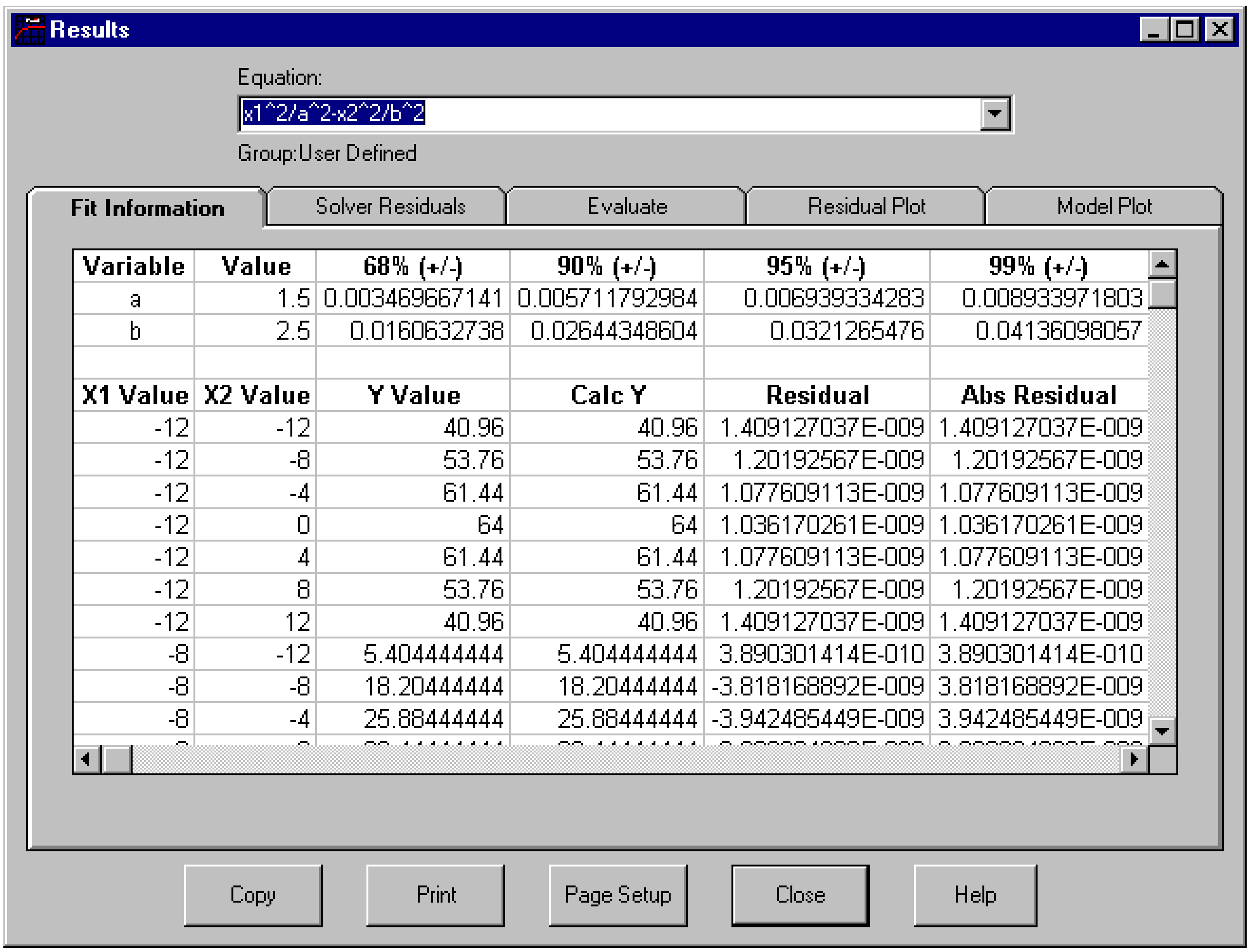
On to Step 6 - Viewing the Results Numerically
On to Step 7 - Viewing the Results Graphically

Step 6 - Viewing the Results Numerically (3D Tutorial)

Results can be viewed both graphically and numerically.

Note: If you are interested only in viewing the results graphically, you can skip on to <u>*Step 7 - Viewing the Results Graphically*</u>.

