

BlackBox Math Expert Help



Version 2.0 1996

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Introduction to BlackBox

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Perhaps the best way to begin learning BlackBox is to travel around the program with the mouse, reading the fly-by hints and clicking/typing anything.

The Big Idea of BlackBox in a Nutshell

Educational Framework:-

- 1 Expertise in a field like mathematics comes not from having one good strategy that you apply to all problems but a repertoire of strategies that you apply to different types of problems. BlackBox provides a framework in which you can rapidly try many approaches to any problem and build your own expertise based on **experience**.
- 2 BlackBox saves you from repeating tasks you know well (like adding up numbers or making a graph) and lets you instead focus on what you must learn. Your study will not be undermined by the human error that creeps in during a long night of study, when a silly unspotted error can render long calculations useless.
- 3 Once you fall in love with mathematics, your marks will skyrocket. By removing much of the grind, BlackBox makes it more likely for this relationship to develop.

It grows in usefulness by being used:-

- 1 It is only when teaching a **new symbol** or equation to BlackBox that you really have to type much in. After the first time, the information is there and ready to be used. This means that all the equations you might use for Volumes, Areas, Science course topics such as Motion in 2-Dimensions etc will become permanent fixtures (or built-in functions). The same applies to spreadsheets, which can cover everything from experiment write-ups to simplifications of complex procedures (ie. vector algebra).

Whether at home or in an institution, BlackBox will become in time a wealth of mathematical ideas, shortcuts, templates and revision material as well as a splendid tool for students and teachers.

What is BlackBox ?

BlackBox is to math what a word processor is to writing.

That is, it won't teach you math directly but it helps you to get through it by giving you shortcuts, answers, records and fantastic graphs.

BlackBox Math Expert is a toolkit for math and science students at the tertiary level. It includes a symbolic equation Calculator, files that collect all your calculations and symbols, a spreadsheet and a sophisticated graphing unit within an integrated package.

Whether you are studying..

- At the Senior Secondary or Tertiary level ..
- Physics, Chemistry, Biology, Geology, Nursing Science, Engineering ..
- Pure Math, Statistics, Economics
- Any humanities-based course that involves graphs/research/data

..you will save definitely time and probably learn more using BlackBox.

Unlike most other math software, BlackBox is not a tutorial that gives you extra study. Instead, it helps you get through the work you have been assigned.

With BlackBox you can ..

- Calculate math equations as they appear in your textbooks and assignments. You will be able to get the answer to almost any problem, regardless of whether you are sure you could solve it yourself. This is great for checking answers before you hand in assignments.
- Graph anything from simple equations to the results of a complex science laboratory practical.
- Save a lot of time using the intelligent features, such as detailed information about math errors, rapid automatic graphing, the matrix and vector unit, in-built word processing and general user-friendliness.
- Be freed from the repetitive tasks, such as perpetually re-typing math into a calculator or calculating 30 points to make a hand-drawn graph, and instead concentrate on what you should be learning at the moment.

See Also ...

[The main ideas behind BlackBox](#)

.693Using BlackBox to Study

Here is how you might use BlackBox..

- To check your answers to calculations more quickly than before
- To keep an automatic record of your calculations, so you can revise and refer to past answers that are neatly set out.
- To save you typing or writing a lot of math - after BlackBox has learnt the symbols you want to use in your calculations, it sets out well structured answers that can be copied and pasted into finished documents for assessment.
- To save you constructing graphs by hand - and letting you create spectacular graphs you could never have drawn in time yourself.
- To rapidly graph all the equations you come across in your courses so that you will better understand their behavior. With BlackBox, it is so easy to visually represent equations and formulas that you can become very familiar with them.
- To solve science type problems and have the answers come out already formatted with the correct units. This saves typing and focuses your mind on the actual forces/velocities etc being evaluated in any problem.
- To check answers for very time-consuming math such as matrix math. BlackBox lets you type the numbers into the spreadsheet and then work with it as a matrix using built-in functions.
- The spreadsheet has 128 built-in functions and is capable of holding any data in any style - from a business balance sheet to the results of a science experiment. The Graph page has a direct link to the Spreadsheet, so graphing is automatic.

See Also ...

[Doing Scientific Calculations](#)

Doing Scientific Calculations

The BlackBox Calculator has special features for scientific calculating:-

- It calculates using symbols and if those symbols have units involved, it will print them out with the answer.
- This follows the format favoured by most people marking math and science assignments at university
- When you look at the units of the symbols involved in the calculation, you can check your answer is appropriate as the symbols units should logically lead to the units of your answer.

For example, if the equation was **Velocity = Distance/Time**,

and Distance = 20.0 m

and Time = 20.0 s

Then the units for Velocity must be m/s.

If you have any other units in your answer, there must be a problem somewhere in what you are trying to do.

See Also ..

[Using the spreadsheet for Science Experiments](#)

[The Calculator](#)

[Symbols Page](#)

Using the spreadsheet for Science experiments

Spreadsheets are the natural place to do calculations such as those required in science laboratory practical write-ups. You can write your raw data in once, perform a whole range of automatic calculations on it, make any type of graph from the data and then print the lot out. This will save you hours if your course has lots of laboratory work.

See ..

[Spreadsheet Math Functions](#)

[Spreadsheet Statistical Functions](#)

[Detailed Spreadsheet Help](#)

The Calculator

The Calculator is the section that usually covers the top of the screen. It is where you enter the math equations you want answers to.



- The **Equation Box** takes the actual equation or math expression. When you click in this box, the Function Keypad pops up for entering math functions into equations.
- The **Variable Box** holds the symbol you will use in the equation as the independent variable - you won't need to use this if your equation is something like "27/6 + 44" because it has no symbols in it. You will need it if you want to graph "y=27/x +44" because BlackBox will need to know the value(s) of x in order to make the graph. Click the down arrow to see a list of the current symbols. Click for rules about = signs in Equations

Variable Box

- The **Equals button** will make the symbol in the Variable Box equal to the number in the Equals Box

Equals Button

- The **Equals Box** holds the number that the symbol is equal to. You can change the value by typing in a new one. You can also type in equations like 2Pi - ie. If x is in the Variable Box, "y=sinx" is in the Equation Box and you click Calculate, the value of x will be set to 2Pi (6.28..).

Equals Box

- The **To Box** holds the upper value for the Variable if the process needs one. It is only needed for Graphs, Integrations, Sequences and Series. You can also put equations in this box, same as the Equals Box.

To Box

- The **Calculate button** will give an answer to the equation as you have written it. This will popup in a window. You can copy these to the clipboard using the keyboard.
- The **Graph button** will turn the equation into a graph.
- The **Over button** will overlay the new graph over the old one. This lets you compare two or more equations (ie. see where two equations intersect as in a simultaneous equation problem).

Overlaying or superimposing Graphs

- If you click on the **Equation label**, it will turn the Book to the Equation List page.
- If you click on the **Variable Symbol** label, the notebook will turn to the Symbols page where you can do more serious editing of the symbols.

See Also..

[Pages of the Notebook](#)

[Entering Math Functions](#)

[Examples of Equations](#)

Variable Box

This is below the Equation Box in the Calculator.

- It holds a list of the current Symbol Set
- You can make new symbols on the fly by writing them into the Variable Box, putting a value in the Equals Box and then clicking the Equals Button between the two boxes.
- Double-clicking the Variable Box inserts the current symbol into the Equation above at the current insertion point.
- If the value for a symbol is greyed out inside the Equals Box, it is because the value has been made constant on the Symbol Page and can only be changed via that page.
- You can use the Variable Box to set the values of variable symbols, by..
 - 1 Choosing a symbol from the drop down list
 - 2 Putting a number value or small calculation like 2π in the Equals Box
 - 3 Clicking the button marked "=" between the two boxes (the Equals button)
 - 4 When you use this symbol in an equation, it will have this value
- Any differentiation or Integration will be with respect to the symbol in the Variable Box.
- The variable in a series or sequence calculation will be the symbol in the Variable Box
- If you graph an equation, the x-axis of the graph will be based on the symbol in the Variable Box. The y-axis will be based on the symbol that is before an "=" sign at the beginning of the equation (ie. $W = \dots$).

See Also..

[Equals Button](#)

[Equals Box](#)

Equals Button

This button is on the [Calculator](#) between the [Variable Box](#) and the [Equals Box](#) and is marked "=".

- When you click it, it forces the [symbol](#) in the Variable Box to be equal to the number or calculation in the Equals Box
- If the symbol is set to **Constant not Variable** on the [Symbols](#) page,, you will not be able to change its value in the Calculator this way - you will need to go to the Symbols page.
- If you have typed a new symbol into the Variable Box that you want to use in [equations](#), click this button to register the symbol with the calculator so that it will be recognised. Use the Symbol Page if you want to fully define a new symbol.

See Also..

[Variable Box](#)

[Equals Box](#)

[The Calculator](#)

Equals Box

This box is on the Calculator and holds the current value of the symbol in the Variable Box

- You can select a past value from the drop-down list
- The value in this box will be the far left point on a graph's x-axis. The far right point of the x-axis will be the value in the To Box
- You can put simple calculations in this box instead of actual numbers if you wish. For example, $3\pi/4$ or $2y^6$. The calculation will be replaced by a number answer when the equation in the Equation Box is calculated or graphed - the equation will be stored in the boxes drop-down list for later reference, as well as the result.
- The number shown may be rounded off for display purposes, but the box holds the true value of the symbol. To turn off and on the number display formatting, double click in the box. This feature ensures that calculations done using symbols are as accurate as possible without you having to look at lots of decimal places when you really don't need to.

See Also..

[Equals Button](#)

[Variable Box](#)

To Box

This box works in a few ways but for a standard calculation, you won't need it.

If you are making a graph ..

- This box holds the maximum value of the variable (the symbol in the Variable Box that forms the x-axis of the graph)

if you are doing a sequence, series or definite integration

- This box holds the maximum value for the variable symbol in the Variable Box.

Please note ..

- You can put simple calculations in this box instead of actual numbers if you wish. For example, $3\pi/4$ or $2y^6$. The calculation will be replaced by a number answer when the equation in the Equation Box is calculated or graphed - the equation will be stored in the boxes drop-down list for later reference, as well as the result.
- The number shown may be rounded off for display purposes, but the box holds the true value of the symbol. To turn off and on the number display formatting, double click in the box. This feature ensures that calculations done using symbols are as accurate as possible without you having to look at lots of decimal places when you really don't need to.

See Also ...

[Equals Box](#)

[Variable Box](#)

[Equals Button](#)

[The Calculator](#)

How do I put one graph on top of another?

- 1 Put your new equation into the Equation Box and click the Over button.
- 2 It will be overlaid on the existing graph
- 3 You can put many graphs on top of each other.

This is a good way of :-

- Seeing what graphs look like in comparison to each other - does one shoot off to infinity while the other gets smaller, for example.
- seeing where two or more equations cut across each other (as in simultaneous equation problems)







please note:-

If you click Graph instead of Over, it will wipe the graph clean before it redraws the new one, so if you are really working hard on a graph for presentation, be sure to save it to disk regularly via the Graph Page Menu.

The Main Pages in BlackBox

These are in the notebook in the middle of BlackBox. They hold the major parts of BlackBox like the Graph Page and the Spreadsheet Page. You can turn the pages by clicking on the tabs.

Note: The windows that can clutter up the screen (Answer Window, Function Keypad) will disappear when you click on the tabs shown above - even if you are not changing pages, this can be a quick way to clear the screen.

-  Graph Page
-  Equation List
-  Symbols
-  Spreadsheet
-  Document
-  Program Settings

See Also ...

