

# Review of CalculationCenter

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CalculationCenter is a new product from Wolfram Research, publishers of the highly regarded mathematical software package Mathematica. CalculationCenter is described on the Wolfram Research website as “New software for people too busy with calculations to learn new software”. This is perhaps a rather clumsy way of indicating that it is suitable for the occasional user. More broadly, however, the aim has been to provide potential users of mathematical software with an easy-to-use scratchpad for doing mathematical calculations and the production of mathematically rich technical reports. In this respect, CalculationCenter appears to be targeted at the same market as Mathcad. It is pleasing that leading staff at the European office of Wolfram Research, located near Oxford, have been much involved in the new enterprise, with Conrad Wolfram as one of its creators and Jon McLoone a key developer. A pity therefore that US spelling was adopted for the name of the package!

The software comes on a CD, and, according to the Getting Started booklet, a full installation on a PC under Microsoft Windows 95 or later, or on a Macintosh machine under Mac OS 7.5.3 or later, occupies about 85 Mb of hard disk space. This includes the on-line help documentation. The only hard-copy documentation is that contained in the Getting Started booklet. The Press Release accompanying the review software states that the “Introductory price is £255 (excluding applicable taxes and shipping), making it highly competitive with other calculating solutions.”

## InstantCalculators

On loading the software, one is presented with what looks like and indeed is a blank Mathematica notebook, filling most of the right hand side of the screen, a toolbar of common mathematical operations along the top and a Home Controller window to the left – well actually the very first time the software is loaded, a Welcome Controller window opens; but this is soon disposed of!

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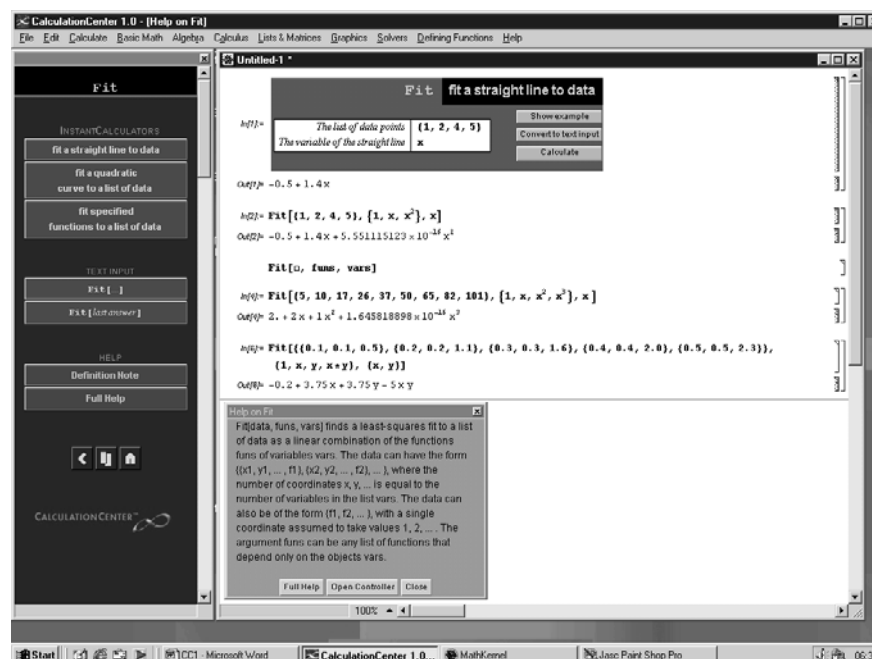


Fig 1 An InstantCalculator

Under the heading Controllers are links to several submenus: Formula; Characters; Units & Constants; Style; Calculation. Clicking on Formula opens up a new window containing a palette of tools for building functions and a machine for generating matrices. We shall come back to the uses of this and the other submenu windows presently. Let us first do some calculations, and in particular demonstrate the InstantCalculator environment.

For example, suppose one wants to fit a straight line to some data. The first thing to do is decide which function is appropriate to achieving this end. By browsing the submenus of the toolbar, via Lists & Matrices and Data Operations, one comes upon Fit Line to Data. On clicking this, the left hand window, called the “Control Area”, becomes a menu of useful tools: Under InstantCalculators are “fit a straight line to data”, “fit a quadratic curve to a list of data” and “fit specified functions to a list of data”. There is also a link to help on Fit and an immediate implementation of the function Fit. Clicking on the first item of the first submenu provides an example of an InstantCalculator – this is the box at the top of the notebook in Fig 1.