1. Click on **Results...** in the **Available Solutions** area. This will bring up the **Results** window as shown below.



Variable	Value	68% (+/-)	90% (+/-)	95% (+/-)	99% (+/-)
a	1.5	0.003469667141	0.005711792984	0.006939334283	0.008933971803
b	2.5	0.0160632738	0.02644348604	0.0321265476	0.04136098057

X1 Value	X2 Value	Y Value	Calc Y	Residual	Abs Residual
-12	-12	40.96	40.96	1.409127037E-009	1.409127037E-009
-12	-8	53.76	53.76	1.20192567E-009	1.20192567E-009
-12	-4	61.44	61.44	1.077609113E-009	1.077609113E-009
-12	0	64	64	1.036170261E-009	1.036170261E-009
-12	4	61.44	61.44	1.077609113E-009	1.077609113E-009
-12	8	53.76	53.76	1.20192567E-009	1.20192567E-009
-12	12	40.96	40.96	1.409127037E-009	1.409127037E-009
-8	-12	5.404444444	5.404444444	3.890301414E-010	3.890301414E-010
-8	-8	18.20444444	18.20444444	-3.818168892E-009	3.818168892E-009
-8	-4	25.88444444	25.88444444	-3.942485449E-009	3.942485449E-009

2. At the top of the **Results** window, there is a Drop Down list box which contains all of the solved models, again listed in order of goodness of fit. By default, the best fit results are shown. To change the model you wish to investigate, click of the drop down list and select a different model.
3. The **Results** window is broken up into four different Tabbed dialogs. To switch between the different Tabs, click on the appropriate Tab at the top (on the text).

a) **Fit Information:** Shows the calculated coefficients for each variable, or parameter, in the model. This Tab also shows the confidence intervals for each parameter, as well as the Residual Sum of Squares (RSS), Residual Standard Deviation (RSD), Correlation Coefficient (R^2), Standard Error (StdErr) and a table of entered vs. estimated data. If ranges were set up as initial conditions, each enumerated solution from the range setup will be listed.
b) **Solver Residuals:** Shows the Merit Function for each Nonlinear iteration.
c) **Evaluate:** This allows you to evaluate the equation at any value of the independent variable(s) X. It also calculated the derivatives for each variable, or parameter, at the entered value(s) of X.
d) **Residual Plot:** Shows a plot of the residuals (Calculated Y - Entered Y) for each point in the dataset.
e) **Model Plot:** Shows a plot of the solved model along with the input data for previewing.

Note: For more information on interpreting the results, see the help topic Interpreting the Results

On to Step 7 - Viewing the Results Graphically

Step 7 - Viewing the Results Graphically (3D Tutorial)

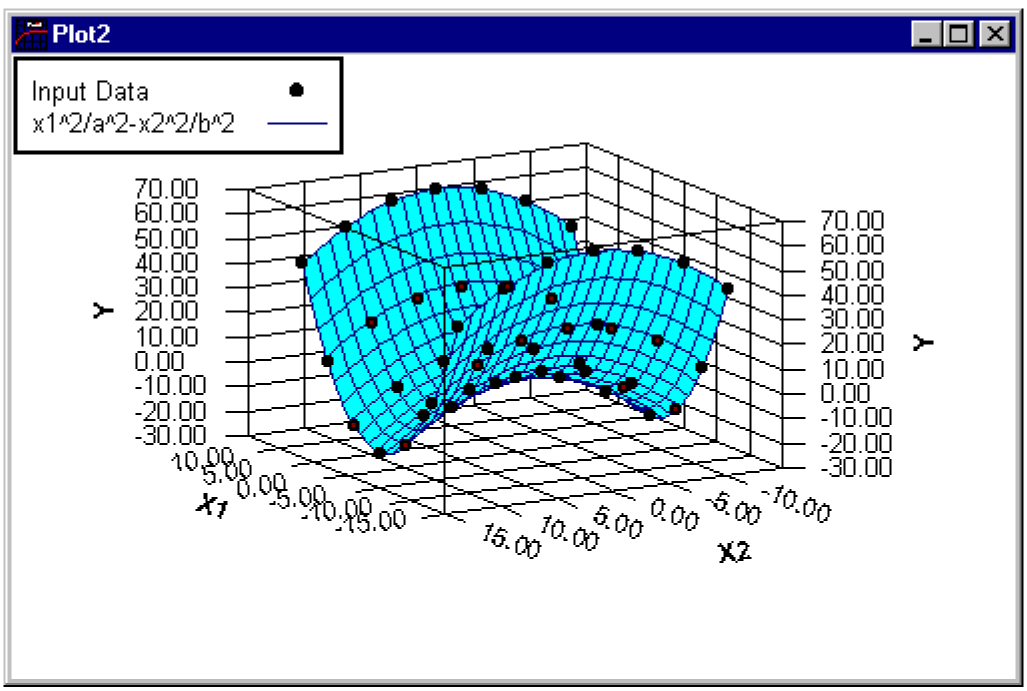
Plots can be created of the entered data and include any of the fitted models.