[The Calculator](#)

[The Speedbar](#)

Graph Page

The Graph Page can display 23 different types of chart from XY (or scatter) graphs to 3D Gantt charts (used in project management graphs).

[Graphing Data from the Spreadsheet](#)

Quick Guide to graphing equations ..

To graph an equation, fill in the graph details in the [Calculator](#) and click Graph

To make a graph from the spreadsheet, select the region of the sheet you want to include and then click the Graph button for the different options.

Editing Graph

To change any feature of the graph, you may..

- Dbl-click any part of the graph
- Click the graph with the right mouse button

See Also ...

[BlackBox Graph Gallery](#)

[Detailed Graph Help](#)

\BlackBox Graph Gallery9

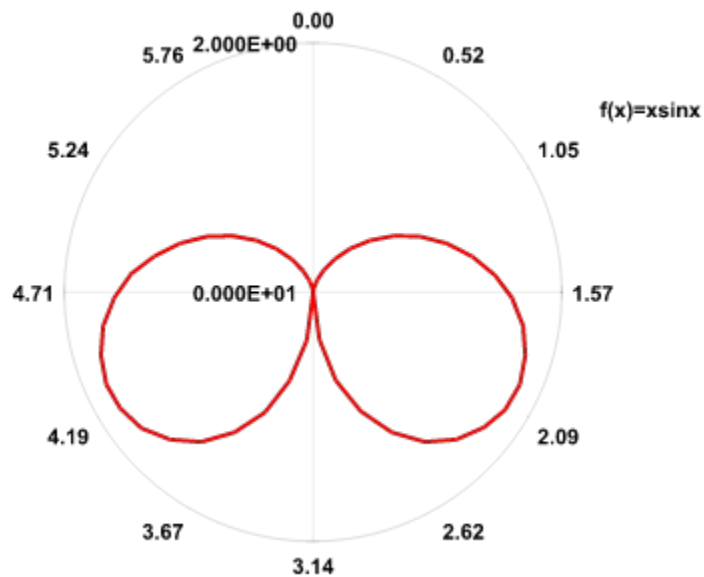
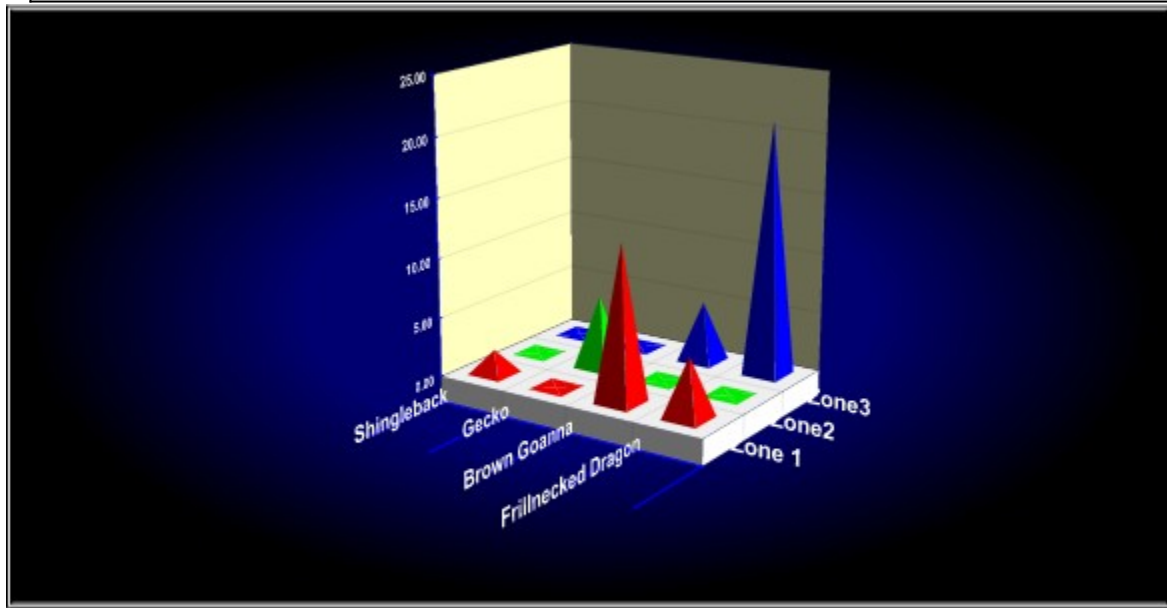
See also ...

[Graphing from the Spreadsheet](#)

[How to Graph an Equation](#)

[Detailed Graph Help](#)

A few graphs to show what you can do with the Graph Page



How to Graph an Equation

- 1 Enter the equation into the [Equation Box](#)
- 2 Decide what symbol will be the x-axis symbol and select it in the [Variable Box](#). If you don't mention this symbol in the above equation, the graph will generally be a flat line.
- 3 Put the minimum value (left) of the x-axis into the [Equals Box](#)
- 4 Put the maximum value (right) of the x-axis into the To Box
- 5 Click the Graph button on the [Calculator](#)

If you want to change the format of the numbers printed on the graph's axes, you can do that on the [Program Settings](#) page.

If you want to change the graph itself, right click on it to get the menu or dbl-click any part to change it directly. You can drag elements around the screen with the left mouse button, as well as resize them.

See Also ...

[Overlaying Graphs](#)

[Detailed Graph Help](#)

[Writing Equations into BlackBox](#)

[Examples of Equations](#)

Writing Equations - an Overview

Examples of Equations

- Equations are mainly entered into the Equation Box
- .. though they may also be put into the Equals and To Boxes. You would do this if, say, you wanted to graph $y=\sin x$ when $x = -\pi$ to 2π . In this example, you would put $-\pi$ in the Equals Box and 2π in the To Box - when you calculate the equation, these are calculated first and the value(s) of x are set.

Click here for advice on using = signs in Equations

- If the math equations you are using coming out of a textbook, you should try to enter it into BlackBox as it is written. This is not always possible:-

Differences between normal math and BlackBox-style math

When BlackBox doesn't understand the equation

- You are not restricted to the standard calculator styles on entering math expressions, as you can use symbols to stand for numbers.

Examples of Equations

[The Calculator](#)

[Spreadsheet Math](#)

The following examples use symbols like y,x,a,b,c to stand in for numbers. You are free to use any symbols you like, or even no symbols at all (as on a standard calculator). The math symbols come from the Function Keypad that pops up when you click in the Equation Box.

Basic Math

You can type in anything of this sort into the Equation Box and calculate by clicking the Calculate button -

- 112^2 , $1+2+3+112^2$, $1/1000 * 6/7$, $27*Pi$, $\sin 3 + \cos 7$, $\log (1/100)$

Symbolic Math

These examples use symbols instead of only functions and pure numbers -

- $x \sin x$ (*x times the sine of x, don't need "something = "*)
- $y = x \sin x$ (*now y is equal to the answer*)
- $y = ax^2 + bx + c$ (*standard quadratic equation*)
- $x=2x$; $t=\sin x$; $y=(xt)/(2t \sin(x))$ (Chained Equation - each time you click calculate, it recalculates all three equations. You can chain as many as you like. For an example , see

[Newton's Method for Roots](#)

- $1/x + 1/x^2 + 1/x$
- $\text{Velocity} = \text{Distance} / \text{Time}$ (*from Physics*)
- $y' = d/dx: 3x^4$ (*y' = the derivative of(3 times x to the power of 4)*)
- $\text{TotalWeight} = \text{Weight1} + \text{Weight2} + \text{Weight3}$ (*to suit a problem perhaps*)
- $\text{Area} = \text{Base} * \text{Height} / 2$ [Area of a triangle] (*comments can go in [...] square brackets - handy if you want a few notes to go with the Equation, such as the textbook page or tutorial assignment it is from*).

See Also..

[Things to note about BlackBox Math](#)

[Using Symbols](#)

[Calculus with BlackBox](#)

[Chained Equations](#)

Newton's Method for finding Roots

If you are given any equation, such as $y=e^{(2x+3)}$, and you are given a value that the equation can equal, Newton's Method lets you find the value(s) of x that will lead the equation to equal that given value. The values of x are called the roots of the equation. Newton's Method finds the values of x that make the equation equal to zero, but with a little trickery, you can find the values when they equal **any legal answer**

Example..

When $y=e^{(2x+3)}=17$, {e to the power of $(2x+3)$ }
what does x equal?

To solve this we need:-

- **Equation 1** - an rearranged expression of the equation that gives us an answer of zero in total (the trick) - so, if $y=e^{(2x+3)}=17$, then our Equation 1 is $y=e^{(2x+3)}-17$ (this will equal zero only when $y=e^{(2x+3)}=17$).
- **Equation 2** - the derivative of $y=e^{(2x+3)}-17$. You don't need to do the actual calculus yourself in BlackBox, simply stick a d/dx: symbol after the equals sign:- $y=d/dx: e^{(2x+3)}-17$. Instead of making this equation $y=...$, we will make it $y'=...$ so that we don't lose the first value of y when we do this second calculation.
- A first **guess** for the value of x - you can get an estimate by graphing Equation 1 and looking at where it crosses the x -axis. Having graphed $y=e^{(2x+3)}-17$ when $x = -1$ to 1 , I chose a first guess of $x = -0.1$

Doing the calculations....

Newton's method involves repeating a process over and over until the value of x settles down (converges) to the right value.

The process on paper is:-
 $x_n = x_{(n-1)} - y/y'$

In BlackBox, you do it like this (as a Chain Equation):-

In the Equation Box: $y=e^{(2x+3)}-17$; $y'=d/dx: e^{(2x+3)}-17$; $x=x-y/y'$

In the Variable Box: x

In the Equals Box: You first guess for the number value of x

Now click the Calculate button over and over until the value of x in the Equals box stops changing - that value is the answer. There is one real answer for every time your chosen equation crosses the x -axis. In this case, there is only one answer for x and that is -0.08339 (see below). Now if you calculate $y=e^{(2x+3)}$ when $x = -0.08339$ then the answer should be 17 :-

(When -

$e = 2.718$

$x = -0.08339$

$y=e^{(2x+3)} = 17$ (yes indeed!)
_____)

BlackBox's output in getting the answer ..

Note:- if you just want the answers and not the other text, turn off Full Answer Text on the Settings Page

$$x = -0.1 = -0.1$$

When -

$$e = 2.718$$

$$x = -0.1$$

$$y = e^{(2x+3)-17} = -0.5554$$

When -

$$e = 2.718$$

$$x = -0.1$$

$$y' = d/dx: e^{(2x+3)-17} = 32.89$$

When -

$$y = -0.5554$$

$$y' = 32.89$$

$$x = -0.1$$

$$x = x - y/y' = -0.08312$$

When -

$$e = 2.718$$

$$x = -0.08312$$

$$y = e^{(2x+3)-17} = 0.009426$$

When -

$$e = 2.718$$

$$x = -0.08312$$

$$y' = d/dx: e^{(2x+3)-17} = 34.02$$

When -

$$y = 0.009426$$

$$y' = 34.02$$

$$x = -0.08312$$

$$x = x - y/y' = -0.08339$$

When -

$$e = 2.718$$

$$x = -0.08339$$

$$y = e^{(2x+3)-17} = 3.554E-6$$

When -

$$e = 2.718$$

$$x = -0.08339$$

$$y' = d/dx: e^{(2x+3)-17} = 34$$

When -

$$y = 3.554E-6$$

$$y' = 34$$

$$x = -0.08339$$

$$x = x - y/y' = -0.08339$$

See Also

[Chain Equations](#)

The Calculator
Writing Equations

Chains of Equations

Doing this lets you calculate or graph many equations in one hit.

