

Expression calculator (ExpCalc)

Introduction

Expression Calculator

Written by WILLEMS Gunther

<https://guntherwillems.com/expression-calculator>

This program is Freeware

With the calculator you can:

- Calculate expressions of an infinite length and complexity.
- Store an infinite number of lines containing expressions for reference or later use.
- Create an infinite number of user variables.
- Create an infinite number of user functions with up to three parameters.
- Save all the preceding possibilities for later use.

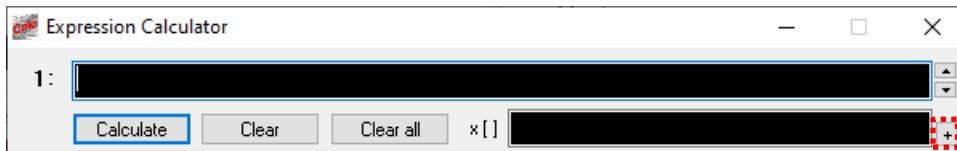
- Draw two-dimensional graphics.

Infinite means as long as your memory and the system can support it.

The main window is kept small. It can be moved over another program to see the values in it. There is a second window mode with more options. The window has a zoom function to make it bigger/smaller. It can draw and save a graph of functions.

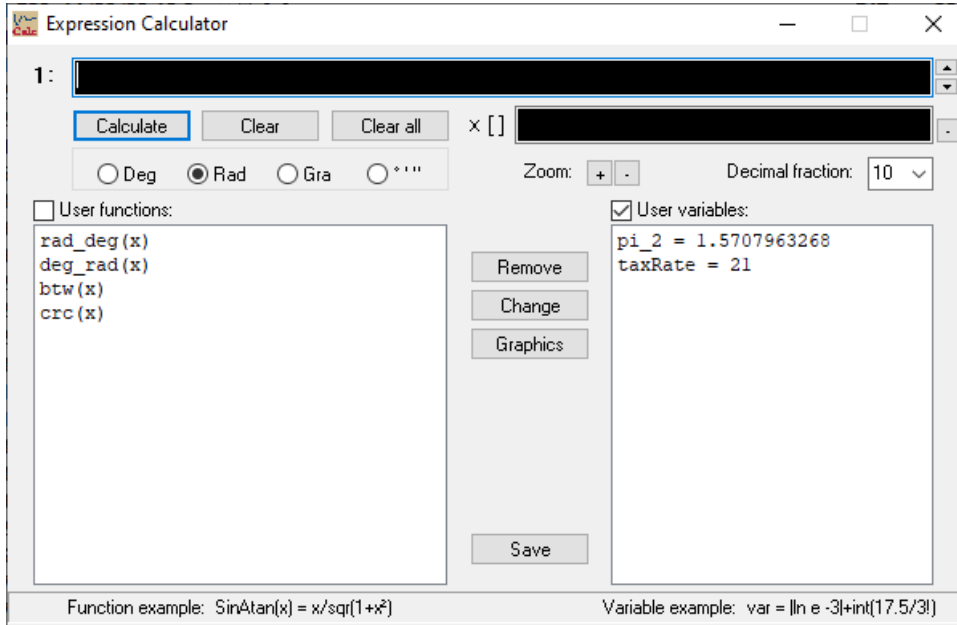
Main window

Small window



Click the + button to open the full window

Full window



Small window

Calculate: Calculates the expression

Clear: Clears the current expression

Clear all: Clears all the expression lines

Arrows next to the expression textbox:

Circulate between the saved expression lines or at the end, create a new one.

The up and down keyboard buttons have the same effect when the cursor is in the expression textbox.

Click '[']' to cycle thousands/decimal separator [], [.), [,] in the result x

Click x before [] to insert 'x' at the cursor position in the expression textbox

Full window

Zoom +/-: Make the window with all its controls bigger or smaller

Remove: Remove the active 'user function' or 'user variable'

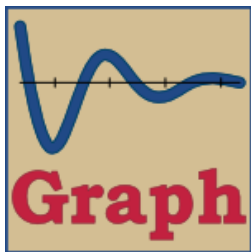
Change: Copy the selected 'user function' to the expression line. You can change it and click calculate to replace the old one.