Beneath the description, “fit a straight line to data”, are three buttons, and to the left are two placeholders for entering the data to be fitted and the variable. The uninitiated will probably need some help, and the best way forward is to press the topmost button for an example. The placeholders are filled in with the data list {1, 2, 4, 5} and the variable x. Now press the bottom button to perform the calculation. The InstantCalculator becomes an input, and the answer,  $-0.5 + 1.4x$ , is an output, all in Mathematica style. We can go through the same procedure for the second InstantCalculator to find a quadratic fit to the same data. This time, however, conclude by pressing the middle button. The InstantCalculator is now replaced by the command `Fit[{1, 2, 4, 5}, {1, x, x^2}, x]`, which reveals enough of the syntax of the Fit function for us to try our own example. This can be done in a number of ways. The quickest is to press one of the Text Input buttons, and then fill in the placeholders for data, basis functions and variables. A cubic fit to the data list {5, 10, 17, 26, 37, 50, 65, 82, 101} is shown in Fig 1. The function is activated by pressing Shift-Enter. Although one might be rather surprised at the output in this example, one has to realise that real numbers are always decimalised in CalculationCenter – on entering the input  $\frac{1}{2}$ , the output is 0.5, unlike in Mathematica, which would preserve the rationality of this input, unless instructed to regard it numerically. At this point it might be worthwhile pressing a Help button to explore the functionality of Fit. There are two buttons, labelled “Definition Note”

and “Full Help”. The former is shown at the bottom of Fig 1. Above this is shown a two-variable example with a more elaborate dataset to fit to basis functions {1, x, y, xy}.

A large number of functions and their associated InstantCalculators are accessible through the menus on the toolbar or by selecting from a list obtained by pressing the “Open controller” button on the Home Controller window. A fairly random selection of these is shown in Fig 2, mostly arithmetic/algebraic, and Fig 3, mostly calculus-based.

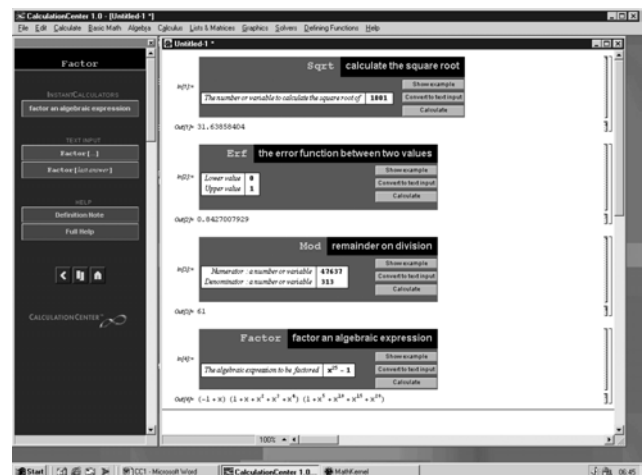


Fig 2 Some InstantCalculators

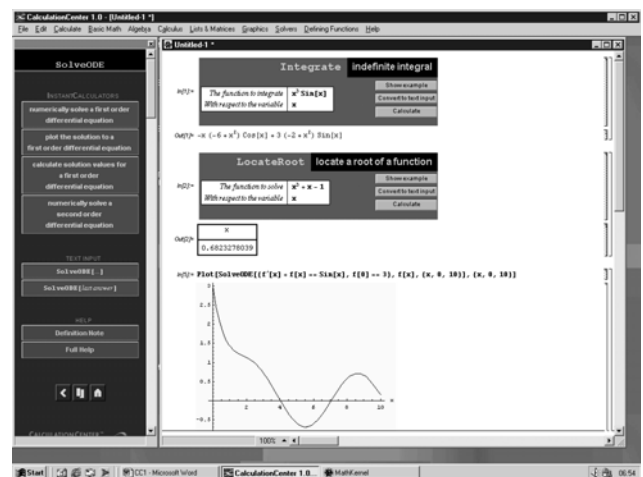


Fig 3 Some more InstantCalculators

There seem to be so many of Mathematica’s functions implemented in CalculationCenter that I initially wondered if it presented a cheap way of buying the former. This turns out not to be the case. In fact many of the specialised and esoteric functions in Mathematica have been disabled! For example, PrimeQ, which

interrogates an integer to determine if it is prime or not, is not amongst the active functions in CalculationCenter. On the other hand, CalculationCenter has some things not to be found in Mathematica. On browsing the Units submenu, I chanced upon the following units of volume: Jeroboam, Noggin and Jigger. I am not sure if one of the authors has a sense of humour or if Wolfram Research has expectations of sales to the drinks trade!