To chain equations together:-

- Put a semicolon ; between the equations in the Equation Box.
- ie, try { $x;2x;3x;4x;5x;6x$ } in the Equation Box and click the Graph Button - you will make six graphs that demonstrate the differences between the equations

You can use this technique for Newton's Method for finding Roots, as well as any process that involves doing a series of calculations over and over.

See Also ..

[Examples of Equations](#)

Things to note about BlackBox Math

We've tried to make it a natural math style, but please note..

- Most rules of math apply (order of operations, ways of writing math etc)
- Equations that may be written over two lines on paper must be reduced to one line to fit the Equation Box.
For Example, the written equation
$$y = \frac{x+2}{x-1} - \frac{x+4}{x-2}$$
would be entered into BlackBox as $y = (x+2)/(x-1) - (x+4)/(x-2)$
(assuming you don't rearrange it first)
- You don't need to put an = sign into the equation
- If you have an = sign in an equation , you may only have one symbol on the LHS (left hand side) of it. This means you may have to rearrange some equations to get just a single symbol as the subject of the equation.
- 2π is the same as 2Pi , $\sin(3x/2)$ is the same as $\sin(3*x/2)$
- Uppercase/lowercase does matter when writing symbols. V is not the same as v - they are two different symbols (if you want to use them to stand for something like Volume or velocity or whatever you want)
- Some math function symbols have a ":" in them, such as the BlackBox symbol for differentiation, "d/dx". This means that they go before the body of the equations and act on the whole equation, not just part of it. When you choose one of these function symbols from the Function Keypad, they are placed in the correct spot in the equation automatically. This means that to calculate, say, $[y = d(2x)/dx - 3\ln x]$ for when $x = \text{some number}$ would require two BlackBox calculations:-
 - 1 $y = d/dx: 2x$ {click calculate}
 - 2 $y = y - 3\ln x$ {click calculate for ultimate answer}
- When you differentiate (or Integrate), it is with respect to the symbol in the Variable Box. The symbol for differentiation reads "d/dx:" but it doesn't have to be with respect to x.
- In normal math, you would write, for example, $y = \cos^2 x + 2$
In BlackBox, you must put it as $(\cos x)^2 + 2$ or the results may be unpredictable.
Note: $\sin x^2$ is still $\sin x^2$ etc - you only follow the above rule when the trig-functions itself is squared.

See Also ..

[Writing Equations](#)

[Examples of Equations](#)

[Using Symbols in Equations](#)

Using Symbols

[Symbols Page](#)

[Calculating Using Symbols](#)

Symbols..

- are used in place of numbers in some calculations
- are edited and created on the [Symbol](#) page
- when used instead of numbers in a series of calculations, they reduce any compounding of rounding off errors. You only round off the numbers when you get your final answer. BlackBox shows the values of [symbols](#) as being rounded off, but when you [calculate](#) with the symbols BlackBox uses the full unrounded values. You can inspect the full values by double clicking in the [Equals Box](#) when the symbol is in the [Variable Box](#).
- can be almost anything you want. You can call them things like "PriceOfFruit" and set their [units](#) to "DollarsPerKg" if that helps you express the math/science problems you are dealing with.
- If they can have any value you want them to, they are referred to as [variables](#).
- If they only have one value, they are referred to as [constants](#).
-

Examples of Symbols..

- x & y - they are commonly used in math problems. x stands for a number you are given and y stands for the answer to the equation when x has that value. For this reason, they are called the Independent and Dependent variable respectively.
- Pi and e are symbols that stand for number values. As they only have one value each (3.14159.. and 2.7218..), they are constants. These are automatically included in any [Symbol Set](#)
- There are many science constants that you can incorporate into your [equations](#), such as "g" that stands for acceleration due to gravity (approximately 9.8 metres per second squared). When you register **g** with BlackBox, you can from then on just drop the symbol into your equations and BlackBox will know what you mean by it.

Symbols Page

The Symbols Page holds the symbol set, a complete list of all the symbols BlackBox recognises in equations. You can make your own symbol sets and save them in a Math file. You can also load in the pre-defined sets and customise them.

The essential boxes ..

Symbol for use in Equations - this box holds the currently selected symbol. When BlackBox comes across a symbol in an equation, it looks up its number value for use in the calculation.

Number Value - this is the value that the symbol is currently equal to.

Optional Boxes ..

Constant, Not Variable - this button is like a safety catch that won't allow the value of a constant to be changed by accident (giving you wrong answers). You will want some symbols to be variables (take on any value you give them ie x & y) but you will need others to be constant, such as **Pi** (3.141...), **e**, **c** (speed of light) or **g** (acceleration due to gravity).

Units - If the symbol stands for some measurement (such as speed, weight, length, seconds, Joules Per MeV), you can register its units here and they will be printed out with any answers or graphs. Units are very important - don't neglect to think about them as you do calculations.

Long Name - put the proper title of the variable here if it has one. You are best off using short symbol names in the actual equations but in this box you can fill in the proper version. For example, your symbol might be **a** but the long name is **Acceleration**.

Notes - put any notes here that will help you either now or later.

Symbol Page Buttons

Calc With Symbol - Inserts the selected symbol into the Equation Box at the current cursor point.

New Symbol - Prepares the Symbol Page for the entry of a new symbol's details.

Edit Symbols - Turns on Edit Mode, in which you can change the selected symbol's details.

Accept Changes - Registers the changes you have made to the symbol set.

Ignore Changes - Reject the changes you have made to the symbol set.

Del Symbol - Deletes the current symbol from the symbol set.

Fresh Symbol Set - Makes the current set into a fresh set with only a few basic symbols in it such as x, y, Pi etc.

Save as Text File - Saves the current set as a tab-delimited text file for use in the spreadsheet or any text editor.

Help - Activates help file topic on symbols.

See Also ..

[Using Symbols in Equations](#)

Examples of Equations
Equation List

Equation List

The Equation List is a page that holds all the equations in a math file. You can reuse equations from the list by dbl-clicking them.

Whenever you calculate or graph, the equation is stored here and saved automatically at the end of your session. You can load in sets of equations from disk to work with them.

Equation List Popup Menu

- To access the popup menu associated with the Equation List, right-click on the Equation List. These choices will let you edit the list and change the font and colour. You may also copy all or one of the Equations to the clipboard to paste them into a document.

To use an equation from the list..

Dbl-click the equation of your choice. It will appear in the Equation Box ready to be calculated.

To load or save an Equation List on disk

Click the Math Files button in the middle of the button bar at the bottom of the screen.

See Also ..

[The other Pages in BlackBox](#)

[The Calculator](#)

[Writing Equations](#)

Equation List Popup Menu

Use Selected Equation

- Places a copy of the selected equation into the Equation Box of the Calculator, making it ready to work with. This saves you retyping often used calculations.

Copy to Clipboard

- Copies the selected equation to the clipboard for pasting into a text-holding box (maybe Document, Spreadsheet, Equals Box etc) or another program.

Copy Entire List to Clipboard

- Copies all equations on the list to the clipboard.

Delete All Equations

- Clears the Equation List of all stored equations

Delete Selected Equation

- Deletes the selected equation from the list.

Save as Math File

- Opens up the Math File Dialog

Save as Text File

- Saves the equations as a text (*.txt) file for use in any text editor.

Change Font

- Select a new font for the Equation List

Change Background Colour

- Change the background colour of the Equation list

Help

- Brings up on-line help to do with the Equation List

See Also ..

[Equation List Page](#)

[Symbols Page](#)

Symbolic Equations and Formulas

[The Calculator](#)

[Examples of Equations](#)

BlackBox can deal with math expressed symbolically, or using symbols instead of simply numbers with math functions.

Normal Calculation..

- $1+3/4,$ $5498*6543/543\sin 7$

Symbolic Calculation..

- $x\sin 2x, x*\sin 2x, x*\sin(2*x), x\sin(2x)$ - All these are the same mathematically.
- $y=e^x$ {y = e to the power of x}
- $\text{Income} = \text{GrossProfit} - \text{Costs}$

When you do a symbolic calculation..

- You can set the value for the symbols using the Variable Box and the Equals Box

See Also ...

[Making New Symbols](#)

How do I make a new symbol?

[Symbols Page](#)
[Using Symbols](#)

Method 1:- Simplest

Type the symbol into the Variable Box, put a number in the Equals Box and click the Equals Button. The symbol is now ready to use in equations but you may need to set its units later (if Strict on Units is checked on the Settings Page)

Method 2:- Trickiest

Simply use the new symbols in an equation. BlackBox will get totally confused and then ask you about the bits it can't recognise. You may have to clarify what you meant as your new symbol (especially if it is similar to another symbol or math function).

Method 3:- Best

- 1 Go to the symbols Page
- 2 Enter the symbol in the box marked "Symbol to use in Equation" or edit the symbol that has been placed there after BlackBox halted on a calculation.
- 3 This flips the Symbols Page to Edit Mode
- 4 Fill in the number value you want the symbol to have at first
- 5 Give the symbol some units if you want. You can select them from the drop-down list or invent your own (they will be added to the list)
- 6 Decide whether you want the symbol to be a constant by checking the Constant, Not Variable box.
- 7 Fill in any other details you would like stored with the symbol, such as its proper name and notes on how you might use it.

When you are finished, click Accept Changes button ..

- or Del/Cancel button if you want to cancel the changes you have made.

- Any changes you make will be automatically saved when you exit BlackBox. If you want to load in a new file, you need to save the current file first or you will lose your changes. Click F6 for autosave every so often.

Calculus

BlackBox can only perform numerical calculus ...

- This means that it can give you answers to differential and integral calculus problems but **it cannot do an algebraic rearrangements for you**. It uses the Fundamental Theorem of Calculus (see your textbook) to do the numerical differentiation and Simpson's Rule to do the numerical integrations. Therefore, you can only use BlackBox to evaluate Definite Integrals, where the answer is the area under a curve along a defined interval (set in the [Equals Box](#) and To Box, much like setting up a graph).
- So you can either generate graphs, number answers or test to see whether your algebraic differentiation of an equation gives the same answers that the BlackBox one gives given the same input values.

Setting up for differentiating an equation

- Type the equation you want to differentiate into the [Equation Box](#) (eg, $y = \sin x + \cos z$)
- Click the "d/dx:" button on the [Function Keypad](#) - it will insert the [symbol](#) at the correct place (after the = sign). **Please Note:** While the function key reads "d/dx:", it can differentiate with respect to any of your [symbols](#), not only x
- What symbol will the differentiation be in respect to? The symbol in the Variable Symbol box. In the example above, this could be x or z.
- The press [Calculate](#) or Graph buttons on the [Calculator](#)

Setting up an Integration

- The process is the same as above but you choose the "int:" button from the Function Keypad instead

See Also ..