Graphics: Open the ExpGraph program. The content of the expression line is put into the function textbox

Save: All expression lines, user functions and user values are saved for later usage

Clicking on the checkbox before the 'user function' or 'user variables', cycles between: show function/variable only, show the definition/value, show hidden functions.

When you click on a 'user function', its definition is shown in the status bar.



Expression calculator graphics (ExpGraph)

Graphics window

Graphics options

Function:

Image width: Label ticks x:

Image height: Label ticks y:

Origin x: Ticks x:

Origin y: Ticks y:

Minimum x: Color graph:

Maximum x: Font size:

Minimum y: ☐ Clear previous graph

Maximum y: ☐ Use points

☒ Draw axis ☐ Show gridlines

Zoom:

Graphics

The “Expression Graphics” program can draw 2 dimensional functions of type: $f(x) = x^2 + 1$

All the user functions and variables saved with the “Expression Calculator” can be used.

Here you can insert all the parameters needed to draw a function.

If label ticks x or y equals zero, the axis will be divided into 20 ticks.

To draw a new graphic, click inside the graphics image or close the window. The options dialog box behind it will reappear.

The graphic can be saved in .bmp format.

Examples:

$\tan x$

$2x^3 - 4x^2 + 5$

$\sin(x) * \exp(-.25x)$

$4x - 7\sin x$

$(x^2 - 5x) / (2x^2 - 5)$

Graphics options

Function:

Image width: Label ticks x:

Image height: Label ticks y:

Origin x: Ticks x:

Origin y: Ticks y:

Color graph:

Minimum x: Font size:

Maximum x:

Minimum y:

Maximum y:

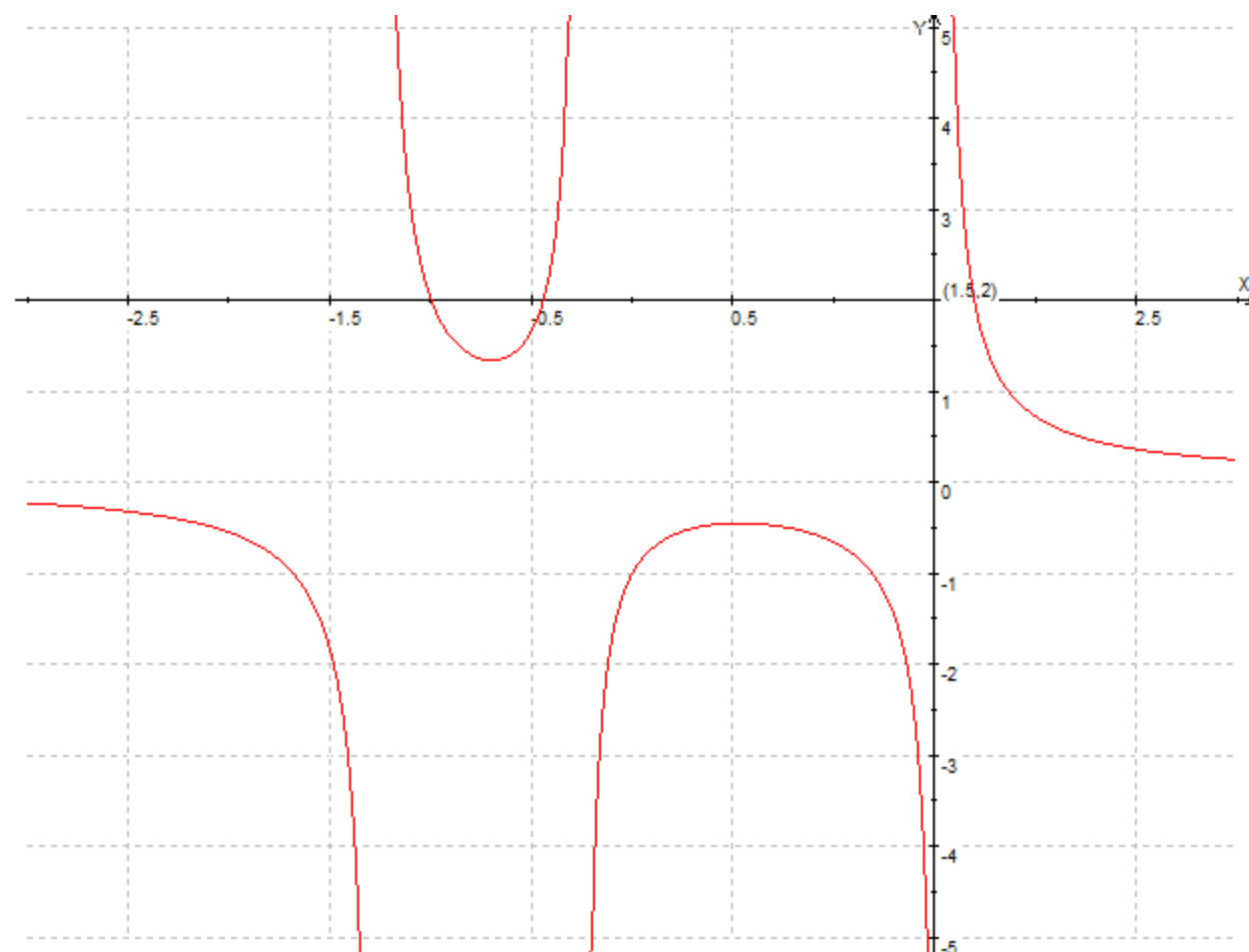
☐ Clear previous graph

☐ Use points

☒ Draw axis ☒ Show gridlines

Zoom:

• $f(x) = (x^2+1)/(2x^3-4x-1)$



Graphics options

Function:

Image width: Label ticks x:

Image height: Label ticks y:

Origin x: Ticks x:

Origin y: Ticks y:

Color graph:

Minimum x: Font size:

Maximum x:

Minimum y:

Maximum y:

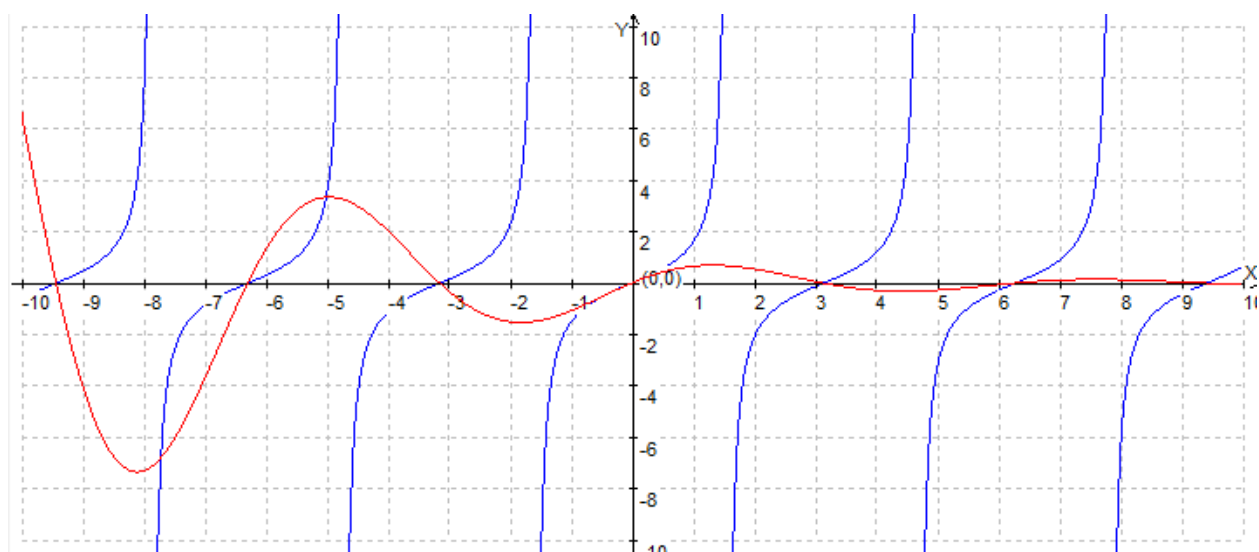
☐ Clear previous graph

☐ Use points

☒ Draw axis ☒ Show gridlines

Zoom:

- $f(x) = \tan x$
- $g(x) = \sin x * \exp(-.25x)$



Graphics options

Function:

Image width: Label ticks x:

Image height: Label ticks y:

Origin x: Ticks x:

Origin y: Ticks y:

Color graph:

Font size:

Minimum x: ☒ Clear previous graph

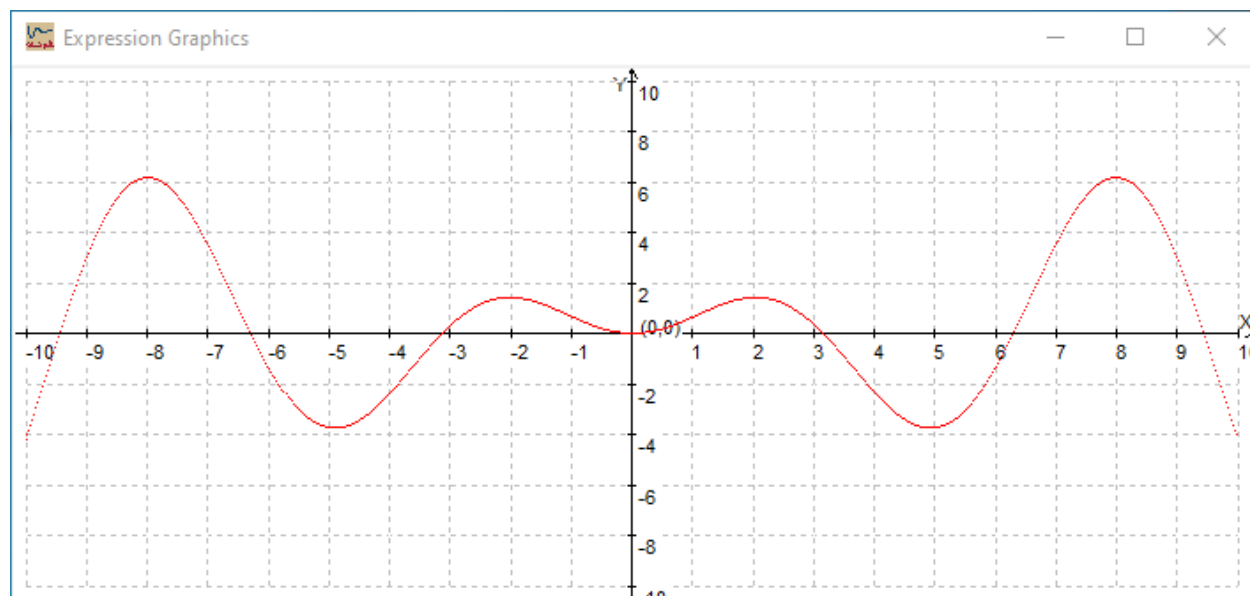
Maximum x: ☒ Use points

Minimum y: ☒ Draw axis ☒ Show gridlines

Maximum y:

Zoom:

- $\sin(x) * \exp (-.25) * x$



Function overview

The following functions are built-in:

Trigonometric functions:

$\sin(x)$	sine
$\cos(x)$	cosine
$\tan(x)$	tangent

Inverse trigonometric functions:

$\text{asin}(x)$	arc sine
$\text{acos}(x)$	arc cosine
$\text{atan}(x)$	arc tangent

Hyperbolic functions:

$\sinh(x)$	hyperbolic sine
$\cosh(x)$	hyperbolic cosine
$\tanh(x)$	hyperbolic tangent

$\exp(x)$	exponential: e^x
$\ln(x)$	logarithm base e
$\log(x)$	logarithm base 10, natural logarithm

$\text{sqr}(x)$	square root
$\text{cur}(x)$	cubic root

$\text{int}(x)$	integer part
$\text{floor}(x)$	floor finds the largest integer not greater than x
$\text{ceil}(x)$	smallest integer greater than
$\text{abs}(x)$	absolute value, or use $ x $

$\text{sgn}(x)$	Sign: -1 for $x < 0$, 0 for $x = 0$, 1 for $x > 0$
$\text{frac}(x)$	Fractional part of number
$\text{fact}(x)$	Factorial : $x! = x(x-1)(x-2)\dots 1$ or use $x!$ or $(x+1)!$