1. In the **Available Solutions** area, select the models you wish to plot from the list by clicking on them. For this example, plot the user defined model we entered in step 4 (x1^2/a^2-x2^2/b^2).

Note: When items are selected in the list, they will appear highlighted. To multi-select models listed consecutively, click and drag the mouse through the list. To select models that are not consecutively listed, hold down the Control key on the keyboard while clicking the mouse on individual models.

2. Select **New** from the **Plot** menu. The resulting plot of the entered data and the selected model will appear. By default, the entered data will appear as discreet data points (markers only), while the equations will appear as a meshed surface. The resulting plot should look like the following:

Note: Avoid plotting all of the solved models at once, especially if there a number of them, as there will be too much information on the plot to decipher, and it may take some time to generate the plot if there is a large amount of entered data points..



*Note: If you want to plot only the entered data, Click on **Deselect All** in the **Available Solutions** area to de-select all of the models in the list. With no models selected, only the entered data will be plotted.*

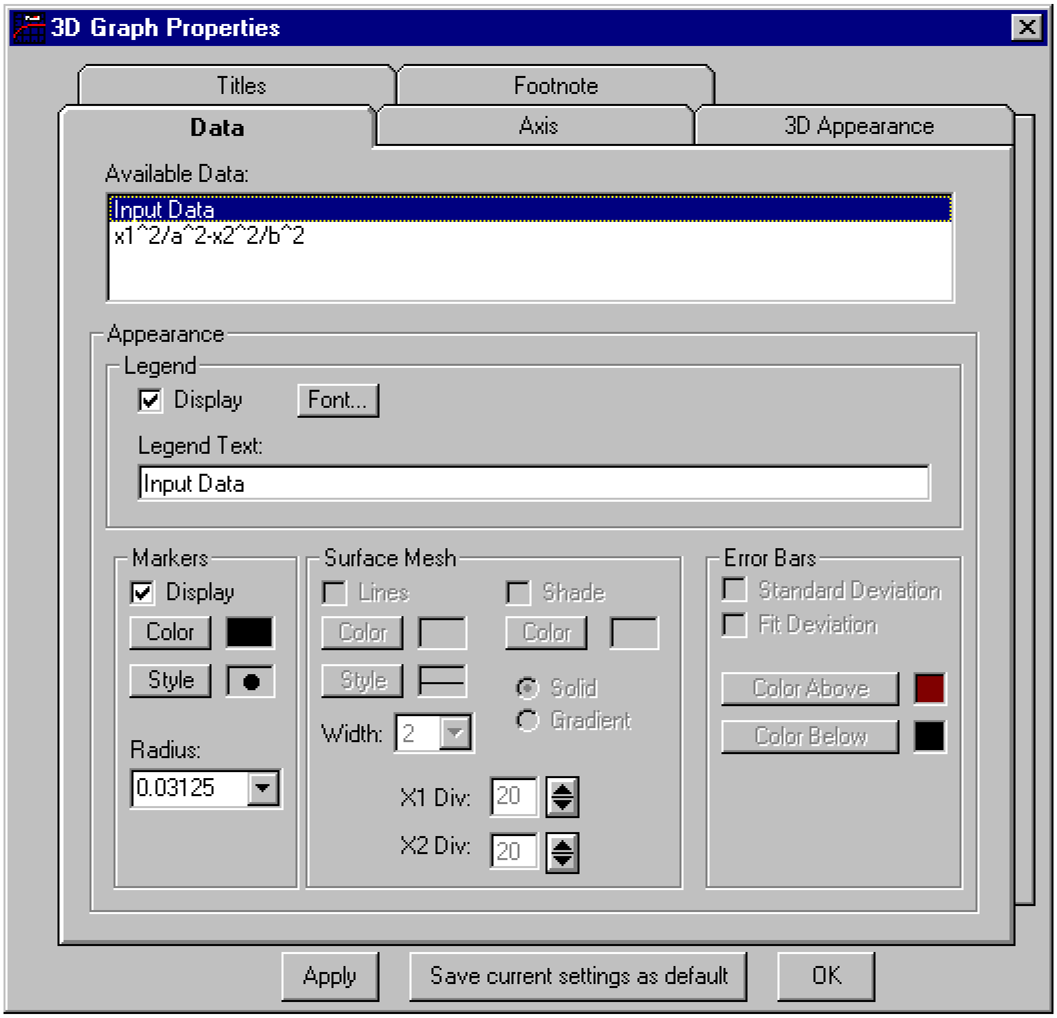
On to Step 8 (optional) - Formatting Plots
On to Step 9 (Optional) - Presentation Graphics

