

# Review of MathAid Precalculus v15.33

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Visit supplier's website at:

<http://www.mathaid.com/>

Precalculus is one of four separate 'courses' produced and supplied by MathAid, LLC, P.O.Box 52424, Philadelphia, PA 19115, USA. The other three, College Algebra, Algebra2 and Trigonometry are subsets of Precalculus.

The software requires an up-to-date web browser supporting Java/JavaScript. It runs on the client side only and requires nothing from the server side. All MathAid products can work with or without a web-server, from CD-ROM, a local harddrive, or a local network using "Sharing". The following client platforms/browsers are supported:

- Microsoft Windows 95/98/ME/NT/2000
  - Microsoft Internet Explorer 4.0 or higher
  - Netscape Communicator 4.5x-4.7x
- Linux Red Hat/SuSe/Debian
  - Netscape Communicator 4.5x-4.7x

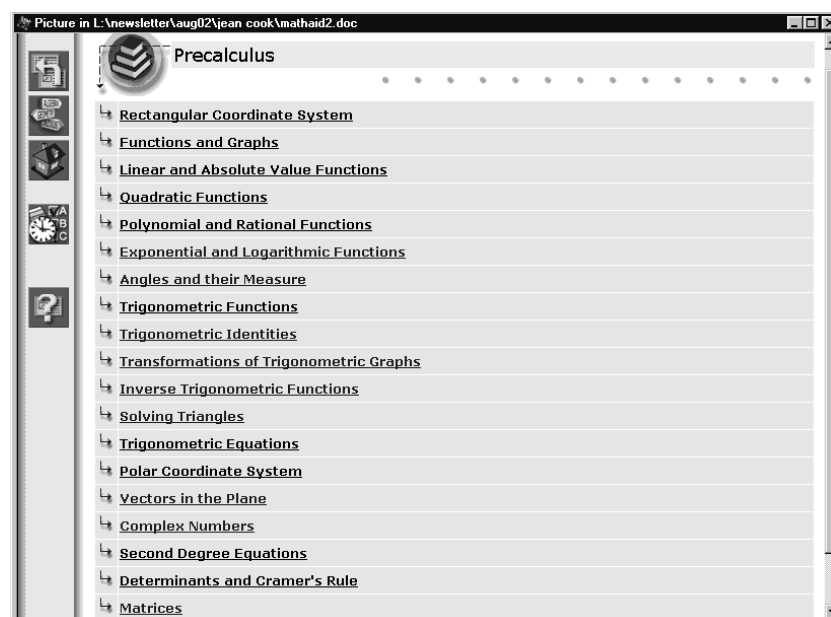
MathAid products are expected to run on other platforms/browsers but comprehensive testing has not yet taken place so full functionality is not guaranteed. In particular, as of now they do not support officially any browser on Apple Macintosh or Netscape/Mozilla 5.0 or higher on any platform. The recommended screen resolution is 800x600. I used 1024 x768 and detected no problems.

There are two basic types of licences issued for MathAid's products: a single user licence which allows the product to be used on only one computer at a time, and a multiple user licence, which permits the product to be used on an unlimited number of computers at the same physical site location.

## Overview

According to MathAid, its "teaching methodology combines maximally interactive teaching methods with a system of evaluation and tests for the new generation of internet savvy students". All of the MathAid products contain two major parts: learning material and a test generator. The learning material is arranged in topics in the order recommended for studying. However, there

Figure 1 Menu



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**Inverse Functions**  
Problem 1.2 (complexity 1)

Given:  $f(x) = -3x^3 - 5$ . Find:  $f^{-1}(x) = \sqrt[3]{mx + n}$ .

$m =$      $n =$

**Right Answer:**  $m = -\frac{1}{3}$ ,  $n = -1\frac{2}{3}$ .

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Figure 2 Inverse of a cubic function

**Concepts**, presented in a succinct way on easy to read attractive screens, consist of reference material containing central formulae, definitions, and theorems. These are not interactive and are intended to serve as a basic theoretical review and reference. In many cases they would not provide sufficient content for most of the first-time learners I meet.

**Interactive Examples** provide an opportunity for unguided hands-on exploration of a mathematical concept. They make good use of the interactive controls which are present in all MathAid products. The first is a scroll bar (figure 3) which can, where

are no limitations, and you may choose to access the material in a different order. As with any courseware of this type, you would need to ensure that the pre-requisites are in place. The topics included in Precalculus are chosen for the school and college system in the United States where the coverage of mathematics follows a different pattern from that in the United Kingdom. It is thus a tutorial package, sections of which could be used at various levels within the UK system from GCSE through to first year university.

### Content

Figure 1 is a screen shot of the main menu screen from Precalculus. Each of the nineteen topics contains what MathAid calls Basic Blocks. For example Functions and Graphs contains seven Basic Blocks; Basic Definitions and Notations, Graphs of Functions, Composite Functions, Inverse Functions, Transformation of Graphs, Graphic Solution of Equations and Graphic Solution of Inequalities. MathAid claim that Basic Blocks are activities designed to teach basic concepts and develop problem-solving skills. Each block normally covers one important topic, such as a particular theorem, formula, or standard problem, and may contain three standard types of presentation: Concepts, Interactive Examples, and Drills.