$\text{min}(x,y)$	minimum
$\text{max}(x,y)$	maximum
$\text{mod}(x,y)$	x modulo y, or $x \% y$, the remainder on dividing x by y
$\text{round}(x,y)$	rounds x to y values after decimal point

Constants

The calculator knows these two constants: (However, you can create as many values as you wish!)

e Euler's constant (or Euler-Mascheroni constant): base of natural logarithm : 2.7182818285...

pi the ratio of circumference of a circle to its diameter: 3.1415926536...

User variables

You can define an infinite number of variables.

In the expression line enter:

variablename = value

The name that you choose for a variable can be of any length, but it must start with a letter. The rest can be any character except a space or $+ - * / \wedge | ! ^$

Everything is case sensitive. So the name "FreeFall" is not the same as "freefall"!

The value can be any number or expression (in this case the result of the expression will be used).

The calculator only knows two variables 'pi' and 'e'. You can assign another value to them. When removing your assignment for 'pi' and 'e', the original values will be available again.

Some examples:

$g = 9.80665$ (Free fall)

$c = 299792458$ (Speed of light)

$G = 6.672E-11$ (Gravitation)

$V_m = 2.241383E-2$ (Ideal gas)

$pi = 355/113$ Tsu Ch'ung-Chi's value: approximates pi to 6 places

User functions

You can define an infinite number of functions.

In the expression line enter:

1) A function with one parameter:

functionname(x) = expression

The name you choose for a function can be of any length, but it must start with a letter. The rest can be any character except a space or $+ - * / \wedge | ! ^$

Everything is case sensitive. So the name "SinAtan(x)" is not the same as "sinatan(x)"!

Some examples:

$f(x) = x^2 + 1$

$bef2eur(x) = x / 40.3399$

$g(x) = (f(x))^2 - f(x) + 1$

$func1(x) = 3x^3 + 5x^2 + 10x - 1$

2) Two parameters:

functionname(x,y) = expression

$$\text{binominal}(x,y) = x! / (y! * (x-y)!)$$

3) Three parameters:

$$h(x,y,z) = x^2 + 3y * z$$

<u>Expression:</u>	<u>Equivalent:</u>
f(13)	f 13
sin(f(13))	sin f 13
h(sin 23.5, 5+2, f(2))	
bef2eur(1 000)	

Expression syntax

Whenever you enter an expression, the calculator evaluates the expression and returns the result.

Operators are used to perform calculations, make assignments.

+	Addition
-	Subtraction
*	Multiplication
/	Division
=	Assignment
!	Factorial (or fact function)
%	Modulus (or mod function), gives the remainder of a division

.	Decimal point
,	Separator for function parameters
Space	for readability

Order of precedence:

()
² ³
 unary -
 ^
 * / %
 + -

Spaces can be used for readability:

Also inside values

<u>Expression:</u>	<u>Equivalent:</u>
$x^2 + 1456376 * (4! + 2)$	$x^2 + 1\,456\,376 * (4! + 2)$

Examples: (The two notations are correct)

<u>Expression:</u>	<u>Equivalent:</u>	
x^2	x^2	
x^3	x^3	
$3x^2$	$3*(x^2)$	
$\sin x$	$\sin(x)$	
$\sin x^2$	$\sin(x^2)$	
$\sin x^2$	$(\sin(x))^2$	
$x!$	$\text{fact}(x)$	
$ x $	$\text{abs}(x)$	
$10^\circ 12' 14''$	$10\text{d}12\text{m}14\text{s}$	$10\text{h}12\text{m}14\text{s}$
-10^2	$-(10^2)$	
$\sin x^2$	$\sin (x^2)$	
$\sin x^2$	$(\sin x)^2$	
$\sin -10$	$\sin (-10)$	
$\sin -10^2$	$\sin (-10^2)$	
$3x+7(12+3)$	$3*x + 7*(12+3)$	
$\sin (\tan (\pi))$	$\sin \tan \pi$	

You can define variables that can be used in your expressions: see [User variables](#)

You can define functions with up to three parameters: see [User functions](#)

Advanced topics

- Functions defined with leading # sign are hidden. To see them check the checkbox ‘User functions’ until it is grayed.