Step 8 (optional) - Formatting Plots (3D Tutorial)

Plots can be formatted in a number of ways. In this example, you will customize the look of the plot by rotating, adding titles, footnote text, and editing the legend.

1. With the plot generated in the previous step as the active window, choose **Format Properties...** from the **Plot** menu. This will bring up the **Graph Properties** window.

Note: The Graph Properties window is broken up into different Tabbed dialogs. To switch between the different Tabs, click on the appropriate Tab at the top (on the text).

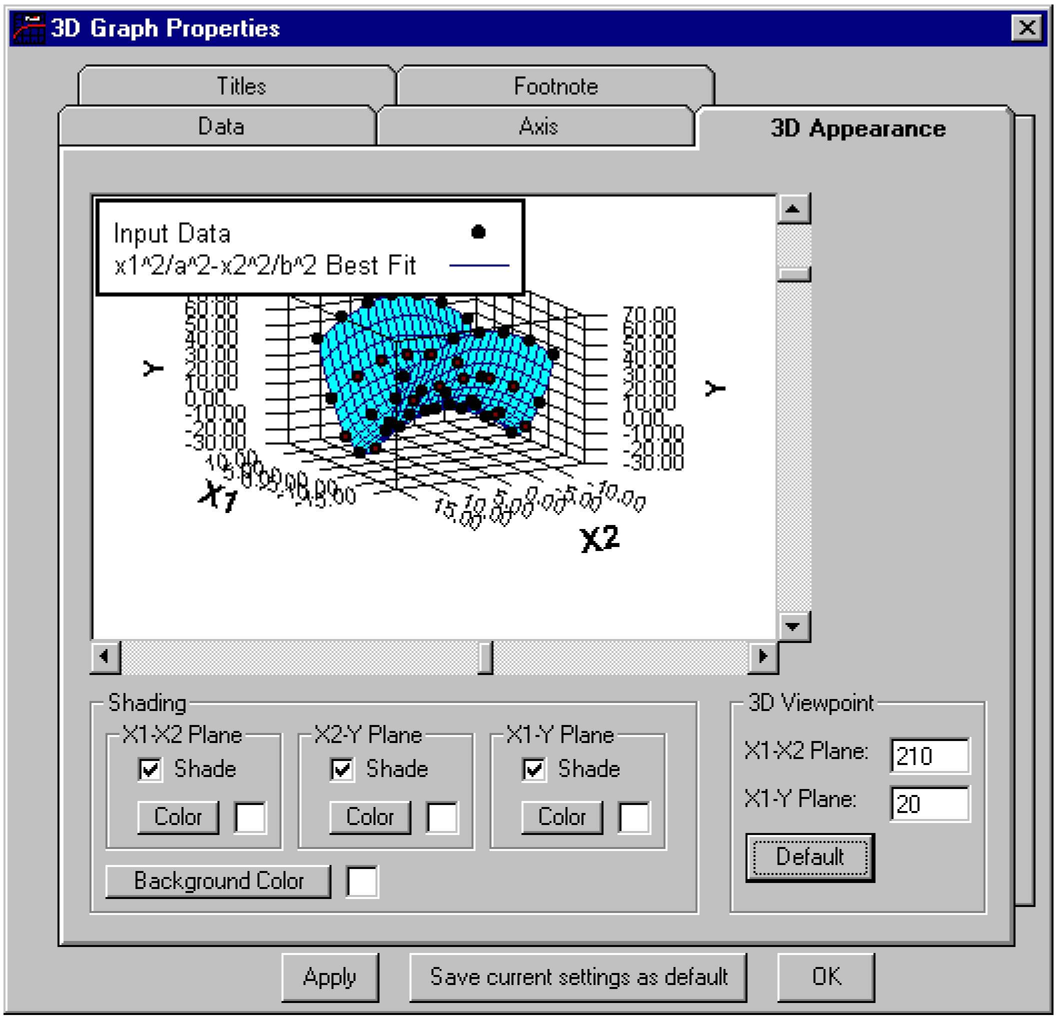


2. First, edit the title to the X1 Axis. Click on the **Titles** tab to make it the active tab. In the **X1 Axis** area, click on the text box and type in the X1 axis title you wish to appear on the plot.

Note: You can change the font appearance, size and color of any text font appearing on a plot *by clicking on the **Font...** button next to the text box.*

3. Repeat the same process for the X2 Axis. In the **X2 Axis Title** area, click on the text box and type in the X2 axis title you wish to appear on the plot.