[Newton Method for Finding Roots](#)

[List of Math Functions](#)

List of Math Functions

Access these functions via the Function Keypad

[Show Function Keypad](#)

[Things to note about BlackBox Math](#)

This is a list of all the supported math functions:-

Standard Functions

+ [Plus, as in " $1+2$ "]
- [Minus, as in " $5x - 3$ "]
/ [Divide, as in " $1/x$ " or " $2/3$ "]
÷ [Divide, Same as above but not accessible by keyboard, only by the Function List]
* [Multiply, as in " $2*3$ " NOTE - Multiply is "", not "x" as "x" is also common symbol used in equations]
^ [Power, as in " $y = e^{(kt+x)}$ ", or " x^2 " (same as " x^2 ")]
^2 [Squared, as in " $y = x^2$ "]
^3 [Cubed, as in " $y = 2^3 + 5x^2 - 2$ "]
sqrt [Square Root, as in " $y = \sqrt{x}$ "] {The usual symbol is not available}
! [Factorial, as in " $x = 5! = 5 * 4 * 3 * 2 * 1 = 120$ "]
abs [Absolute or Modulus, as in " $y = \text{abs } \sin x$ "]
| [Same as Above, Absolute or Modulus, as in " $y = \text{abs}(\sin x)$ "]
ln [Natural logarithm, as in " $y = 2 \ln x$ "]
log [Base 10 Logarithm, as in " $y = 1 / \log x$ "]
½ [Shortcut for writing one-half or 0.5]
¼ [Shortcut for writing one-quarter or 0.25]

Trigonometrical Functions

sin [Sine, as in " $y = \sin(2x + 1)$ "]
cos [Cosine, as in " $y = \cos x$ "]
tan [Tangent, as in " $y = \tan 2.4$ "]
sec [Secant, as in " $y = \sec x$ "]
csc [Cosecant, as in " $y = \csc 2x$ "]
cot [Cotangent, as in " $y = \cot 3x$ "]

Inverse Trigonometrical Functions

arcsin [Arcsine, as in " $y = \arcsin(3x)$ "]
arccos [Arccosine, as in " $y = \arccos x$ "]
arctan [Arctangent, as in " $y = \arctan x$ "]
arcsec [Arcsecant, as in " $y = \text{arcsec } x$ "]
arccsc [Arccosecant, as in " $y = \text{arccsc}(3-2x)$ "]
arccot [Arccotangent, as in " $y = \text{arccot } x$ "]

Hyperbolic Functions

sinh [Hyperbolic Sine, as in " $y = \sinh x$ "]
cosh [Hyperbolic Cosine, as in " $y = \cosh x$ "]
tanh [Hyperbolic Tangent, as in " $y = \tanh x$ "]
sech [Hyperbolic Secant, as in " $y = \text{sech } x$ "]
csch [Hyperbolic Cosecant, as in " $y = \text{csch } x$ "]
coth [Hyperbolic Cotangent, as in " $y = \coth x$ "]

Inverse Hyperbolic Functions

arsinh [Hyperbolic Arcsine, as in " $y = \text{arsinh } x$ "]
artanh [Hyperbolic Arctangent, as in " $y = \text{artanh } x$ "]
arccosh [Hyperbolic Arccosine, as in " $y = \text{arccosh } x$ "]
arccsch [Hyperbolic Arccosecant, as in " $y = \text{arccsch } x$ "]

arcsech [Hyperbolic Arcsecant, as in 'y = arcsech x']
arccoth [Hyperbolic Arccotangent, as in 'y = arccoth x']

Calculus and Special Functions

d/dx: [Numerical Differentiation, as in "y = d/dx: cosx + sin x"]

int: [Numerical Integration, as in 'y = int: x^4"]

inv: [Inverse of the Equation, as in "y=inv:sinx"]

seq: [Sequence, as in "y = seq: 2x+2 "]

ser: [Series, as in "y = ser: 2x^2 "]

Please note that only one of these special functions can be used per calculation. This is because these are the only functions in BB that act on the entire equation and not just act as a part of it. For example, you cannot have this:-

"y = int: 2x+d/dx:3x^4"

but you can split them as a chain equation like this:-

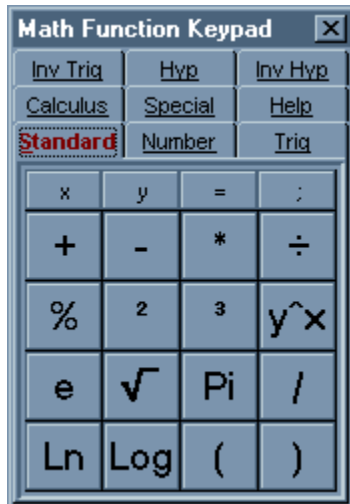
"y1=d/dx: 3x^4 ; y = int: 2x+y1".

Because of this limitation, some things will not be easily graphed, but these are the more complicated formula such as the length of a curve that requires an integration and differentiation.

Function Keypad

This appears when you click in the Equation Box.

When you click a key, the math function is inserted at the current cursor position in the Equation Box



The math functions are grouped on different pages.

Right-Mouse button on the page tabs to hide the Functions Keypad.

= signs in Equations

Use an equals sign in an equation if ..

- You want to make a symbol's value equal to the answer on this calculation. It will be handy in you need to use that answer in the next calculation you do - in this case, you can use the symbol to stand for this answer in the next calculation's equation.

Example:

1. $y = \sin x$ [Calculate] - now $y = \text{answer}$
2. $3 \ln y - 2y^2$ [Calculate]

This would give the final answer equal to $3 \ln(\sin x) - 2 \sin^2 x$

- You would like your answer expressed in particular units. For example, if you have a symbol called Mass that has units of Kilograms, when you do an equation like '**Mass = Force / Acceleration**', the answer will come out as "... **Kilograms**'. Handy if you want to copy the answers straight to the Document or if you want to be reminded what the units of your answers are.
- You would like the y-axis of a graph to have this symbol automatically written in as its label:-
Example: Graphing Distance/Time is the same as graphing Velocity=Distance/Time except the second graph would have Velocity and its units written on the y-axis.

See Also ..

[Writing Equations](#)

When BlackBox doesn't understand

Sometimes BlackBox will tell you that it doesn't recognise something from an equation you have tried to calculate. It brings up the Inquiry about the Equation box.

This can be for two reasons ..

- 1 The equation contains symbols that are not yet in the current Symbol Set on the Symbols Page - if you want to use the new symbol, you must define it by clicking the Define Button. You will be taken to the symbols page
- 2 You have made a simple spelling error - in this case, click Rewrite and you will be taken back to the Equation Box for corrections

If you are given a choice of unrecognised symbols ...

Sometimes, you will be presented with a choice of possibilities for what the symbol is that BlackBox doesn't recognise. This is only because the types of symbols you may use are very broad and BlackBox wants to let you use almost any type of symbol, even one that looks very similar to symbols you have already defined. If you get a message saying " or maybe ...", it means BlackBox can't be certain exactly what to pick out and has handed its best guess across to you - in this case, you will need to edit out the bits you don't want to keep in the symbol you are about to define.

Clarifying the Symbol

Examples of very similar symbols that are acceptable ..

you may have symbols like B, B1, B11, b`, b``, 1B1` if they make any sense to you. B is often used in Physics for the strength of a magnetic field. If you were solving a problem that mentioned many magnetic fields, you could use a similar but different symbol for each field - B1, B2, B3, B4, Btotal, Bsmallest and do calculations like $B_{total} = (B_1 \sin \theta - B_2 \cos \theta) - B_{smallest}$.

See Also ...

[Symbols Page](#)

Clarifying the Symbol

This box pops up when BlackBox is uncertain of exactly how your new symbol is written. At this point you can either:-

1. Choose one of BlackBox's guesses from the drop-down list and press OK to go on to further define the symbol's details.
2. Type in your own symbol and click OK. You will need to do this if BlackBox does not correctly pick out what you meant - this can happen if your new symbol is very similar to an existing one.

With BlackBox, you do not always have to write in the multiply sign because it is assumed in a situation when nothing else makes sense.

For example, you don't need to write " $y=2*x$ ", you can write it as " $y=2x$ ", much as you would on paper. The trade off with that flexibility is that BlackBox can become rather confused when you make a new symbol and this is why you sometimes get sent to the Clarify dialog box.

Symbols

[Symbols Page of BlackBox](#)

Symbols are words, names or single letters that can be used instead of numbers in mathematical equations.

Instead of using specific numbers in an equation (ie. $3.14159 * 4^2$ for area of a circle), we can write $\text{CircleArea} = \text{Pi} R^2$ into the [Equation Box](#). CircleArea is a symbol we made up, R stands for radius (of any length) and Pi is a constant or symbol with a fixed value. They are all symbols and they can save lots of time for you.

When equations are written with symbols..

You can use them over again and only change the values that they stand for.
(a good example is the Quadratic Equation $y = ax^2 + bx + c$ that gets used often).

In the previous example, you could change the value of the radius (R) and recalculate without typing all the numbers in again as you would do on a pocket calculator.

It also looks better and it is in the form of the standard equation. It is more important to remember the equation than any numbers.

Symbols can store answers to calculations you do often - and they keep the value you last gave them.

Using symbols instead of numbers in calculations allows you to have units printed out with the answers - for work in science especially, this will help keep you on track.

Making your own symbols to stand for anything..

You are free to invent any symbols you like, with just a few rules:-

- Avoid using symbols that are the same as math functions
(ie, don't call a symbol "Log" because there is a math function called log, or call a symbol A+ etc).
- Upper and lower case letters are not the same - this lets you have one symbol for Volume called V and one symbol for Velocity called v if you wish.
- Don't have spaces or use the "_" character. If you invent a symbol for the weight of a dog on the moon , call it something like "WeightOfDog" or "DogWeightOnMoon".

Spreadsheet

[How to learn about the Spreadsheet](#)

The BlackBox spreadsheet is used to ...

- 1 Manipulate columns of data, such as would come from a science experiment or survey. It holds 128 built-in functions from statistics to business finance.
- 2 Create graphs and charts from tables of data
- 3 Create mathematical models by linking data with math function that create some outcome based on the data (perhaps modelling population growth in a colony of rabbits over time given different factors like birth rates, death rates etc).
- 4 Print tables of data alongside their graphs
- 5 Simplify many math processes, such as vector arithmetic
- 6 Launch the [matrix tools](#)

The spreadsheet is standard in its use and imports/exports Microsoft Excel files

To see examples of spreadsheets ..

- Go to the Spreadsheet in BlackBox, click the menu button and choose Files | Open. You will see (in BlackBox's home directory) all the example sheets that come with the program.

[Click here for Detailed Spreadsheet Help](#)
[Matrices and Vectors](#)

To get the Spreadsheet Menu ..

- Either click the Spreadsheet Menu button or Right-click on the spreadsheet itself.

To enter formulas..

Begin the cell entry with an equals sign (ie $=a1+b1$, $=\sin(a1)$, $=\text{SUM}(A1..D4)$)

[Spreadsheet Functions](#)
[Spreadsheet Math Functions](#)

To Graph the Spreadsheet..

[Click here](#)

To paste a graph into the spreadsheet..

- Choose copy from the [Graph page menu](#)
- Click on the spreadsheet
- Choose Edit|Paste from the spreadsheet menu

See Also ..

[Spreadsheet Files](#)

How to learn about the Spreadsheet

... by playing with it.

- 1 Start by typing in a list of numbers
- 2 Try using the Edit Functions from the spreadsheet menu to copy and paste cells around the sheet. You will soon see how easy it is to create tables of numbers without too much work. These table could be all the data from an experiment. When your table is set up, any changes you make to it trigger an update to the entire table (recalculation) - this is what makes it better than pencil and paper.
- 3 Try adding and averaging some number lists. To find out about the math functions you can build into the sheet, see the Detailed Spreadsheet Help File (button at the top of this screen). Try mutiplying one list of numbers by another and getting the answers out as a new list. What happens when you change the value of a number in the original list?
- 4 Highlight some numbers and turn them into a graph using the menu. Paste the graph back into the spreadsheet and resize it with the mouse. Put in some headings for the columns in the spreadsheet, and highlight these as well when you make a graph - the graph will now show the column names in the legend.
- 5 Put some headings in for the columns of numbers. You can make the spreadsheet more attractive by changing the fonts (Formatting Menu) and putting boxes or shading on the columns. Make the gridlines disappear when you no longer need to refer to them, or before printing.

