

# Mathomatic Man Pages

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**NAME**

mathomatic – a computer algebra system

**SYNOPSIS**

**mathomatic** [ **-bcehqrtuvwx** ] [ **-s** level ] [ **-m** number ] [ input\_files or input ]

**DESCRIPTION**

Mathomatic is a general-purpose computer algebra system (CAS) that can symbolically solve, simplify, combine, and compare algebraic equations, perform complex number and polynomial arithmetic, etc. It does some calculus and handles all elementary algebra, except logarithms. Trigonometry and function expansion are supported in a separate program called **rmath**(1). Plotting expressions with **gnuplot**(1) is also supported.

**mathomatic** is the main Mathomatic application that does interactive symbolic-numeric mathematics through a simple command-line interface. Readline support is usually compiled into this application, making it easy to edit input and recall previous input with the cursor keys. The numeric arithmetic is double precision floating point with about 14 decimal digits accuracy. Many results will be exact, because symbolic math is an exact math, and because multiple floating point numbers can be combined for a single mathematical value; for example:  $2^{(1/3)}$ , which is the cube root of 2 exactly.

**OPTIONS**

- b** Enable bold colors. Color mode will be turned on and colors will be brighter if this option is specified. Same as the "set bold color" command.
- c** Toggle color mode. This mode outputs ANSI terminal escape sequences to make each level of parentheses a different color, for easier reading. Requires a terminal emulator that supports ANSI color escape sequences. If the colors are too hard to see, use the **-b** option to increase the brightness.
- e** Process mathematical expressions and Mathomatic commands instead of input files on the shell command line, and then quit. Unquoted space characters are the line separators on the Mathomatic input that follows this option. Works similar to entering it into the Mathomatic main prompt, except the autoselect option is turned off. Useful for quick command-line calculations. The startup messages are not displayed with this option. Follow this option with "--" so that expressions can start with a minus sign (-).
- h** Display a brief help message listing all of these options and then exit.
- m number**  
Change the memory size of equation spaces. It is followed by a decimal floating point number which is a multiplier of the default equation space size. This allows larger equation spaces so that manipulating extremely large expressions will succeed without getting the "Expression too large" error. Specifying a number higher than 100 may make Mathomatic unresponsive.
- q** Set quiet mode. The startup messages and prompts are not displayed. This is useful when piping or redirecting input into Mathomatic, because the input won't be displayed, so prompt output should be turned off. This option does the same thing as the "set no prompt" command.
- r** Disable readline input processing. Readline allows line input editing using the cursor keys, and outputs terminal control codes, all of which can be turned off with this option.

**-s level**

Set the enforced security level for the Mathomatic session. Level 0 is the default with no security. Level 1 disallows shelling out (forking). Level 2 disallows shelling out and writing files. Level 3 disallows shelling out and reading/writing files. Level 4 is the highest security level and is the same as compiling with the `-DSECURE` option. This run-time option was created for use on open public servers that can't use the `SECURE` compile-time define.

- t** Set test mode. Used when testing and comparing output. Bypasses loading startup (`rc`) file, turns off color mode and readline, sets wide output mode, ignores pause command, etc.
- u** Guarantee that standard output and standard error output are unbuffered. Also echoes all line input if not in quiet mode (`-q`). Useful when piping.
- v** Display version number, compilation options used, maximum possible memory usage, then exit.
- w** Set wide output mode for an unlimited width output device like the "set wide" command does. Sets infinite screen columns and rows so that 2D (two dimensional) expression output will always succeed and not be downgraded to 1D output when it doesn't fit in the display area. Use when redirecting output or with a terminal emulator that doesn't wrap lines. This mode only affects 2D output.
- x** Enable HTML output mode (which is also valid XHTML). This makes Mathomatic output suitable for inclusion in a web page. The color mode and bold colors flags affect this mode, allowing HTML color output. Wide output mode is also set by this option, meaning expressions will always be displayed in 2D.

**GENERAL**

After any options, text files may be specified on the shell command line that will be automatically read in with the read command, unless the `-e` option is specified.

Mathomatic is best run from within a terminal emulator. It uses console line input and output for the user interface. First you type in your mathematical equations in standard algebraic notation, then you can solve them by typing in the variable name at the prompt, or perform operations on them with simple English commands. Type "help" or "?" for the help command. If the command is longer than 4 letters, you only need to type in the first 4 letters. Most commands operate on the current equation by default.