4. Add a plot title and Y axis title in a similar manner.
5. Click on the **Data** tab to make it the active tab. The legend text for each line in the plot is displayed in the **Available Data** list. Click on the first equation listed (below Input Data), and all of the line information pertaining to that equation will appear.
6. In the **Appearance** area, click in the text box containing the legend text. Next to the equation, type "Best Fit".
7. Now, let's preview the changes we've made so far. Click on the **Apply** button at the bottom left of the window. Then, click on the **3D Appearance** Tab and the plot should look similar to the following. You can use the horizontal and vertical scroll bars to rotate the plot about the X1-X2 plane and the Y Axis.

*Note: The **Apply** button cycles through all of the tab's settings and applies all of the changes simultaneously.*



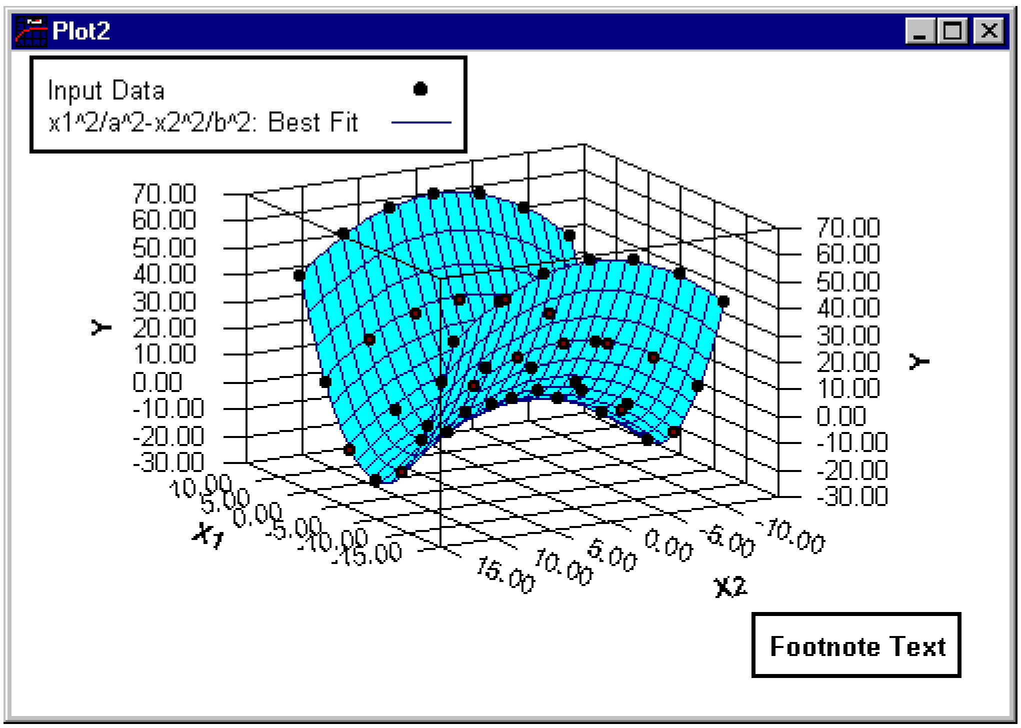
8. Add a footnote to the plot by clicking on the **Footnote** tab. Check the **Display Footnote** check box by clicking on it. Type "Footnote Text" in the text box. Leave the **Alignment** option set to **Center**, and **Show Rectangle** checked.