Figure 3 Scroll bar

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Precalculus > Functions and Graphs  
**Inverse Functions**  
Interactive Example 1

Given:  $f(x) = ax + b$ . Find: formula for  $f^{-1}(x)$ .

$a =$    $b =$

$f(x) = 4x - 3$

- $y = 4x - 3$  Write  $y$  instead of  $f(x)$ .
- $x = 4y - 3$  Interchange  $x$  and  $y$ .
- $4y - 3 = x$  Solve the equation  $x = f(y)$  for  $y$ .  
 $4y = x + 3$
- $f^{-1}(x) = \frac{1}{4}x + \frac{3}{4}$  Write  $f^{-1}(x)$  instead of  $y$ .

appropriate include an edit box which displays the current value of a parameter and possibly an animation button next to a Scroll Bar which, when clicked, automatically changes the parameter value from the smallest to the largest in the designated range. The scroll bar is used extensively to avoid the user having to type in parameter values. Figure 3 shows two scroll bars with edit boxes and animation buttons.

The graph window incorporates possibly three features. They are enabled by the system and cannot be activated by the user. Active Point enables the user to determine the co-ordinates of any point in the graph window, the

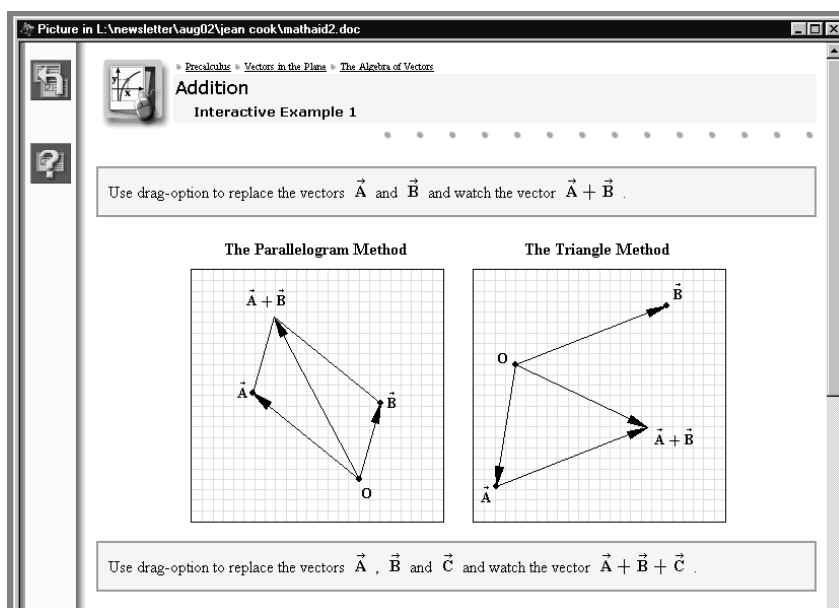


Figure 4 Drag option

correct one is lost. The solutions displayed often had layout difficulties, particularly where powers were involved and the use of a centre-vertically aligned period for multiplication gave rise to expressions which were sometimes very difficult to read. In many cases the equals sign in a solution appears at the end of a line and even when it did not, the signs were often not lined up.

Randomness of the parameters is in general a good thing, but often produces problems where the arithmetic is difficult. For the less confident student this could have a demoralising effect and the objective

of encouraging a student to gain confidence by repeated practice in a technique, could be lost.

Because of the difficulties of algebraic input on the web, the questions have to be ingeniously framed and the input precisely specified. Throughout, a fractional input is required in the form of a mixed number rather than the more usual top heavy fraction. This is illustrated in Figure 2.

Finally there were many cases where I would have preferred simpler problems before launching into those in the system. For example the first problem on Solving Equations of the form  $\sin x = c$ , required a solution in the interval  $[-7\pi/2, -3\pi]$ .

Drills are essentially tutorial questions with random parameters. A re-randomised question is provided by clicking the dice. Figure 2 shows a problem from the Basic Block on Inverse Functions from the topic Functions and Graphs. Wherever possible, the suggested solution uses the graphical tools in the system. Answers can be entered by the user and checked by the system by clicking on the scales icon. Clicking on the light bulb automatically supplies the correct answer. Solutions to more difficult problems are provided via the blackboard icon. Drills have all the desirable features of a tutorial system, random parameters, and full solutions where appropriate. However, if an answer is judged incorrect the correct answer overwrites the wrong one before an opportunity is given to compare the correct and wrong answers. In addition, if a solution is requested, this appears on a separate page, so again the opportunity to compare the answer input with the

