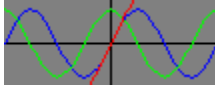# WinFG Help Index

Welcome to WINFG - A Windows Function Grapher
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Version 1.0

WinFG is designed to allow the user to view the Cartesian graphs of mathematical functions. The user can enter from one to four functions, the bounds for the *x* and *y* axes, and other pertinent information. WinFG then displays the graph on the screen in accordance with the settings specified by the user.

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File Commands

This menu selection allows you to access the file related services of WINFG. WinFG does not have document files per se, however, all settings can be preserve from one session to another (see WINFG.INI).

Print   Prints current any graphs in the client area to the current printer. The current printer can be changed from the Windows control panel. If your graphs are not visible when you print, see Colors Dialog Box.

Page Setup   Invokes the Page Setup Dialog Box

Printer Setup   Invokes the Printer Setup Dialog Box

Exit   Exits WinFG. If you have made changes to any settings, you will be given an opportunity to save them.

Edit Commands

The edit menu provides alternate access to the zoom/unzoom function. It also lets you export a bitmap to other programs.

Zoom/Unzoom   See <u>Zooming and Unzooming</u>

Copy Bitmap   When you select this function, WinFG generates a bitmap of its <u>client area</u> and copies it to the clipboard. This bitmap can then be pasted into any program that can paste a bitmap.

Settings Commands

This menu selection allows you to change WinFG's settings. Most changes made through this menu can be preserved in <u>WINFG.INI</u> if you like.

Show Axes	Toggles the display of the graphs axes. When this selection is checked, axes are display if they lie within WinFG's <u>range</u>.
Show Controls	Toggles on the display of the Zoom/unzoom buttons and the cursor coordinates.
Show Ruler	Toggles the display of the <u>ruler</u>. Clicking the right mouse button in the graph has the same effect.
Range	Invokes the <u>Range Dialog Box</u>
Functions	Invokes the <u>Functions Dialog Box</u>
Colors	Invokes the <u>Colors Dialog Box</u>

Redraw Command

Selecting this menu item causes WINFG to redraw itself in accordance with the current settings

Zoom/Unzoom

WinFG allows you to change a graph's range visually with the mouse in addition to using the <u>Range Dialog Box</u>. Zooming allows you to select a rectangle within the graph and have it fill the whole graph. Unzooming allows you to select a rectangle within the graph window and have the current graph shrunk to fit in that rectangle.

To Zoom:	1.	<u>Select a rectangle</u>.
	2.	Press the zoom button, or
		Select Zoom from the Edit menu, or
		Press Alt-Z

To Unzoom:	1.	<u>Select a rectangle</u>.
	2.	Press the Unzoom button, or
		Select Unzoom from the Edit menu, or
		Press Alt-U

The selection box remains on screen after you zoom or unzoom. This makes it easy to undo your action. Press ESC to erase a selection box you no longer want.

Shortcuts

Here are some useful shortcuts for getting around in WinFG:

Right Button   Toggles <u>ruler</u>.

Ctrl-C   Invokes <u>Colors Dialog Box</u>.

Ctrl-F   Invokes <u>Functions Dialog Box</u>.

Ctrl-R   Invokes <u>Range Dialog Box</u>.

Ctrl-X   Exits WinFG. If you have changed any settings, you will be asked if you want to save them.

Function Syntax

The functions you ask WinFG to graph are expressed algebraically using the familiar computer versions of mathematical operators. You can also use any combination of predefined functions. Several useful constants have been included as well. Your functions can contain any valid combination of the following elements:

Numbers
Numbers are formed according to this mask: 9[9...][.9...][e|E]9[] [9...] where 9 is any numeric digit.

Operators
Valid operators, in order of precedence are:
(,)   Parenthesis
+, -   Unary sign
^   Exponentiation
*, /   Multiplication and division
+, -   Addition and subtraction

Built in functions
With the exception of **X** all of the following functions require an argument. The argument can be any valid expression and must be enclosed in parentheses. For example: sin(x). Case is ignored.The built in functions are:

ACOS   Inverse cosine.
ASIN   Inverse sine
ATAN   Inverse tangent
COS   cosine
COSH   hyperbolic cosine
EXP   e raised to a power
LOG   natural logarithm
LOG10   base 10 logarithm
SIN   sine
SINH   hyperbolic sine
TAN   tangent
TANH   hyperbolic tangent
SQRT   square root
X   This function requires no argument or parenthesis. It returns the current value of *x*.