A command preceded by an exclamation point (such as "!!s") is taken to be a shell command and is passed unchanged to the shell (`/bin/sh`). "!" by itself invokes the default shell, which is specified in the `SHELL` environment variable. "!" is also the factorial operator.

Complete documentation is available in HTML and PDF formats; see the local documentation directory or online at "<http://mathomatic.org/math/doc/>" for the latest Mathomatic documentation.

**ENVIRONMENT****EDITOR**

The `EDITOR` environment variable specifies which text editor to use for the edit command.

**FILES****~/.mathomaticrc**

Optional startup file containing Mathomatic set command options. It should be a text file with one set option per line. Do not include the word "set". For example, the line "no color" will make

Mathomatic default to non-color mode, which is useful if you aren't using a standard ANSI terminal emulator. "rc" stands for "run cold".

**AUTHOR**

Mathomatic has been written by George Gesslein II ([gesslein@linux.com](mailto:gesslein@linux.com)) with kind help from John Blommers (<http://www.blommers.org>) and the Internet community.

**REPORTING BUGS**

The command to take the limit of an expression is partially functional and experimental. All else should work perfectly; if not, please report it as a bug to the author or on the Launchpad website: "<https://launchpad.net/mathomatic>".

**SEE ALSO**

**[rmath\(1\)](#)**, **[matho-primes\(1\)](#)**, **[primorial\(1\)](#)**, **[matho-mult\(1\)](#)**, **[matho-sum\(1\)](#)**, **[matho-pascal\(1\)](#)**, **[matho-sumsq\(1\)](#)**

**NAME**

**rmath** – a computer algebra system with functions and readline  
**matho** – a computer algebra system with functions

**SYNOPSIS**

**rmath** [ input\_files ]  
**matho** [ input\_files ]

**DESCRIPTION**

Mathomatic is a general-purpose computer algebra system (CAS) that can symbolically solve, simplify, combine, and compare algebraic equations, perform complex number and polynomial arithmetic, etc. It does some calculus and handles all elementary algebra, except logarithms. Plotting expressions with **gnu-plot**(1) is also supported.

**rmath** and **matho** are shell scripts that allow you to use Mathomatic with input of functions like **sin**( $x$ ) and **sqrt**( $x$ ) automatically expanded to equivalent algebraic expressions by the **m4**(1) macro preprocessor. Additionally, **rmath** runs the **rlwrap**(1) program to provide readline input editing support.

The following general functions are defined when using **rmath** or **matho**: **sqrt**( $x$ ), **cbrt**( $x$ ), **exp**( $x$ ), **pow**( $x,y$ ), **abs**( $x$ ), **sgn**( $x$ ), **gamma**( $x$ ), **floor**( $x$ ), **ceil**( $x$ ), **int**( $x$ ), and **round**( $x$ ).

The following trigonometric functions are defined: **sin**( $x$ ), **cos**( $x$ ), **tan**( $x$ ), **cot**( $x$ ), **sec**( $x$ ), and **csc**( $x$ ).

The following hyperbolic trigonometric functions are defined: **sinh**( $x$ ), **cosh**( $x$ ), **tanh**( $x$ ), **coth**( $x$ ), **sech**( $x$ ), and **csch**( $x$ ).

The following binary operators are defined: **mod**.

The following universal constants are defined:  $\pi$ ,  $e$ ,  $i$  (the imaginary unit), *euler*, *omega*, and *phi* (the golden ratio).

**GENERAL**

Text files may be specified on the shell command line that will be automatically read in through the m4 preprocessor into Mathomatic. After any files are read in, Mathomatic prompts for input from the console.

Mathomatic is best run from within a terminal emulator. It uses console line input and output for the user interface. First you type in your mathematical equations in standard algebraic notation, then you can solve them by typing in the variable name at the prompt, or perform operations on them with simple English commands. Type "help" or "?" for the help command. If the command is longer than 4 letters, you only need to type in the first 4 letters. Most commands operate on the current equation by default.

Complete documentation is available in HTML and PDF formats; see the local documentation directory or online at "<http://mathomatic.org/math/doc/>" for the latest Mathomatic documentation.

**FILES**

**~/.mathomaticrc**

Optional startup file containing Mathomatic set command options. It should be a text file with one set option per line. Do not include the word "set". For example, the line "no color" will make Mathomatic default to non-color mode, which is useful if you aren't using a standard ANSI terminal emulator. "rc" stands for "run cold".