See Also ...

[Using the Spreadsheet](#)

Matrices and Vectors

BlackBox has some special functions for when you are studying matrices and vectors. (Note: Vectors are simply matrices with only one column or only one row).

Making a matrix or vector

Type the numbers into the spreadsheet in the shape of the matrix you want, highlight them with the mouse. Then click the matrix button and select Turn Selection into Matrix from the popup menu. It will become its own window.

[Launching a Matrix from the Spreadsheet](#)

Doing operations on one or more matrices

The button on the top left of the Matrix window will activate the popup menu.
This holds all the choices, such as getting the Determinant, Inverse etc or multiplying matrices.

Built-in Matrix Functions available ..

[Matrix Functions](#)

Matrix Functions

[Matrices and Vectors](#)

[Launching a matrix from the spreadsheet](#)

These operations are available when you click the left-corner icon of a **Matrix Window**:-

Name Matrix - lets you give the matrix a distinct name by which you will know it when doing calculations

Calculations Between Matrices - a box opens up that lets you add, divide, multiply and subtract matrices

Row and Column Operations - a box opens up that lets you perform matrix row and column operations. This is useful for row reductions when solving simultaneous equations using matrix methods.

Multiply/Divide Whole Matrix by a Number - scalar operations on a matrix

Determinant - calculates the matrix's determinant

Invert - Makes a matrix that is the inverse of the current matrix

Transpose - makes a matrix that is the transposition of the current matrix

Cofactors - makes a matrix that is the cofactor matrix of the current matrix

Eigen Vectors and Eigen Values - Calculates these for the current matrix. If you cannot read the Eigen Value from the Matrix's title, click on the title bar with the right-mouse-button for it to be shown in a message box.

Copy Matrix to Clipboard as Text - Using this, you can paste the matrix either back into the spreadsheet or into a text box like the Document.

Document

A basic word processor

This is for:-

- Making notes (revision notes, workings)
- Preparing neat documents for handing in
- You can paste into it from the spreadsheet, graph page and Answer window
- It exports files in RTF and text format. These can be read by all major word processors.

Document Tool Bar ..

Activate the Document tool bar by clicking on the Document's status bar at the bottom of its window. This gives you buttons for changing fonts, saving and loading, searching through text.

Hypertext link to Equation Box ..

The button on the tool bar marked **H** is the hypertext button. When you change selected text to have a hypertext underline (blue line), it will appear in the Equation Box when clicked. In this way, you can hypertext math expressions in the document and enter them into the calculator without having to type them in.

Inserting Graphics ...

If you have the Graphics in Document box checked on the Settings Page, you can insert graphics into the document. This can get a bit messy, that is why we have made it an option only. You can insert either by pasting in (Ctrl-V) or by clicking the Insert Graphic button.

See Also

[The Spreadsheet](#)

[The Graph Page](#)

[Printing from BlackBox](#)

Printing from BlackBox

In BlackBox you may print from ...

- The Graph Page via the Graph Page Menu
- The Answer Window via its menu
- The spreadsheet via the Print button on its toolbar
- The Document via its toolbar

See Also ...

[Getting Around BlackBox](#)

Getting Around BlackBox

[Handy Tips for Beginners](#)

[Keyboard](#)

- F1 - [Context-sensitive help](#)
- F2 - [Math File Dialog Box](#)
- F3 - [Untypeable Characters Box](#)
- F4 - Show or Hide the [Calculator](#)
- F5 - Show the [Answer window](#)
- F6 - Activate/Deactivate the toolbar on the current page.
- F7 - Turn page of the notebook
- F8 - [Calculate](#)
- F9 - Graph
- F10 - [Overlay a Graph](#)
- F6 activates any hidden tools for the current page
- Get the About Box by clicking on the BlackBox logo (bottom left)
- Get the Answer window by clicking the "tick" button at the bottom of the screen. This window should popup automatically when you do a calculation.
- Get the [Function Keypad](#) by clicking in the [Equation Box](#).
- Get the [Equation List](#) by clicking the label "Equation" on the left of the Equation Box in the Calculator.
- Get the [Symbol Page](#) by clicking the label "Variable" on the left of the [Variable Box](#) in the Calculator.
- Hide or show the Calculator by clicking the Hide/Show button at the bottom of the screen. This feature lets you , for example, have the [spreadsheet](#) cover most of the screen when you are not using the Calculator.
- To hide the Answer window, double-click inside it.
- To hide the Function Keypad, right-click on the [page tabs](#) near the top of the Function Keypad dialog box.
- When you are in the Calculator, you can calculate by pressing the Enter key.

See Also..

[Detailed Graph Help](#)

[Spreadsheet Keyboard and Mouse Control](#)

Handy Tips for Beginners

Shortcuts

- Click F6 to reveal any toolbar or menu that relates to the page you are on in BlackBox
- At any point, you can press F1 and get context-sensitive help on that feature of BlackBox.
- Try to calculate in the way you understand best. BlackBox is very flexible in this regard, so don't be intimidated by lots of rules. As you are getting used to BB, watch your answers to see if you are getting the results you expect. Remember that you are very welcome to ask Sci-Math Software any questions about calculating with BlackBox - send us an email on 100400.630@compuserve.com and we will get back promptly.
- Most changes to the way BlackBox calculates and behaves generally can be made on the Settings Page. If for example, the numbers are coming out in scientific Notation, you can change Number Format to Automatic on the Settings Page.
- As you cruise around the screen with the mouse, you will get Fly-By hints. When they start to annoy you, turn them off on the Settings Page
- If you make your graphs very fancy (Gradient colours etc), they take longer to redraw when you turn pages. On a slow machine, this could be unbearable. Turn on the fancy effects before you copy the graph to the clipboard, save it or print it out.

Shortcuts around BlackBox

[Getting Around BlackBox](#)

[Keyboard](#)

[Spreadsheet Keyboard](#)

[Spreadsheet Mouse](#)

Keyboard

[Getting Around BlackBox](#)

F1 - [Context-sensitive help](#)

F2 - [Math File Dialog Box](#)

F3 - [Untypeable Characters Box](#)

F4 - Show or Hide the [Calculator](#)

F5 - Show the [Answer window](#)

F6 - Activate/Deactivate the toolbar on the current page.

F7 - Turn page of the notebook

F8 - [Calculate](#)

F9 - Graph

F10 - [Overlay a Graph](#)

- When you are in the Calculator, the Enter key will calculate to current equation.
- If you are in the [Equation Box](#) or any boxes with drop-down lists, the up and down arrows will scroll through the lists without need for the mouse.
- In most boxes and windows, the tab key will step you around the screen.
- Escape key will close many popup dialog boxes.
- Most text boxes handle the [clipboard](#) keystrokes

See Also ...

[Spreadsheet Keyboard Controls](#)

BlackBox Settings Page

These control the way BlackBox behaves. There are Math Settings and General Settings:-

Math Settings..

[Number Format](#)

[Setting Decimal Places/Significant Figures](#)

Number of Graph Points - this sets the number of points that make up a graph. The more points you set, the smoother the curves but the longer it takes to plot. A good value range is between 50 and 200.

Hint: If you are planning to make a 3D Bar type graph from an equation in the [Equation Box](#), you might get the best look with about 10-30 points set.

h-Value: - this refers to the symbol **h** that gets mentioned in the Fundamental Theorem of Differential Calculus. BlackBox uses this value to calculate number answers for derivatives of equations. You can experiment with different values but be aware that making it very small (<0.00000001 etc) does not necessarily make the answers more accurate - possibly the reverse. A good value is about 0.0001.

Angles/Degrees - this determines how BlackBox deals with angles. It will effect the answers to trigonometrical calculations and the shapes of Polar graphs. **Please Note:-** when you are doing calculus with trig functions (sin, cos, tan etc) you must be in Radians mode to get the correct answers.

Full Answer Text - When turned off, answers come out as raw numbers only. When turned on, answers include the full calculation text (units, equation, symbol values).

Strict on Units - when turned on, BlackBox will hassle you to define units for any new symbols you create. If you are making symbols on the fly to test ideas, you might want to turn this off.

XY Graph Default - Most graphs you make with the Calculator should be drawn as XY-Graphs to make sense. If you have this turned off, calculated graphs will have the style of the last graph. This setting does not affect graphs made via the spreadsheet.

General Settings..

Exit Setting - set this to Quick Exit if you like to shut down quickly with no hassling. Exit check will ask you to confirm the shut down.

Wipe History Lists button - this clears the drop-down lists in the Equals and To Boxes, handy if they are full of now-irrelevant numbers.

Hint Style - Choose Fly-By help to get those annoying hint boxes on the screen as your mouse passes by parts of the screen. Choose Caption Bar hints Only to turn that feature off - now the hints are in the bar at the top of the screen. The buttons below this box set fonts, colours and styles for the hint balloons.

Restart where left off - if this is checked, BlackBox makes a copy of the current Graph and Spreadsheet and reloads them next time you start up.

Save Custom Settings - Make an icon in the BlackBox Program Group. When this icon is used to start BlackBox, it will have a custom startup file containing the settings that were active when this button was clicked. This feature is for teachers that want their students to have individual settings

and files when using BlackBox.

Graphics in Document - teachers may want to turn this option off if they feel this feature would overload the computer. Having lots of graphics in a document can use a lot of memory and also slow down the processing considerably. The graphics is best printed either from the Graph Page or the spreadsheet.

Changing number formats

[BlackBox Settings Page](#)

Numbers can be formatted with different styles...

- **Automatic** - BlackBox decides the best way to display a number based on the number of decimal places you have specified
- **Scientific** - BlackBox uses scientific notation only. Please note that instead of using the notation $\dots \times 10^2$ etc, BlackBox uses a capital E.
Example $100 = 1.00 \times 10^2$ (normal SN) = 1.00E+02 (BlackBox SN)
 $0.012 = 1.2 \times 10^{-3}$ (normal SN) = 1.2E-03 (BlackBox SN)
- **Fixed** - Number has as many decimal places as you have specified on the Settings page
- **Normal** - Numbers are expressed with commas.
- **Currency** - Numbers are expressed as dollars with 2 decimal places regardless of how many you have set.

See Also..

[Program Settings Page](#)

[Setting Decimal Places and Significant Figures](#)

Setting Decimal Places and Significant Figures

[BlackBox Settings Page](#)

It is important in science and math to set a realistic number of decimal places for your answers. Too many significant figures imply your results are more accurate than they are likely to be and can even lead to errors. Too few decimal places or significant figures can lead to too much rounding off.

As a general rule..

- Set the decimal places in your answer to match the least accurate number you were given in the problem.
For example, if you are asked to divide $5.00/9.0$, you would give the answer to two significant figures because that is the accuracy limit of the number written as 9.0.
- If you are working with measurements you have taken yourself, figure out how confident you are with them. For example, if you measured a box with an old wooden metre rule that is marked in cm, you might be able to judge down to the mm level, but not far beyond - so it would be impossible to end up with a result like 50.00000 cm, more like 50.0 cm.

See Also ...

[Number Format](#)

Speed Bar

The Speed Bar is at the bottom of the BlackBox screen. It gives you access to various functions described below.

About Box..

- Click the BlackBox label or icon to see the About Box for version information

Buttons..