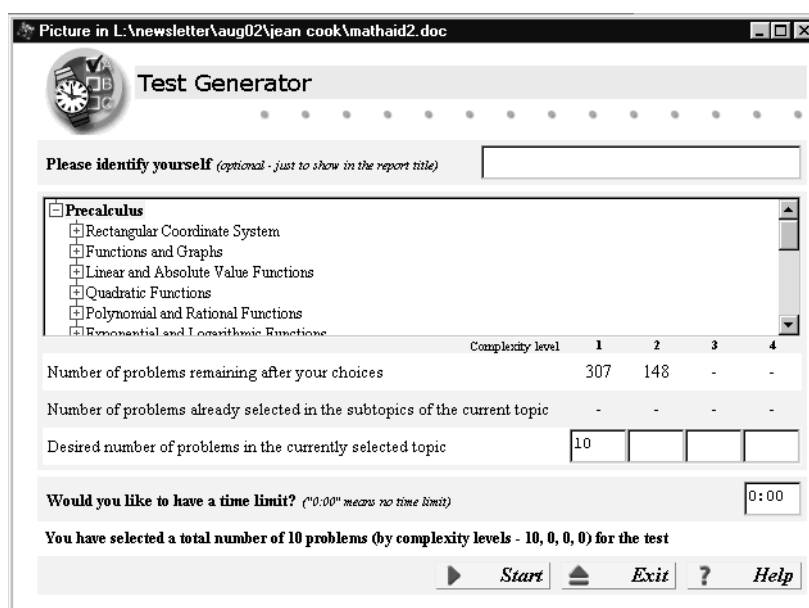


Figure 5 Test Generator

### ***The Test Generator***

The test generator can be accessed from any page displaying the clock icon (Figure 1). The system enables the user to choose the topics covered by the test, the number and degree of difficulty of the test problems, and the time allocated for the test. See Figure 5. The test problems are those from the Drill section of the system. When the answer is input, the scales have to be clicked to have the answer judged. A tick at this point does not indicate that the problem is correct but that the answer entered has been judged. Re-entry to a question erases the original input. When the test is completed, the system generates a report and provides the correct answers and solutions to questions on request. Irrespective of whether an answer was correct, or incorrect, re-entry to the question to see a solution erases the original input. The software does not allow the user to specify the actual question type at a particular level. For example, if there are five questions at level 1 in a Basic Block and you wish to put three in a test, you have no control over which of the three will be selected.

### ***Navigation***

The navigation is clear throughout and context specific help is available on every page via the question mark icon. For example, Help on an index page (Figure 1) provides information about the navigation system in MathAid products. Help on a problem page (Figure 2) provides information about buttons and interactive features, rules for entering numbers and checking your answers etc. In some cases Help provides interactive demonstrations of the product features.

### ***Summary***

The software is designed for high school and college students in the USA but because the building blocks are independent the material is appropriate for school and university students elsewhere, providing care is taken in the order of the topics accessed.

The Precalculus course provides good interactivity and 455 problems with random parameters. However, some restriction on the parameters would enable the software to be used by a wider audience. The navigation is clear and the screen layout is uncluttered and attractive in most cases.

The MathAid website <http://www.mathaid.com> is informative and well worth a visit. There is no accompanying paper material but none is needed to run the software. All the details for installation are available from the web-site.

The displays and the expected student input have had to be carefully chosen because the software is running through a browser. The limitations imposed by this interface place obstacles between the user and standard mathematical notation, most obviously in user input. The system does not monitor progress or save the scores on the tests.

### ***Conclusions***

I found the software easy to use with several engaging exploratory features. However, the overwriting of the input in questions, the minor display problems in solutions and the over-randomness of parameters could detract somewhat from the learning experience.

### **Supplier comments from Mark Vishnyakov, MathAid, LLC**

I would like to thank Dr. Cook for writing the review and for her comments. We will study these comments and adjustments will be made in the following versions of Precalculus as appropriate. However I would like to point out that I consider this review somewhat biased and overall evaluation not as high as our product deserves. I would like to apologize to the readers for not having enough time for correcting all mistakes and misunderstandings of the reviewer. I am also sorry that as a supplier, I did not have opportunity to describe the attractive product features, which were left out by the reviewer. I would like to invite the readers to visit our site [www.mathaid.com](http://www.mathaid.com) and form their own opinions about our products.

There is a free online access to the demo versions of the courses and to the full versions of all separate topics offered by

MathAid. In addition I would like to mention that MathAid has developed and implemented the new MathAid Tex Applet, which allows displaying math formulas in all browsers, under all platforms and without server support (only on the client side). The use of this new technology eliminates any possible problems with layout. I invite the readers to see online the topics Exponents and Radicals, Fractions, and Sequences and Series, where this new applet is already implemented. We hope that students and educators will find useful the new topics in Probability and Statistics. In November 2002 MathAid is planning to release the new versions of the products incorporating MathAid Tex Applet and interactive 3D graphics.

We are positive that our users will be satisfied with our new developments.