### SmartPlots

As one would expect of a relative of Mathematica, CalculationCenter has inherited an excellent suite of visualization tools. To make life easier there is a special InstantCalculator called SmartPlot. To illustrate this, suppose I have typed the function  $\text{Sqrt}[x] \text{Sin}[x]$  into the notebook. Select this function and then press the SmartPlot button from the Home Controller window. The result is similar to that given in Fig 4.

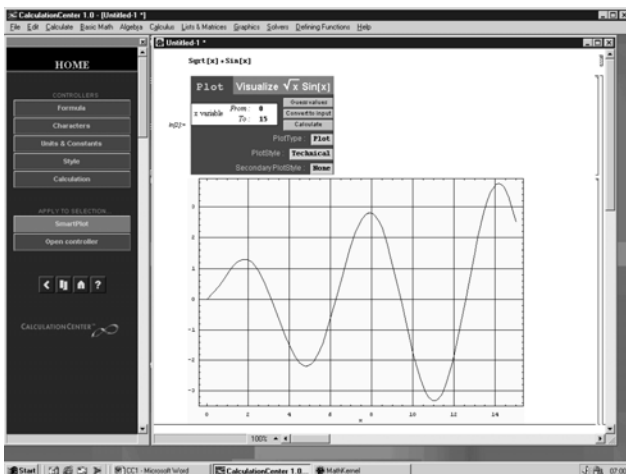


Fig 4 A 2D SmartPlot

SmartPlot attempts to pick ranges that are “interesting”. For the selected function it chooses the range 0 to 5 for  $x$ . This is moderately interesting (!), but doesn’t actually demonstrate the overall trend of the function for large  $x$ . This is easily remedied by changing the upper limit of  $x$  to 15 in the InstantCalculator. Other parameters can also be changed: PlotType, with options including LogPlot and PolarPlot; PlotStyle, with options Technical, Minimal, Business and Colorful; Secondary PlotStyle. I note as a curiosity that if the function  $\text{Sqrt}[x] \text{Cos}[x]$  is selected, SmartPlot chooses the range 0 to  $\pi$  for  $x$  – some fancy AI going on here.

SmartPlot can also be applied to functions of more than one variable. In Fig 5, the function  $\text{Sin}[x y z]$  has been selected and plotted.

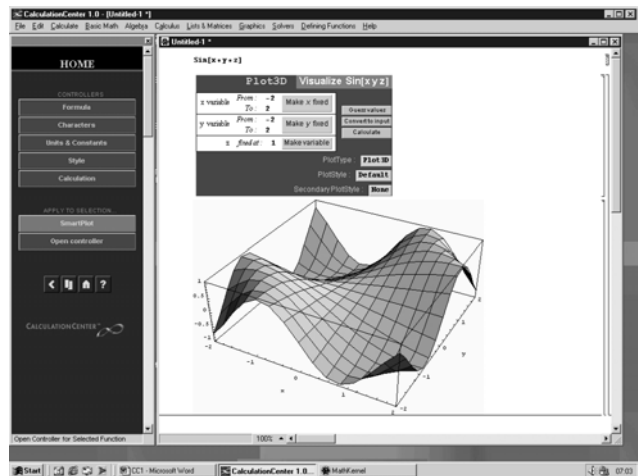


Fig 5 A 3D SmartPlot

In this case, the program realises that it cannot actually plot a function of three variables, so it decides to hold one constant and plot the resulting function of the remaining two variables over suitable ranges. For such a 3D plot, PlotType includes the options of ContourPlot and DensityPlot, and Secondary Plotstyle offers the interesting RealTime rotation tool from Mathematica.