Constants
Using a constant is identical to keying the numerical representation. The defined constants are:

PI   3.14159....

Error Handling

Whenever WinFG encounters an <u>arithmetic error</u> while graphing your functions, it displays a dialog box giving you details about the error and offering you the option to either continue until the next error or ignore future errors for that function.

WINFG.INI

WinFG stores its default settings in WINFG.INI. If this file does not exist, it will be created in your Windows directory. It is a plain text file that can be edited with any text editor capable of reading and writing flat ASCII files. The files consists of four sections whose headings are enclosed by brackets. Each section has several keywords defining some part of WinFG's operation.

Whenever you change one of these settings through a dialog box within WinFG, you will be prompted to save them to WINFG.INI when you exit.

[Function]	This section contains the actual text specifications of the functions WinFG will graph. Follow the text of the function with ",1" to indicate that it should be drawn. e.g. "Func1=sin(x),1" means that function 1 is a sine function and should be displayed. Func1=sin(x) will define function 1 as a sine function, but will not display it until you turn it on in the Functions Dialog Box.
Func1	Text for function 1.
Func2	Text for function 2.
Func3	Text for function 3.
Func4	Text for function 4.
[Range]	This section will define the maximum and minimum bounds for your graphs as well as some other cosmetic settings. These settings can also be changed in the RangeDialogBox.
xMin	Minimum x value.
xMax	Maximum x value.
yMin	Minimum y value.
yMax	Maximum y value.
ShowAxes	If this setting is "1" axes will be shown. If it is "0", they will not.
ShowControl	"1" to show Zoom/Unzoom buttons and current cursor position, "0" to hide.
ShowRuler	"1" to show ruler, "0" to hide.
NumIters	This number controls the number of iterations WinFG will perform to display your graph.
[Color]	This section contains the color values for WinFG's surface. All off these settings can be changed in the Colors Dialog Box. The values listed are 4 byte hexadecimal values coded with a leading "0x", e.g. 0x00ffffff. These values represent Windows COLORREFs. The first byte should 0. The remaining three bytes are levels of Blue, Green and Red respectively. They can range from 0 to 0xff. Pure black is 0x00000000, pure blue is 0x00ff0000, pure green is 0x0000ff00, pure red is 0x000000ff, gray is 0x007f7f7f, and pure white is 0x00ffffff.
Func1	Color for function 1.
Func2	Color for function 2.
Func3	Color for function 3.
Func4	Color for function 4.
Axes	Color for axes.

Background	Color for background.
[Page]	This section controls how WinFG will print out graphs. These settings can also be change in the <u>PageSetupDialogBox</u>.
Box	Set this to "1" to display a box around your output.
HorzPercent	This setting determines controls the amount of the printed page your graph will take up horizontally. It should be between "0" and "1". "1" means that your graph will fill the full width of the paper.
VertPercent	This setting determines controls the amount of the printed page your graph will take up vertically. It should be between "0" and "1". "1" means that your graph will fill the full height of the paper.

Page Setup Dialog Box

This dialog box allows you to configure how WinFG will print. The settings in this dialog box will can be preserve from session to Session if you wish. The available options are:

Percentage of Page Height   This setting controls how much of the page's height your printed graph should occupy.

Percentage of Page Width   This setting controls how much of the page's width your printed graph should occupy.

Box around Output   If this box is checked, WinFG will draw a box around your printed graph. This option produces a neater graph but usually takes slightly longer to print.

Printer Setup Dialog Box

This dialog box is owned by your printer driver. You can change, add, or delete printer drivers from the control panel. WinFG only works with your current printer.

Range Dialog Box

This dialog box allows you to manually set the range that WinFG will plot over. The settings here will be preserved in WINFG.INI if you wish. For the minimum and maximum values, you may use either a number or a valid WinFG expression (See Function Syntax). You can also set the range using the Zoom/Unzoom feature. Show Axes, Show Controls, and Show Ruler can also be set through Settings Commands. The available settings are:

Minimum X   This value is the lowest x value that WinFG will plot.

Maximum X   This value is the highest x value that WinFG will plot.