**AUTHOR**

Mathomatic has been written by George Gesslein II ([gesslein@linux.com](mailto:gesslein@linux.com)) with kind help from John Blommers ("<http://www.blommers.org>") and the Internet community.

**REPORTING BUGS**

Please report any bugs to the author or on the Launchpad website: "<https://launchpad.net/mathomatic>".

**SEE ALSO**

**mathomatic(1)**, **matho-primes(1)**, **primorial(1)**, **matho-mult(1)**, **matho-sum(1)**, **matho-pascal(1)**, **matho-sumsq(1)**

**NAME**

matho-mult – multiply large integers

**SYNOPSIS**

**matho-mult** [integers]

**DESCRIPTION**

This command-line utility is optionally part of the **mathomatic(1)** package. It uses Python to multiply many large integers separated by spaces or newlines. The size of the integers is only limited by the available memory of the computer.

The integers to multiply may be specified on the command line or read from standard input.

**AUTHOR**

George Gesslein II (gesslein@linux.com) at "<http://www.mathomatic.org>".

**REPORTING BUGS**

If you find a bug, please report it to the author or at "<https://launchpad.net/mathomatic>".

**SEE ALSO**

**mathomatic(1)**, **primorial(1)**, **matho-sum(1)**

**NAME**

matho-pascal – display Pascal’s triangle

**SYNOPSIS**

**matho-pascal** [number-of-lines]

**DESCRIPTION**

This command-line utility is optionally part of the **mathomatic**(1) package. It calculates up to 1000 lines of Pascal’s triangle, dumping them to standard output. The default is to center one screen full.

Every number inside Pascal’s triangle is the sum of the two numbers immediately above it.

Each line of Pascal’s triangle is the same as the binomial coefficients for a given power.

The sum of all numbers in each line of Pascal’s triangle is a power of 2.

**AUTHOR**

George Gesslein II (gesslein@linux.com) at "<http://www.mathomatic.org>".

**REPORTING BUGS**

If you find a bug, please report it to the author or at "<https://launchpad.net/mathomatic>".

**SEE ALSO**

**mathomatic**(1), **matho-primes**(1), **matho-sumsq**(1)



**NAME**

matho-primes – generate consecutive prime numbers

**SYNOPSIS**

**matho-primes** [start [stop]] ["twin"] ["pal" [base]]

**matho-primes** [-ht] [-c count] [-p base] [start [stop]]

**DESCRIPTION**

This command-line utility is optionally part of the **mathomatic**(1) package. It quickly computes any number of consecutive prime numbers using a windowing, memory efficient sieve of Eratosthenes algorithm, dumping them to standard output. They are displayed one prime per line in ascending order, unless the "twin" option is specified, which displays only twin primes, two primes per line.

Generates up to 18 decimal digit primes, or whatever is the number of digits of precision for a **long double** in the C compiler used to compile this utility. All numbers displayed by this utility are decimal (base 10) prime numbers. A prime number is an integer that cannot be factored.

A range may be specified on the command line, otherwise the starting number and the number of primes to output is prompted for. The range is **start** to **stop** inclusive, and **stop** must be greater than or equal to **start**.

If the **-c** option is specified, the number of lines of primes displayed is limited to the decimal count that follows this option.

If the **-t** or "twin" option is specified on the command line, only **twin primes** will be displayed. Twin primes are two primes that differ in value by 2. Each twin pair is displayed together on the same line separated by a space character.

If the **-p** or "pal" option is specified on the command line, only **palindromic primes** are displayed. Palindromes are symmetrical, they read exactly the same forward and backward. The palindromic number **base** may be specified, the default is base 10. The **base** can be any integer greater than 1. Primes are always displayed in decimal (base 10).

Short help is displayed when given the **-h** option.

**AUTHOR**

George Gesslein II (gesslein@linux.com) at "<http://www.mathomatic.org>".

**REPORTING BUGS**

If you find a bug, please report it to the author or at "<https://launchpad.net/mathomatic>".

**SEE ALSO**

**mathomatic**(1), **primorial**(1), **matho-mult**(1), **matho-sum**(1)

**NAME**

matho-sum – sum large integers

**SYNOPSIS**

**matho-sum** [integers]

**DESCRIPTION**

This command-line utility is optionally part of the **mathomatic**(1) package. It uses Python to sum many large integers separated by spaces or newlines. The size of the integers is only limited by the available memory of the computer.