- **Hide and Show the Calculator button** - if you are not using the Calculator, you can hide it and use the space for the page you are working on.
- **Hide and Show Answer window**. The Answer window pops up automatically if you are doing a calculation but if you need to refer to it, click this button. If it is already showing, this button will hide the Answer window.
- **Help ? button** Click this button to activate the Help File. If you press F1, you will get help specific to the part of BlackBox you are in.
- **U button** Click this to bring up the Untypeable Characters Box. This is for special characters that cannot be typed in from the keyboard. This can be handy when making your own symbols to use in calculations. You won't need this box for entering equations, as the Function Keypad takes care of that.
- **Math File button** Click this to load/save math files to disk. Math files contain all your symbols and equations. For example, if you were studying Physics, you may start a math file called 'Motion in 2 Dimensions' to hold all the related symbols (such as $v = \text{Velocity in m/s}$ etc) and equations ($v = u + at$ etc).
- **Exit Button** Use this button to exit BlackBox.

Math File Label..

The label on the far bottom right shows what Math File title is currently loaded into BlackBox

See Also..

[The Pages](#)

[The Calculator](#)

Entering Math functions

To enter math functions, either ..

- Type them into the Equation Box

or

- Click in the Equation Box to bring up the Function Keypad - from here you can enter them with the mouse by clicking the buttons as if it were a pocket calculator.

See Also ..

[List Of Math Functions](#)

[Spreadsheet Math functions](#)

[Writing Equations - an Overview](#)

Examples of work done with BlackBox

[Math Problem 1](#)

[Math Problem 2](#)

[Math Problem 3](#)

[Math Problem 4](#)

[Math Problem 5](#)

[Math Problem 6](#)

For examples of spreadsheets and equations ...

Check out the sample material that came with BlackBox - there are some examples of spreadsheets, [math files](#) (symbols and equations), graphs and text (*.rtf files that can be loaded into the BlackBox Document).

See also ...

[Calculating](#)

[Math Files](#)

[Files in BlackBox](#)

[Spreadsheet File Functions](#)

[Detailed Graph Help](#)

Quadratic Problem

Solve $2x^2+3x+4=0$

Steps ..

- 1 We can use the equations $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ and $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ to get the answer(s). If these equations aren't on the Equation List, you can either enter them in via the Equation Box or load them in from a Math File.
- 2 Choose the symbol **a** in the Variable Box. Type 2 into the Equals Box and click the Equals Button. Then choose the symbol **b** and set it, as before, to equal 3. Do the same for **c**, making it equal to 4.
- 3 For each of the two equations, put them into the Equation Box and click Calculate.

Here is what you will see ...

When - {My Notes in Brackets}
b = 5.00
c = -7.00
a = 2.00
 $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = -3.50$ {answer #1}

When -
b = 5.00
c = -7.00
a = 2.00
 $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = 1.00$ {answer #2}

{Answer: $2x^2+3x+4=0$ when $x = -3.5$ or $x = 1$ }

If you want to check your answer, go backwards ..

- 1 Put $2x^2+3x+4$ into the Equation Box
- 2 Choose x in the Variable Box, set its value to -3.5 in the Equals Box
- 3 Click Calculate - then answer should be zero
- 4 Now make $x = 1$, by putting 1 in the Equals Box, - then click Calculate

To graph the whole problem ...

- 1 With $2x^2+3x+4$ in the Equation Box ..
- 2 put **x** in the Variable Box, -5 in the Equals Box and 5 in the To Box
- 3 Click Graph - you will see where the curve cuts the x-axis (where $y = 0$)

To show these points on the Graph ..

- 1 With $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ in the Equation Box ..
- 2 click **Overlay** to stick this on the new Graph (the inv: function in the equation makes it sit upright (or inverted) as you will see)
- 3 Repeat the process for the equation $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ to mark the other quadratic root.

Making Graphs

Make a graph of $f(x)=-4x^2+4x+3$

- 1 Type $f(x)=-4x^2+4x+3$ into the Equation Box
- 2 Put x in the Variable Box, a number like- 3 in the Equals Box and a number like 3 in the To Box
- 3 Click the Graph button ...



Looking at this graph, we can see that the equation equals zero at two points on this convex parabola, somewhere between -1 and 0 and somewhere between 1 and 2. If you use a smaller range for the x variable (maybe -2 to 2) you can zoom in on the graph.

Math Problem 3

Suppose the Earth to be a perfect sphere and we determine its radius to be 3959 ± 0.1 miles. What effect would the tolerance of ± 0.1 miles have on our estimate of the Earth's surface area?

How to solve ..

Need: the formula for the surface area of a sphere:-
 $S = 4\pi R^2$ {where R = radius = 3959}

Next: the formula that gives us the answer is $dS = (dS/dR) \cdot dR$
where dS is the change in Surface Area, and dR is the change in Radius (0.1 miles). We have to find dS/dR ourselves using the rules of algebraic differentiation - $dS/dR = 8\pi R$, therefore **$dS = 8\pi R \cdot dR$** {BlackBox-ready equation}

- 1 Put **$dS = 8\pi R \cdot dR$** in the Equation Box - you may have to teach BlackBox these symbols if its the first time you are using them, but it will ask you about this so press on...
- 2 In the Variable Box, type **R** and then put the number **3959** in the Equals Box. Click the Equals button to store this information, that $R = 3959$
- 3 In the Variable Box, type **dR** and then put the number **0.1** in the Equals Box. Click the Equals button to store this information.
- 4 Click the Calculate button

Answer ...

When -

$\pi = 3.142$

$R = 3959$ miles

$dR = 0.1$ miles

$dS = 8\pi R \cdot dR = 9950$ miles² This is the difference in surface area depending on whether you use our lower or upper estimate of the earth's radius.

Note: If you have just entered your new symbols such as dR into the Variable Box, you might have to enter information about their units via the Symbols Page to get the answer looking exactly like above.

Going Further ...

If almost 10,000 square miles seems like a big error, how significant is it in relation to the Earth's total surface area?

$ds/\text{Calculated } S =$ Relative Error = **$RE = dS/4\pi R^2\%$**

When -

$dS = 9.95E3$ miles²

$\pi = 3.14$

$R = 3.96E3$ miles

$RE = (dS/4\pi R^2)\% = 0.00505\%$

{ie not much of a relative error, given that the Earth has a surface area of :-

When -

$\pi = 3.14159265$

$R = 3,959$ miles

$S = 4\pi R^2 = 196,961,284.1$ miles²

Math Problem 4

Convert 107 km/h to mph:-

BlackBox Hint:-

If you are doing a section of work on , say, converting one measurement to another unit system (like the above problem), you can make symbols that simplify what would be repetitive work. When you need them , you don't have to remember their number value (such as 3600 seconds per hour, -simply invent a symbol SecPerHour with that value)

Solving

We will make a symbol called KmToMi on the Symbol Page and give it a value of 5/8 (5 miles per 8 kilometres). You can do this by typing **KmToMi** in the Variable Box and typing **5/8** into the Equals Box. Its units would be Miles per Kilometer

- In the Equation Box, type **107 KmToMi**
- click Calculate for the answer

A more elegant way ..

You can apply this technique to more complex unit conversions.

- Invent a symbol called **MPH** with units Miles per hour. Invent another symbol called **K's** with units kilometres per hour - you can use these whenever you need an answer in these units.
- Make an equation you will reuse in the future:-
MPH = K's KmToMi
- Whenever you need to use it, just set the value of **K's** in the Variable Box and click Calculate:-

When -

K's = 107 Km per hour

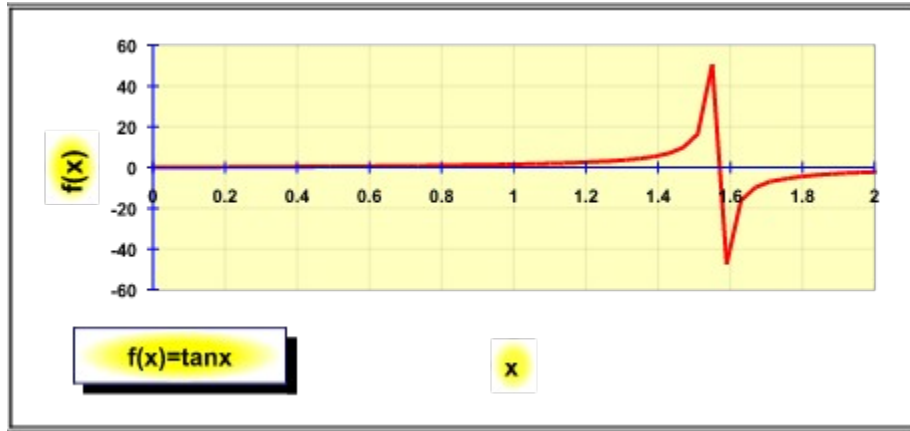
KmToMi = 0.625 Kilometres per Mile

MPH = K's KmToMi = 66.875 Miles per hour

Math Problem 5

Is the curve $f(x)=\tan x$ continuous between $x=0$ to 2 ?

- 1 Put $f(x)=\tan x$ in the Equation Box
- 2 Put x in the Variable Box, 0 in the Equals Box and 2 in the To Box
- 3 Click the Graph button



The sharp vertical line does not represent valid values for this graph. BlackBox connects each point to the one before it to create the illusion of a smooth curve. When you see a sharp line, such as is around $x=1.5$ to 1.6 , you should investigate to see whether those points are real. To do this you could make the domain of x more narrow and centered on the interval of interest (such as $x=1.5$ to 1.6 in this case). What you will find is that $x=\pi/2$ is an asymptote of the curve $f(x) = \tan x$. Calculating " $\tan(\pi/2)$ " will verify this - if the answer does not exist (ie infinity) you will get a math error.

Calculating with BlackBox

[The Calculator](#)

[Simple Calculations](#)

[Symbolic Equations and Formulas](#)

[Examples of Equations](#)

[Examples of Work Done with BlackBox](#)

[Graphing Equations](#)

[List of Math Functions](#)

[Things to note about BlackBox math style](#)

[Math Crimes](#)

[Matrix Calculations](#)

[Spreadsheet Calculations](#)

Simple Calculations

Basically..

- You type the math in to the Equation Box (eg. $1/3$, $2\pi + 3\sin 2$, e^4 , $e^{(4/3)}$, $(1+2+3+4+5)/22 + (6+7+8+9)\arcsin 0.5$)
- Click the Calculate button with the mouse or press Enter key
- The answer pops up in the Answer Window

You can ..

- Use the Function Keypad to enter math functions
- Chain equations together so they get calculated or graphed one after the other with just one click. This equation suits multi-step calculations very nicely.

See Also..

[Entering Math functions](#)

[Copying Answers to the Document](#)

[Changing number formats](#)

How Do I copy text from the Answer window to the Document?

You would want to do this so you can make a neat document that has all your answers on it and properly set out with fonts and colours.

- Highlight the text you want to copy on the Answer Window using the mouse
- Press Control-C to copy the text to the clipboard
- Click in the Document at the point you want to insert the text
- Press Control-V to paste the text into the Document.

This technique works between any two text windows or boxes where you can highlight the text. To cut to the clipboard, use Control-X.

See Also..

[Making Neat Documents](#)

Making Neat Documents

The Document page of BlackBox can be used to make documents for handing in for assessment. Neat work is very much appreciated by people that have to mark it, especially math and science.

Pointers..

- Use Save button to make backups.
- Do all your calculations around a problem first, then decide what you want to grab from the Answer Window to keep as your workings. Use the clipboard to copy them across to the Document.
- The Spreadsheet and Graph pages have their own printing functions that will give you the best results. If you want to copy graphs and pictures to the Document,
 1. Have Graphics in Documents checked on the Settings Page.
 2. Add them last, so the page does not take ages to redraw after a change has been made.
 3. If you need to redraw the screen because the graphics are messed up, click the red LED button on the document Toolbar (F6 if it is not visible).
- Document files can be exported to other Windows word processors as RTF files (a common file type that holds all the formatting/font information). A program such as WordPerfect would allow you to combine all the elements you have produced in BlackBox - See Planned Upgrades

Math Crime Dialog

This box pops up when you have done something that is mathematically illegal. It gives you some hints on what you have done and how to avoid making the error.