### Input

I mentioned earlier that from the Home Controller one can access tools for the inputting of functions and the construction of matrices. In fact, the tools can build complicated expressions in an easy to read 2D format. For example, the 1D text-based input  $(9/(1+6/3))+5^{(7-12/2)} / (1+1/(3-2))$  is very hard to appreciate in that form. It becomes immediately transparent when written 2-dimensionally. CalculationCenter presents two ways of achieving that: Either by direct input using the Formulas palette; or by entering the text-based version and then using a conversion tool.

Similarly, the construction of matrices of any dimension is very easy. There are four buttons: New matrix; Add row; Add column; Paste matrix. The first places an empty 2x2 matrix in the notebook. The second and third buttons can be used to increase the dimensions of any matrix, whether it be empty or full. The elements of the matrix can then be filled in with numbers, symbolic expressions or even text. The final button provides a faster way of building a matrix of given dimensions. There are also options for specifying the matrix type: Empty, zero, identity, random or imported.

Of course it is possible to construct user-defined functions using the built-in functions and, if necessary, iterators and conditionals. This provides an introduction to simple procedural programming.

There is much more to assist in the production of technical documents, ranging from palettes for special characters and symbols, Greek letters, tools to change the font size and whether bold, italic or underlined is to be used, and also to change the cell and notebook style. As in Mathematica there is an input completion facility to assist if one has forgotten the full name of a command. There is also an input correction capability. For example if `Plut[x, x, 0, 2]` is input, the program notes the spelling error and helpfully suggests the correct version, namely `Plot[x, x, 0, 2]`. On running this corrected version, the program then reports the syntax error and how to correct it – `Plot[x, {x, 0, 2}]`. Mathematica will also balk at this incorrect input, but the resulting error message, though helpful, is less explicit in the case of

the syntax problem.

Finally, it is possible to save notebooks to HTML for display on the web. At the same time any graphic is converted to a GIF image and the appropriate reference placed in the HTML file.

### Conclusion

This is a very interesting and helpful package for anyone who perhaps has had some experience of using a graphical calculator, but needs the use of a more powerful and mathematically satisfying tool. All this, but without the overheads and frustrations of a steep learning curve. A potential bonus is that users will become acclimatized to the syntax and world of the more powerful Mathematica package. Hopefully, Wolfram Research will provide incentives to make migration easy on the pocket.

#### Supplier comment from Jon McLoone, Wolfram Research

We are pleased that Dr Backhouse liked CalculationCenter and found it easy to learn; indeed it was a central design aim to develop a package with which one could get started in as little as 10 minutes. Another key aim was that this easy-to-use, quick solution should not lock you in if your needs changed and did not prevent you from swapping work with users of more powerful software- hence its compatibility with Mathematica notebooks. As Dr Backhouse has anticipated there will be ways to transfer between CalculationCenter and Mathematica as well as a choice of ways to set up academic site licenses covering both products and the forthcoming webMathematica.

## Courseware News

Further details and Web addresses at TechWatch  
<http://ltsn.mathstore.ac.uk/techwatch/>

**Math Viewer** is a Java applet that displays dynamic, interactive MathML equations in your browser. By installing the Math Viewer in your browser, you will be able to view dynamic math in Web pages created with WebEQ. The installation is quick (less than .5MB download), simple and free.

**TeXaide** is a freespecial version of Equation Editor that generates TeX. Whereas Equation Editor can be used with any application that supports OLE or can paste a graphic from the clipboard, TeXaide only generates TeX on the clipboard, where it can be pasted into any TeX system. Now you can generate TeX equations using Equation Editor's easy-to-use interface and insert hundreds of characters and symbols without having to look them up!

**Mathcad 2001 Academic Edition** released...Adept Scientific is offering members of the academic community the Professional package for £199 and the Premium package for £398.

**StudyWorks 2002 Mathematics Deluxe** is now available.

**Further Mathematics A Level by Distance Learning** being developed.

**MAPLE 7** is available from Adept Scientific - the UK distributor and support centre for both Waterloo Maple and Design Science Inc. Prices (ex-VAT) for a single user, non-concurrent licence are £745 for academic users and £1295 for commercial users.

**LiveMath v3.0.1** has been released.....LiveMath is unique amongst computer algebra software since it shows intermediate calculation steps. An up to date interface allowing drag and drop rearrangement of equations, and CD-ROM based help with the aid of movies and interactive assistance from the "Ask Sally" system particularly recommend it for educational use.

**Mathwright is out soon...**See MSOR Announcements on p6