Note: As you can see, there are many formatting options for plots, however this tutorial will just give you a general idea of how the formatting works and will not cover each option in detail. For more information on formatting plots, see the help topic *Formatting Plots.*

9. Exit the **3D Graph Properties** window by clicking **OK**, and you will be returned to the plot window.

Note: If you made changes and did not apply them as we just did in step (g), you will be prompted to apply or ignore uncommitted changes. For more information on formatting plots, see the help topic *Formatting Plots.*

10. You can move the legend and footnote text around on the plot by clicking within its border. While holding the left mouse button down, drag the text object and place it wherever you like. The final plot should look similar to the following:



On to Step 9 (optional) - Presentation Graphics

Step 9 (optional) - Presentation Graphics (3D Tutorial)

DataFit has the capability of creating plots to be used for quality presentations. There a few different ways of creating presentation graphics.

1. You can copy an enhanced metafile to the Windows Clipboard for pasting into another application, such as Microsoft Word or Microsoft PowerPoint. Make a plot window the active window, then select **Copy as Enhanced Metafile** from the **Plot** menu. This generates a device independent vector based picture which will retain its quality when resized. The image can be pasted into another application.
2. You can create an enhanced metafile and save it to disk. This generates a device independent vector based picture which will retain its quality when resized. Make a plot window the active window, then select **Save As...** from the **Plot** menu. Choose Enhanced Metafile as the file format, and give the file the default enhanced metafile file extension '*.emf'. The file can then be read by presentation software which supports enhanced metafiles.
3. You can copy a bitmap of the image to the Windows Clipboard for pasting into another application if the application does not support enhanced metafiles. Make a plot window the active window, then select **Copy as Bitmap** from the **Plot** Menu. Mostly all presentation software support bitmaps.

Note: For more information on enhanced metafiles, see the help topic Save, Save As... (File Menu), or consult the documentation provided with the presentation software.

Return to Beginning

Description of DataFit

DataFit is a science and engineering tool which simplifies the tasks of data plotting, curve fitting and statistical analysis. What sets DataFit apart from similar curve fitting and regression programs is its ease of use. With the combination of the intuitive interface, online help and wide range of features, it is a tool which is used effectively by both experts and non-experts alike. With DataFit you can:

- Enter your data in a standard spreadsheet interface, import delimited data files, or cut and paste data between DataFit and other Windows applications.
- Fit your 2D Data to 54 built in commonly used scientific, statistical and engineering nonlinear regression models, or define an unlimited amount of your own regression models. You can attach descriptions to your own regression models, and they are saved for future use. Built in models automatically generate initial estimates, and you can define rules for user defined models so that initial estimates are calculated automatically for them as well.
- Fit your 3D data (two independent variables) to over 100 built in nonlinear regression models, or define an unlimited amount of your own regression models with up to 9 independent variables.
- Perform linear OR nonlinear regression on one model at a time that you choose from a list, groups of models (built in model groups, or define your own), or all of the models available with a simple mouse click. The built in models are grouped together based on the number of parameters and the general shape of their curves, so there is no need to 'blindly' solve every model. As models are solved, they are sorted automatically according to their goodness of fit. If you aren't an expert and aren't sure which model you should use, DataFit helps you make this decision.
- View the results, including the fitted parameters along with their confidence intervals, input vs. Estimated data, and goodness of fit information, all with a simple mouse click.
- Data modification is a snap because the software keeps track of the most recently solved models.
- Attach notes to record information and conclusions about the project.
- Save projects along with all of the notes and solution information. There is no need to keep re-solving the problem.
- Export source code to utilize a model of your choice in a program that you have written. You can export self-documented code in either BASIC or C.
- Manipulate raw data or regression models in a built in Data Calculator. The Data Calculator can perform over 70 mathematical and statistical operations on curves, discreet data, or numbers. The calculator can also perform some special functions, such as FFT's, creating a data table based on an equation you type in, or produce a "Normal" (Gaussian) curve based on user entered mean and standard deviation (currently 2D plots only).
- Create 2D and 3D plots of raw data and/or regression models by simply selecting the desired information from a list of available data. Each plot is completely customizable, including fonts, ranges, line colors and styles, error bars, visibility, et.
- Graphically compare the results of different models and/or data on the same plot window.
- Save plots along with all of their customization.
- Copy plots to the Windows clipboard for pasting into other applications.