To close this window, dbl-click into it.

Major Crimes

- **Dividing by zero** -Could be rewritten as:- How many nothings in something? The answer is Infinity and BlackBox don't attempt such a calculation
- **Dividing by really small numbers** - sometimes, if the divisor is small enough, the answer will be too big for BlackBox to handle.
- **Having unequal numbers of "(" and ")" in an equation** - they must balance or else the logic of what you have written is not clear when BlackBox figures out how to do the calculation.
- **Taking the square root or logarithm of a negative number** - this cannot be done in standard math. If you want to use imaginary numbers, you will have to use the spreadsheet. The Equation Box will not calculate imaginary or complex number answers
- **Trying to use inverse trigonometrical functions on numbers outside the function's domain.** You can make a graph of the non-inverse version of the function to see where its y-values fall (ie the Range of the function). The number you put into the inverse version must be within this range.

See Also ...

[Calculating](#)

[The Calculator](#)

Math Files

[Math Files Dialog](#)

Math Files hold equations and their related symbols in a file on disk. You get to work with them by clicking the Math File button on the SpeedBar.

About Math Files ..

- They have **titles** rather than file names - so you can call them names like "Worksheet Number 5", "Sequences and Series", "Set #2", - anything you like.
- The current title is shown in the bottom right corner of the screen when you are turned to the Equation List Page or the Symbols Page.
- If you want to know the DOS-style filename or copy the file to another disk or location, you can click on the title in the Math File Dialog Box with the right mouse button.
- Math Files are automatically saved when you leave BlackBox and that file is automatically loaded when you start up - so unless you want to change files or start a new one, you don't really need to think about the Math File.
- You can have one big Math File or many that relate to parts of your course (ie. one file per topic maybe).

See Also ...

[Spreadsheet Files](#)

[Files in BlackBox](#)

Math File Dialog

You get this box by clicking the Math File button on the SpeedBar.

Buttons ...

Load Title - Loads the selected Title into the Equation List and Symbols Page.

Save over Sel Saves the Title in the Title Box over the selected Title on the Title List.

Save As New - Makes a new Math File using the title in the Title Box

Delete Title - Deletes the Math File from the list. It doesn't destroy the file but renames it from *.bb to *.bb! in case you regret the deletion - you can rename the file to *. bb and it will be back on the list.

Change Working Directory - Opens up the Working Directory Box, from which you can change the directory branch in which BlackBox looks for Math Files. You may not need this feature but it allows multiple users to keep their files separate (in separate directories).

Boxes ..

Title Box - Holds the title that will be used in saving and loading files

Titles on Disk - Holds a list of the titles that are in the current search path (working directory).

To copy Math Files to another disk or directory ..

- With the right-mouse-button, click on the Title in the Titles on Disk list. You will be shown its DOS-style file name and given the option of copying it elsewhere.

See Also ...

[Files in BlackBox](#)

Files in BlackBox

[Math File Dialog](#)

File Types..

- **Math Files** - these hold equations and any special symbols used in those equations. These files have long names (TITLES) and you load/save them via the Math Files button at the middle bottom of the screen. Math Files are automatically saved when you exit, so you don't need to think about these unless you are doing lots of different kinds of math - in this case, you would want different titles for different units of study.
- **Spreadsheet files** - You access these via the File Menu item on the spreadsheet menu. They can either be in the VTS style or Microsoft Excel 4.0 compatible. If you save it as an Excel file, you might lose some advanced features (such as some "objects").
- **Chart (Graph) files** - you access these by choosing load or save from the Graph Page menu. To get the menu, right click on the Graph.
- **Document Files** - Access these from the Document toolbar (press F6 to activate if hidden) - you will see the file load and save buttons.
- **BLACKBOX.INI** - this file holds the configuration information from when BlackBox shuts down. It resides in the \windows\ directory and if you have any trouble on startup, you can try deleting this file to reset BlackBox.
- *.INI - These are customised startup files so that, for example, students in a class can all have individual BlackBox settings. You create these files on the Settings Page and they store the current state of BlackBox as their custom settings. It means that a student called Jenny could run a customised BlackBox by clicking a BB icon marked "Jenny" from Program Manager.
- Text Files (*.txt) - Various parts of BlackBox can save their information as text files, allowing it to be edited in any text editor.

See Also ...

[Detailed Graph Help](#)

[Spreadsheet Files](#)

How to get Context-Sensitive Help from the program

There are two ways to get help in BlackBox:-

- Click the buttons marked " ? " that are around the screen or ..
- Click on a part of BlackBox and press F1 on the keyboard - this will take you to a topic related to the part you selected.

You also get Hints that appear ..

- in the main caption bar at the top of the screen and
- in little boxes on the screen if you have Fly-By hints set on the Settings Page.

Once you know the program well, the hints will drive you insane. You can leave them permanently off via the Settings Page.

See Also ...

[BlackBox Settings Page](#)

Major Parts of BlackBox

At the top of the screen ...

[The Calculator](#)

In the middle of the screen ...

[The Pages of the Notebook](#)

At the bottom of the screen ...

[The Speedbar](#)

When you calculate ..

[The Answer Window](#)

To get tricky characters for use in symbols and text ..

[Untypeable Characters Box](#)

To work with Math Files ..

[Math Files](#)

Answer Window

This window pops up when you calculate something.

To show it ..

- Click the 'tick' button on the SpeedBar or Press F5

To hide it ..

- Dbl-Click in its text window or ..
- Click the 'tick' button on the SpeedBar or ..
- Right-click on the window to get the popup menu, then choose Hide.

[Answer Window Menu](#)

[Copy answers to the clipboard](#)

[Changing Number Formats](#)

Answer Window Menu

Right-click in the window for the menu..

Font Choose the Answer Window font
Colour Choose the Background Colour
Print Answer Page Prints the contents of the Answer Window
Clear Clears the Answer Window of all text
Hide Hides the Answer Window from view - a double-click in the window will also hide it.

See Also ...

[Answer Window](#)

[Calculator](#)

Untypeable Characters Box

This box pops up when you click the U button on the Speed Bar or press F3.

It lets you quickly copy characters to the clipboard for use in symbols and text boxes. These characters cannot be typed in from the keyboard.

You don't need this box to enter equations ...

The Function Keypad takes care of the special function symbols like ³ or ½.

How Do I

[Get around BlackBox quickly](#)

[change the way a graph looks](#)

[copy text from the Answer Window to the Document](#)

[make a new symbol](#)

[join Math Files together](#)

[differentiate and integrate equations](#)

[calculate as on a pocket calculator](#)

[turn a number into a fraction that is roughly equal to it](#)

[get the Function Keypad up on the screen](#)

[make a graph from the spreadsheet](#)

[turn a graph into a Log Graph](#)

[quickly close windows that are in the way](#)

[find the roots of an equation](#)

[change the way the graph displays number on its axes](#)

[set Decimal Places and Significant Figures](#)

[save my equations and symbols to a file on disk](#)

[get more points plotted in a graph](#)

[set or edit the units in a symbol](#)

[make a 3D graph of an equation look better](#)

How do I change the way a graph looks?

Basically, ..

..dbl-click on the part of the graph you want to change. A dialog box will pop up that gives you the range of options. The dialog box will give you access to detailed context specific help

If you want to change the number format ...

[Go to the Settings Page](#)

To rotate a 3D Graph ..

.. press the Control key on the keyboard and drag the mouse on the graph - you will see a 3D wireframe pop up that you can swing this way and that.

See Also ..

[Graph Page](#)

Merging Math Files

- Get to this feature by opening up the [Math File dialog box](#) and clicking the Merge button

This dialog box lets you join existing [Math Files](#) together. You can merge all the [symbols](#) and [equations](#) used, for example, in different physics topics to create a large Physics Math File that recognises most symbols and has most of the standard equations.

To make a merged file:-

- 1) Write the title you want for the new file into the box at the top.
- 2) Using the mouse, select the existing files you want to be included.

Holding down the Control Key while clicking with the mouse lets you choose multiple files. The Shift Key will select all the files between the first selected and the one being clicked on now.

See also...

[Math Files](#)

How Do I differentiate and integrate equations?

Basically ..

- Enter the equation you want to differentiate or integrate into the [Equation Box](#).
- Click either the **d/dx:** or **int:** button from the Calculus page of the [Function Keypad](#).
- Click the [Calculate](#) button (or Graph button)
- The process is done with respect to the [symbol](#) in the [Variable Box](#).

See Also ..

[Calculus with BlackBox](#)

[List of Math Functions](#)

[Newton's Method for Finding Roots](#)

How do I calculate as on a pocket calculator?

Easy, ..

- Click in the Equation Box with the mouse
- The function Keypad will pop up
- Click its keys the way you would do on a pocket calculator - the symbols pop up in the Equation Box. (As an example, you could type in **$1/3 + 4/7 + 8/9$**)
- When you have entered the math, click the Calculate button. The answer will pop up.

You will find ..

that many things that took a few steps on a pocket calculator can be done in one step in BlackBox. The example in bold above is an example - and furthermore, if you wanted to redo the calculation later, you only need Dbl-click it on the Equation List and Click Calculate - three clicks.

See Also ..

[The Calculator](#)

[Examples of Equations](#)

[Writing Equations](#)

Fractions

How to turn any number into a fraction ..

- 1 Type the number into a cell on the spreadsheet.
- 2 Click the Format button in the Spreadsheet Toolbar to get the menu
- 3 Choose Fraction from the menu
- 4 Now the number should be expressed in the cell as a fraction (the closest one BlackBox can compute)

This is a handy way to find common divisors to put in front of matrices (so as to make them look better, whole numbers instead of long decimals). -Simply highlight the whole matrix on the spreadsheet with the mouse instead of Step 1.

(**Hint:**-To put the numbers from a Matrix Window back into the spreadsheet, use the clipboard functions - Copy As Text from the Matrix Window menu, Paste from the Spreadsheet Edit Menu).

The Fractions function only works on the spreadsheet, not the calculator

See Also ...

[Spreadsheet](#)

[Matrices and Vectors](#)

[Number Formats for the Calculator](#)

[Number Formats for the Spreadsheet](#)

How do I get the Function Keypad up on the screen?

If the Calculator is not hidden ...

- Click in the Equation Box with the left-mouse button

If the Calculator is hidden ..

- Click the Hide/Show button on the Speedbar - the Calculator will appear and so will the Function Keypad. (or press F4 key)

See Also ..

[Closing Windows in the way](#)

How Do I quickly close windows that are in the way?

Click the Page Tabs ..

to clear the [Answer Window](#) and [Function Keypad](#)

Dbl-Click the Answer Window ..

to hide it or click the 'tick' button on the [Speedbar](#)

Click the right mouse button on the Function Keypad's page tabs ..

to hide the Function Keypad

Matrix Windows ..

On the [Spreadsheet Toolbar](#), click the [Matrix](#) button and choose Close All [Matrices](#) from the popup menu.

Others ..

Window such as the [Untypeable Characters Box](#) etc can be closed via their system menus.

See Also ...

[Getting Around BlackBox](#)

How do I turn a graph into a Log Graph?

- Go to the Graph Page
- Click the right mouse button to get the popup menu
- Choose Axis, then select which axis you want to work with
- A tabbed dialog box will popup - choose the Scale page
- In the box marked Type, choose Logarithm
- You can choose a Base for the Logarithmic scale by typing one into the Log Base Box (Base 10 by default)

See Also ..