`#test(x,y) = 15x+y2`

To use the function do not use the leading # sign! Just type:

`test(5)`

- Adding remarks to your expressions and functions:
All characters found after a ‘;’ are considered being comments

Defining a function:

`rad_deg(x) = x*180/pi ; Convert radians to degrees`

`deg_rad(x) = x*pi/180 ; Convert degrees to radians`

After an expression:

`355/113 ; Almost pi`

Examples

$$16/113+3$$

$$(12*3+1)*7-5$$

$$\sin(\pi/4)$$

$$\cos -10.2$$

$$12^{\circ}3' + 15^{\circ}34''$$

$$12\text{h}3\text{m} + 15\text{m}34\text{s}$$

$$10\,000 + 20\,540 + 7\,070 \quad ; \text{ money needed next month}$$

$$(15-6*2)!$$

$$7 + |-45*2.3|$$

$$a = 15.5/4-4$$

$$\pi_2 = \pi / 2$$

$$\text{rad_deg}(x) = x*180/\pi \quad ; \text{ Convert radians to degrees}$$

$$\text{deg_rad}(x) = x*\pi/180 \quad ; \text{ Convert degrees to radians}$$

$$\text{bef2eur}(x) = x/40.3399 \quad ; \text{ Convert BEF to EUR}$$

$$\text{eur2bef}(x) = x*40.3399 \quad ; \text{ Convert EUR to BEF}$$

$$\text{btw}(x) = x*1.21 \quad ; \text{ Add 21\% btw to } x$$

$$f(x,y) = x*3+y$$

$$g(x) = x^2+1$$

$$h(x,y,z) = x+y*z$$

$$i(x,y) = g(x) / 2 + y$$

$$a = \text{deg_rad}(45)$$

$$b = \sin a$$

$$\text{rad_deg} \sin(\pi/4)$$

$$\sin \text{deg_rad } 45$$

$$f(4,3)$$

$$f(g(3), 2)$$

$$-4 + h(g(3)*2, f(g(1), 3), -4)$$

$$l(2, 6)$$

$$(x^2+1)/(2x^3-4x-1)$$

$$\sin x * \exp(-.25x)$$

Screen parts

Expression

Enter your expression in this edit box. Press 'enter' or click on the 'Calculate' button for evaluation and calculation of the result.

Use the up and down arrow to move between expression lines or use the buttons on the right side.

Gotoexpr

Use up or down arrow to go to the next or previous expression line. After the last expression a new empty line is created.

Exprlinenr

The active expression line.

Result

Shows the result of the last calculation.

Calculate

Evaluates and calculates the expression show in the expression line above.

Clear

Clears and deletes the active expression line. It is removed from memory.

Clearall

Clears and deletes all the expression lines present in memory.

Degrees

Degrees, radians, gradients and degrees/minutes/seconds mode for calculation of the result

Userfunction

Show all the functions created by the user. By clicking one time on a function it is highlighted and the formula is shown in the status bar. Double clicking on a function puts the function inside the expression line at cursor position.

Uservariables

Show all the variables created by the user. By clicking one time on a variable it is highlighted. Double clicking on a variable puts the variable name inside the expression line at cursor position.

Functionbox

When unchecked, all the function names are shown.

When grayed, all the function names from normal and hidden functions are shown.

When checked, all the function names are shown + function definitions.

Variablesbox

When unchecked, all the variable names are shown.

When checked, all the variables and the value they represent are shown

Remove

Remove the selected user function and/or user variable.

Change

Places the function definition inside the expression line. Change the function definition and press the calculate button.

Graphics

Opens the “Expression Graphics” program and passes the current expression to it. All the functions and variables saved in ExpCalc.ini are usable with the graphics program.

Save

Saves all the expression lines, user functions and user variables to the ExpCalc.ini file located in the same directory as the program.

Statusbar

Shows an example function and variable definition.

Shows the last user function selected by the user.

To remove the last function definition click once on the status bar.

Double click to get program version information.

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