The integers to sum may be specified on the command line or read from standard input.

**AUTHOR**

George Gesslein II (gesslein@linux.com) at "<http://www.mathomatic.org>".

**REPORTING BUGS**

If you find a bug, please report it to the author or at "<https://launchpad.net/mathomatic>".

**SEE ALSO**

**mathomatic**(1), **primorial**(1), **matho-mult**(1)

**NAME**

matho-sumsq – Find the minimum sum of the squares for integers

**SYNOPSIS**

**matho-sumsq** [*numbers*]

**DESCRIPTION**

This command-line utility is optionally part of the **mathomatic**(1) package. It finds the minimum number of positive integers that when squared and added together, equal the given number. There is a proof that no more than 4 squares summed together are required to represent any positive integer.

The command line may contain positive integers, less than 2147483648 ( $2^{31}$ ), to find the squares of, otherwise the program counts up from 0. If the number of squares is 2, this program displays all possible combinations, otherwise it just displays the first combination it finds.

**AUTHOR**

George Gesslein II (gesslein@linux.com) at "<http://www.mathomatic.org>".

**REPORTING BUGS**

If you find a bug, please report it to the author or at "<https://launchpad.net/mathomatic>".

**SEE ALSO**

**mathomatic**(1), **matho-pascal**(1), **matho-primes**(1)

**NAME**

primorial – calculate large primorials

**SYNOPSIS**

**primorial** integers

**DESCRIPTION**

This command-line utility is optionally part of the **mathomatic(1)** package. It uses Python and **matho-primes(1)** and **matho-mult(1)** to calculate and display large primorials.

A primorial is the product of all primes up to the given integer. The integers to show the primorials of are given on the command line.

The calculated primorials are output to standard output. The size is only limited by the amount of computer memory.

**AUTHOR**

George Gesslein II (gesslein@linux.com) at "<http://www.mathomatic.org>".

**REPORTING BUGS**

If you find a bug, please report it to the author or at "<https://launchpad.net/mathomatic>".

**SEE ALSO**

**mathomatic(1)**, **matho-mult(1)**, **matho-primes(1)**

**NAME**

**matho\_init** - Initialize the Mathematic symbolic math library

**SYNOPSIS**

```
int matho_init();
```

**DESCRIPTION**

Call this only once before calling any Mathematic code. This must be called exactly once upon program startup and not again, unless **free\_mem()** is called.

Returns true if successful. If this returns false, there was not enough memory available and Mathematic cannot be used.

**FILE**

lib.c

**NAME**

**matho\_parse** - Process Mathematic expression or equation input

**SYNOPSIS**

```
int matho_parse(char *input, char **outputp);
```

**DESCRIPTION**

Parse a mathematical equation or expression and store in the next available equation space, making it the current equation. Afterwards, it can operated on by Mathematic commands using **matho\_process**(3).

The *input* and output ASCII strings are expressions, if successful. The expression or equation string to enter is in "*input*", the resulting output string is stored in "*\*outputp*". The equation number of the equation space that the output expression is additionally stored in (if any) is available in the global "result\_en", otherwise result\_en = **-1**.

Works the same as **matho\_process**(3), except commands are not allowed, so that variables are not ever confused with commands.

Returns true (non-zero) if successful.

**FILE**

lib.c

**NAME**

**matho\_process** - Process Mathematic command or expression input

**SYNOPSIS**

```
int matho_process(char *input, char **outputp);
```

**DESCRIPTION**

Process a Mathematic command or enter an expression into an equation space. The command or expression ASCII string is given as "*input*", the resulting output string is stored in "*\*outputp*".

This function works just like typing something into the Mathematic prompt.

If this returns true (non-zero), the command or *input* was successful, and the resulting expression output string is stored in "*\*outputp*". That is a **malloc**(ed) text string which must be **free**(d) after use to return the memory used by the string. The equation number of the equation space that the output expression is additionally stored in (if any) is available in the global "result\_en", otherwise result\_en = **-1**.

If this returns false, the command or *input* failed and a text error message is always stored in "*\*outputp*". The error message is a constant string and should NOT be **free**(d).

Some commands, like the set command, will return no output when successful, setting "*\*outputp*" to NULL.

The resulting output string can safely be ignored by calling this function with "*outputp*" set to NULL.

**FILE**

lib.c