[Graphing](#)

Changing the Graph Number Format

[Graphing](#)

The way the graph displays numbers on its axes is controlled by the Number Format box on the BlackBox Settings Page, as it is for calculations

To change it ..

- Go to the Settings Page
- Select the number format and number of decimal places you want
- Go back to the Graph Page to see if it suits

See Also ..

[Changing Number Formats](#)

[Changing the number of Points in a graph](#)

How do I get more points plotted in a graph?

- 1 Go to the Settings Page
- 2 Select the number of Graph Points in the Graph Points
- 3 Generally, a good number is between 50 and 200 points, but you can go from 3 to 500 if you want

See Also ..

[Graphing](#)

[Making 3D Graphs look better](#)

[Detailed Graph Help](#)

[Changing the Graph Number Format](#)

How Do I make a 3D graph of an equation look better

Go to the Settings Page and choose a lower number of graph points.

The 2D XY graphs look good with 50-500 points in them but a 3D graph can look shocking with more than 20 or so points. It will also depend of the type of graph and the type of 3D view you have chosen for the Graph

See also ..

[BlackBox Settings Page](#)

[Detailed Graph Help](#)

How do I set or edit the units in a symbol?

[Symbols Page](#)

- 1 Go to the [Symbols](#) Page
- 2 Choose the [symbol](#) you want to work with from the drop-down list
- 3 In the [Units](#) Box, either choose a unit from the list or invent your own - it will be added to the list for easy access in the future
- 4 After any change to the [symbol set](#), you must click the Accept Changes button if you are happy with what you have done - otherwise click Cancel Edit.

See Also ...

[Making New Symbols](#)

[Doing Scientific Calculations](#)

Some Questions from BlackBox Users

1 How do I get the following things using BlackBox:-

1) Logarithms that can change base i.e. $2, 1/3$ or etc not just base 10 or base e .

The trick to getting logs in any base is to write an equation (in the Equation Box) such as "(lnx/lnb)" - when you click calculate, it will find the log of whatever x equals to the base of whatever b equals. {If "b" is not in the Variable Box's list, type "b" into the Equation Box and click Calculate - this is the quick way to make a new symbol.}

2) For the exponential, the power of (x-y) or to the power of the power of x i.e. $((25^x)^y)^z$

You should be able to do this, using equations like yours above or:-
"Answer=(y^x)^z", "2^(x-y)", "y^((x-1)^-z)". While it should calculate these, it will only make graphs that are 2-dimensional (one variable), meaning that only one of the symbols on the RHS of the "=" sign can change in value during the calculation or graphing while all the others keep their original values. This depends on which one is in the Variable Box when you click Calculate or Graph. The 3-D graphs in BB are really just fancy 2-D graphs in mathematical terms.

3) Conic Section

How could we can demonstrate the circle, ellipse and hyperbola with both +y and - y axis ? I tried this equation but failed to produced any graph i.e. $y = \sqrt{25 - x^2}$. This is from the original $x^2 + y^2 = 25$. It should produce circle graph. Instead when click on Calculation, it result to 0 .

There is a bug in the previous version, whereby it would not like some equations that started with a minus sign and give answers of zero always. This has been fixed in BBv2.0 and thanks Somboon for drawing it to our attention.

This what you would put in the equation box to graph both a positive and negative answer on the one graph: $y = \sqrt{25 - x^2}; y = -\sqrt{25 - x^2}$. By default, the answers to a square root comes out as the positive value - if you want the negative one, you must put a negative sign in front of it. Notice that the calculation is really two calculations joined together with a semi-colon - when you do this, they get calculated or graphed together as a Chain Equation.

Can we graph this parabola equation :

1. $(y-5)^2 = -10(x-2)$? or ellipse equation like
2. $x^2 + 4y^2 = 52$ or hyperbola equation like
3. $9x^2 - 16y^2 = 144$?

In BB, you can only have one symbol on the left hand side of the equals sign, so you must rearrange the equations to get, say, y as the subject.

eg.

(1) $y = \sqrt{-10(x-2)} + 5$ (add "; $y = -(\sqrt{-10(x-2)}) + 5$ " if you want the other root to be graphed or calculated at the same time)

(2) $y = \sqrt{(52 - x^2)/4}$

(3) $y = \sqrt{(144 - 9x^2)/-16}; y = -(\sqrt{(144 - 9x^2)/-16})$

**Does the BB can solve quadratic equation ? i.e. $x+y = 5$ and $x-y = 3$.
Can BB find out that $x= 4$ and $y = 1$?**

Step 1: Rearrange both for y, then graph: " $y=5-x$; $y=x-3$ " - This will show you where the two overlap (at $x=4,y=1$) - you can 'zoom in' by choosing min and max values for x that are closer together - maybe the first graph would be $x=-10$ to 10 , but you will see to zoom in with, say, $x=3$ to 5 . It will not solve it but BB gives you the tools to see whether your reckoning is correct.

When I make a graph, the curve should be smooth but instead it comes out all lumpy?

This is because the number format chosen on the Settings Page in combination with the number of significant figures (or decimal places) set. Depending on what you are graphing, the lumping is due to rounding off value to suit the degree of accuracy set. To get a smooth curve, change to a higher number of decimal places or choose automatic number formatting.

How can I copy the numbers that make up a graph into the spreadsheet?

You cannot do this currently. You can make graphs from the calculator and make graphs from the spreadsheet, but you cannot go the other way. You can paste graphs into the spreadsheet, but not the numbers themselves.

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Sci-Math Software

Sci-Math is an Australian software company dedicated to developing quality software for students and teachers of math and science.

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http://www.compuserve.com.au/sci_math/index.htm

See Also ...

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Planned Upgrades

The next version of BlackBox will..
--

- include improvements based on the feedback we get from users like yourself.
- have a word processor that integrates spreadsheets/graphs/text in the one document.
- have a spreadsheet that holds an actively linked graph rather than just a static picture of a graph.
- OLE support for linking with other Windows applications
- 32-bit (or Win95) version
- Expanded help files and extra support material

[Sci-Math Software](#)

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The cost of BlackBox is \$25.00 US outside Australia and \$20.00 Au\$ from within Australia.

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- You will be able to purchase future Sci-Math products at a discount price, though BlackBox is our only title so far.
- You will be able to get priority assistance with BlackBox via email and correspondence.

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See Also ...

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Craig Brown - Science, East Hills Girls Technology High School

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Title

Eigen Functions (Matrices)

Unlike the other Matrix Functions, the Eigen Vector and Eigen Value are not computed exactly. They are found by repeating a mathematical process until it converges to a value. You are first asked to guess the Eigen Vector - this number is fed in to start the process. If you have no idea, don't worry - just try some whole numbers like 1, 0, -1, 2 etc. The Matrix will tell you if it cannot find a valid answer for the given guess - in this case try another value.

Note:-

Often, you will get an answer that is a vector with an associated Eigen-value written in the caption bar of its Matrix Window. There will be other answers that are integer multiples of the vector matrix.

See Also ..

[Matrix Functions](#)

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Spreadsheet Page Menus

!

Factorial - when a whole number is followed by the ! sign, it is calculated to equal $1*2*3*4*...$ up to the number itself. For example, $10! = 1*2*3*...*9*10$

clipboard

Copy Ctrl-C , Cut Ctrl-X , Paste Ctrl-V

constants

Symbols that only ever stand for one value or physical quantity (eg. c = the speed of light = 300 000 000 m/s)

d/dx:

This is the function symbol that BlackBox recognises as "differentiate the following equation". Though it mentions x, the equation will be differentiated with respect to the symbol in the Variable Box.

equations

In BlackBox, an Equation is ANY math expression that could be calculated to give a number as an answer. Examples are: 114.5×32 , $y = 3/4$, $x = x + 1$, $3^4 + 2 \ln 7$. Equations don't need an equals (=) sign in them - they are used to make some symbol equal to the answer, allowing it to be used in another equation or ensuring that the answer comes out with the right units (ie kg, miles per hour etc).

graph details in the Calculator

To make a graph, you need:- an equation in the Equation Box that mentions the variable symbol in the Variable Box, and a minimum a-axis number in the Equals Box with a maximum x-axis value in the To Box

Graph page menu

You get this by either clicking the right mouse button on the graph or by clicking the left mouse button on the vertical graph label. This menu gives you access to all the Graph's settings.

int:

This function symbol tells BlackBox to integrate the equation that follows it. It will be calculated with respect to the symbol in the Variable Box and within the interval set out in the Equals and To Boxes.

inv:

This function symbol tells BlackBox to invert the equation that follows. To see what this does, type into the Equation Box "y=sinx;y=inv:sinx" and click the Graph button - you will see how this flips the graph.

Limits of this Help file

In this help file, we have tried to give a broad range of examples. If the specific examples don't relate closely to what you are studying, please understand that the scope of the program is very broad. This help file assumes you are studying some type of math and are using BlackBox to help you. In this version, we could not include definitions for technical terms in math (like Sine, Derivative, Eigen Vector etc) but instead focus on using the program. If you need more assistance than this file delivers, feel free to contact Sci-Math Software (priority given to Registered Users)

matrices

a set of numbers or elements arranged in rectangular arrays. They are used in different types of math (vectors, solving simultaneous equations for example). BlackBox lets you make matrices via the spreadsheet and do complex tasks with them easily.

Number Format

How a number is written by BlackBox - it can be in dollars, in normal notation, with fixed decimals, scientific notation or automatic mode. See the Settings page of BlackBox

paste

If a text box, Ctrl - V or Shift-Insert. For the Graph, use its menu. For the spreadsheet, use its toolbar. For the Matrix windows, use their menus

Radians

1 Radian = $(180/\pi)$ degrees

seq:

This is the BlackBox function symbol for sequence. The equation that follows it will be calculated as a sequence. It will be calculated between the interval defined in the Equals and To Boxes for the Variable Box symbol.

ser:

The function symbol for series. The equation the follows it will be calculated for the interval defined by the Equals and To Boxes for the Variable Box symbol. ie. $y=\text{ser: } \sin x + 2\cos x$

spreadsheet toolbar

Get the spreadsheet toolbar by clicking on the vertical Spreadsheet label on the right of the screen. The tool bar holds all the menus for managing the spreadsheet.

Spreadsheet

A table with rectangular cells you can write numbers, text or formulas into. You can make tables where numbers recalculate themselves when you change any section, and you can make your tables very attractive using fonts, borders etc

subject of the equation

The subject is on the LHS of the = sign. It will be equal to the calculated value of the equation after you click Calculate. In BlackBox, you can't have something like " $y - 2x = 3\sin x$ " -- you must rearrange it to " $y = 3\sin x - 2x$ " so there is just one symbol and nothing else on the LHS.

Symbol Set

A set of symbols that travels with a set of equations. They live in the same Math File Title and relate to each other. When you load a Math File from disk, BlackBox should recognise all the symbols mentioned in the stored equations as they are in the attached Symbol Set.

symbol

Symbols are words, names or single letters/characters that can be used instead of numbers in mathematical equations

unit conversions

Unit conversions are when you change the units of measurement for some symbol to another form. For example, you would do a unit conversion to convert a length in centimetres to a length in inches. The conversion factor in this case would be $\text{InchesPerCentimetre} = \text{approx } 1/2.5$

Units

Units describe what the symbol or number is measured in. A symbol for weight might have units of kilograms or pounds. A symbol for height might have units of metres, yards, centimetres etc. Units help you make sense of your calculations, though you don't need them for pure abstract math (ie an equation like $y=x+2$ where you don't really care what x or y are other than symbols for numbers).