Minimum Y   This value is the lowest y value that WinFG will plot. Any values falling below this will be clipped.

Maximum Y   This value is the highest y value that WinFG will plot. Any values above this will be clipped.

Number of Iterations   This scrollbar sets the number of iterations WinFG will execute to draw your graph. The scroller can be set anywhere from 1 to 800.

Show Axes   Toggles display of axes.

Show Controls   Toggles display of Zoom/Unzoom button.

Show Ruler   Toggles display of ruler.

Functions Dialog Box

This dialog box allows you to enter the functions you want WinFG to graph. There are four text fields in this dialog box. One four each function WinFG can display. In addition, there are four check boxes. If the box next to a function is checked, WinFG will draw that function, otherwise it will not. The information from this dialog box can be saved in WINFG.INI if you like.

Colors Dialog Box

This dialog box allows you to customize the colors WinFG uses to display itself. All of WinFG's color settings can be preserved in <u>WINFG.INI</u> if you wish. There are six screen elements whose color you can control. The first four are the functions WinFG will graph. These are identified by the function's text representation, i.e. if you define function 1 as "sin(x)" then the first option will be labeled "sin(x)". The next elements are WinFG's axes. Note that the *x* axis will only be drawn if zero lies between the minimum and maximum *x* values and the *y* axis will only be drawn if zero lies between the minimum and maximum *y* values as specified in the <u>Range Dialog Box</u>. The final screen element is WinFG's background.

To change a screen element's color, select the button corresponding to that element. Then use the three scroll bars to vary the Red, Blue, and Green levels. There box above the scroll bars will change color to show you how the final product will look.

Note: With the exception of WinFG's background, all screen elements are solid colors. i.e. if you are using a sixteen color Window's driver, you will never see more than sixteen colors no matter how much you experiment with the scroll bars. WinFG's background, however, will be dithered to approximate colors other than the available pure colors.

Printing Colors: If your graphs are not appearing when you print, the trouble may be that the color you chose is too light. Since most printers are monochrome devices, Windows must convert screen colors to either black, white, or dithered gray scales. Since all the lines on your graph are solid colors, Window's will map them to either black or white. Try choosing a darker color.

Background

WinFG Version 1.0 was written in Borland C++ over a period of 5 months. I wrote it mainly to learn more about programming for Windows. The roots of this particular application go back the late seventies when I first had the opportunity to use a personal computer. It was a TRS-80 model I with 16 kilobytes of RAM. One of the first programs I ever wrote plotted a simple sine wave graph. The resolution was something like 128 by 75 -- strictly monochrome. A far cry from the 800 by 600 by 256 colors I am using now. The parameters of that program could only be changed by editting the source code and rerunning. The logic to parse and evaluate mathematical functions was very challenging to write and is the cornerstone WinFG. The help system was composed on Microsoft Word for Windows. This program is hereby released into the public domain. This software may not be sold. Enjoy!

Files

WINFG.EXE	Main executable module
WINFG.HLP	This help file
CALCDLL.DLL	Expression parsing dynamic link library
WINFG.INI	Initialization file. This file will be created in your Windows directory if it does not exist.
README.TXT	Installation notes.

Please forward any bugs, suggestions, or comments to:

Steven Van Riper
Compuserve   76646,1346

Bugs

Please report any bugs or problems to:

Steven Van Riper
Compuserve 76646,1346

Select a rectangle
Position the mouse at the upper left corner of the rectangle you wish to select. While holding down the left button, drag out a rectangle until it is the size you want. To clear a selected rectangle, press escape. If you want to change a selected rectangle, simply select a new one.

Client Area
Portion of an application program's window excluding the window borders, menu, and caption area.

Range
WinFG displays any graphs selected by the user varying the x value from the minimum x to the maximum x specified, and clipping any y values to be within the minimum y and the maximum y specified.

Ruler
The ruler is a dashed crosshatch that extends from the borders of the client area to the mouse cursor's position. When the mouse cursor is moved, the ruler follows it.

Arithmetic Error
An arithmetic error occurs any time and illegal arithmetic operation occurs such as division by zero. It will also occur on overflow or underflow conditions.

Iterations

Iterations are the number of points WinFG calculates in displaying a graph. The more iterations, the smoother the curves and the slower the process.