See Also:

Overview of the DataFit Workplace

What’s New In DataFit Version 4.1

The following is a list of **major** changes, bug fixes and enhancements to DataFit Version 4.1:

Enhancements:

1. Added Tool Bar for quick access to commonly used commands. A description of the functionality of each button is described in the Tool Tip Text. To view the tool tip text, simply hold the mouse over the buttons for a moment and the Tool Tip Text will appear.
2. Added the capability of 3D (to ND) Function export, including user defined models.
3. Reformatted 2D Plot Properties panel to be similar to 3D Properties Panel.
4. Added Tip of the day on startup.
5. Added Text Boxes to modify Start and End Rows in the Edit - Fill panel. This allows the user to specify the row range without pre-selecting the rows before choosing **Fill** from the **Edit** menu.
6. Added Email and Internet connection from the Help menu. User can now easily register, obtain product updates and send email to technical support directly from within DataFit.
7. Added additional rules for default initial conditions for multiple independent variable models.
8. Added overflow checks for hyperbolic functions and powers.
9. Added Multiple line capability to model descriptions.

10 Put model plot into Results window. A preview of the solved model can now be viewed when viewing the regression results.

11. Added capability for user to add any variable coefficients, not limited to "a-t". User can define any variable name, as long as it starts with an alphabetic character and is not a reserved word.
12. Increased performance (speed) when solving user defined models. User defined models solve much faster.
13. Added "If" conditional. The conditional is of the form If(Condition, TrueExpression, FalseExpression).
14. Added many additional functions and parameters for user defined models, including bessel, statistical, data table parameters, et.
15. Added Function Template form for placing supported operations and functions in user models. The user can insert a function template directly into a user defined model.
16. Modified 3D solution file structure, not saving duplicate information, solution files are smaller.
17. Compiled to native machine code. This adds a 200 - 300 percent improvement in solution speed.
18. Added temporary license option.
19. Added Tool Tip Text Help
20. Added additional parameter model to all multiple independent variable built in

models. All models include linear combination plus a constant term.

21. Added percent error column in results window which calculates the percent error of the regression model results for each entered data point.
22. Added exponential model to all multiple independent variable built in models.

Bug Fixes:

1. Fixed bug in specifying IC's if variables entered out of alphabetic order. In version 4.0, the initial estimates may have been assigned incorrectly.
2. Choosing File Import no longer clears data and solutions if user cancels.
3. Fixed bug with Rules for multiple independent variable models. The rules did not reflect the capability of multiple independent variable columns.
4. Fixed bug when recovering deleted 3D user defined models from solved files. User defined 3D model recovery always failed when a solution with a model deleted from the database was read in.
5. Fixed bug in plot creation (used to fail) when data is larger than approximately 2e9 (larger than 32 bit integer)
6. Selected models will remain selected throughout regression setup/defining user models unless the selected model is deleted.
7. Fixed bug where first row of range estimates always got cleared when setting up IC ranges after the first time.
8. Fixed problem in Results window where tabulated input data was not updated if the user switched between regression windows and viewed the results.
9. Software initialized on System default settings (date/time format, list separators, decimal separators etc.). Startup is now based on User default settings, since they may be different than System defaults.
10. Corrected the problem of plots appearing incorrectly if user changed Locale information AFTER installation.
11. If software was installed as Administrator (NT Only) and run as user, user would receive "Evaluation Expired" immediately after installation. This problem has been corrected.
12. If user defined model contained the same function call more than once, the source code for the function was printed as many time as it appeared when exporting source code. The supporting function is now only declared once.
13. Number formatting strings in the Graph Properties windows always showed formats in US Locale. Strings now show in current users locale.
14. Numerical Axis Labels on plots were (in some formats) were displayed incorrectly in some Locales.
15. In the Evaluate tab of the Results window, independent variable values were seperated by a comma in the function description F(x1,x2,...). Independent variable values are now separated by the list separator (locale dependent).
16. In the Fit Information tab of the results window, %Error, Min Residual and Max Residual did not appear if the system list separator was not a comma (locale dependent).

Help on Windows File Types and Protocols

Windows can automatically launch applications based on a file type or protocol. For example, files with a “TXT” extension may be registered in the system registry with the application Microsoft Notepad. This allows you to double click on a filename with a “TXT” extension, and Windows will launch Wordpad and load the text file you clicked on. DataFit registers files with a “DFT” extension, and in addition uses the “URL:HyperText Transfer Protocol” (http) and the “URL:Mailto Protocol”. If you get an error trying to send email or connect to Engineered Software’s home page on the web from within DataFit, your http and mailto protocols are not set up correctly. You can modify them yourself, or re-install the software you are using for web browsing and sending email. The protocols and file types **SHOULD** be registered automatically. If for some reason they are not, contact the manufacturer of the software and ask them how to manually configure the protocols for their software.

To change which program starts when you open a file

1. In My Computer or Windows Explorer, click the View menu, and then click Options.
2. Click the File Types tab.
3. In the list of file types, click the one you want to change. The settings for that file type are shown in the File Type Details box.
4. Click Edit.
5. In the Actions box, click Open.
6. Click Edit, and then specify the program you want to use to open files that have this extension.

Credits

A word of Thanks to a few well deserving people:

Thanks to **everyone (you all know who you are) who registered DataFit**. And most of all, thanks for all the nice comments and suggestions.

Thanks to **Greg Kochaniak** of Hyperionics (gregko@hyperionics.com, http://www.hyperionics.com) for writing Hypersnap DX (the source of all my bitmap images), for answering EVERY windows programming related question I throw at you (he is the master) and for being a good friend.

Thanks to all of the **Shareware Archives, Software Clubs and Computer Magazines** who make shareware authors efforts worth while by making programs accessible to the public. Also, special thanks to all of software sites that took the time to review and promote DataFit.

Thanks to **Bob Jordan**, “The” Transformer Design Engineer Guru, for teaching me things I never thought I’d understand, and for sending me down the curve fitting path a long time ago. By the way, Bob, I’ve finally figured it out…..

Most of all, the biggest thanks to my wife **Nancy**. You are always there when I need you. You are my best friend.

Removing DataFit From Your Machine

If you are running Windows '95 or Windows NT version 4.x and want to remove DataFit from your machine, do the following:

1. Click on **Start/Settings/Control Panel**.
2. Double Click the **Add/Remove Programs** Icon.
3. On the **Install/Uninstall** Tab, click on DataFit in the list.
4. Click on **Add/Remove**

If you are running Windows NT version 3.x, Double Click the UnInstall DataFit icon in the Engineered Software program group.

Warning: Most of the files distributed with DataFit are shared files, which may be used by other applications. These files should not be deleted manually. Uninstalling DataFit as recommended above checks to see if the shared files are used by any other program installed on your computer and will not delete them if they are in use. If you delete these files manually, your system may become unstable. The only files that can be manually deleted safely are the files copied to the application directory.

The files copied to the application directory (the directory you specified when installing DataFit) are:

File	Description
DataFit.exe	The DataFit Executable File
Register.exe	The Register Executable File
DataFit.cnt	The DataFit Help Contents File
DataFit.hlp	The DataFit Help File
Register.hlp	The Register Help File
Engrsoft.html	Local Web Page
ReadMe.txt	Read me file
TipOfDay.txt	Tip of the Day Text File
Tutor2D.dat	Data File for the 2D Tutorial
Tutor3D.dat	Data File for the 3D Tutorial

The following files are created during installation and execution of DataFit:

File	Description
DataFit.gid	DataFit Help Related File
St*Unst.Log	Installation Log File
user.equ	2D user defined equations
usermv.equ	ND user defined equations