

RPNS

Simple Reverse Polish Notation Environment for TI-89 Ver. 2.00

The program RPNS() offers fast and simple Reverse Polish Notation environment for near 60 frequently used mathematical functions and conversions. Fourteen of them require only one keystroke and greater part of other functions require only two keystrokes. This environment is supported with basic edit, stack and mode operations.

The stack and lastX registers

RPN memory stack consists of four registers X, Y, Z and T, which are »stacked« on top of each other. Whenever a next expression is entered the contents of the highest register is lost. The stack enables easily processing of complex operations without parentheses.

There are two main operations on the stack: lift and drop. In both cases the value in the X (lowest) register remains unchanged.

Stack lift is the operation where the contents of the stack move up:

$$\begin{aligned}Z &\rightarrow T \\ Y &\rightarrow Z \\ X &\rightarrow Y\end{aligned}$$

The stack lifts automatically when new values enter in the X register. Most functions prepare the stack to lift its contents when the next value enters the X register. Only keys [ENTER] and [CLEAR] disable stack lift for the next entry.

Stack drop is the operation where the contents of the stack move down:

$$\begin{aligned}T &\rightarrow Z \\ Z &\rightarrow Y\end{aligned}$$

The stack drops automatically when operations combine two values in the X and in the Y registers to produce a result in the X register.

There is a lastX register. It renews its content before the execution of any mathematical function. Edit, stack and other functions do not affect the lastX register.

All these registers keep their values even if the calculator is turned off.

Display and edit mode

Results of mathematical operations are displayed in the display mode. The visible result can be long up to 78 characters (57 characters with large fonts) in up to three lines. Editing is disabled.

Key in [ENTER], [CLEAR] or [←] prepare the program for new entry. Key in a character displays also the cursor at the end of entry line. Entering and deleting characters is possible.

Any mathematical or stack operation returns the program back to the display mode.

Changing Modes

The key [MODE] opens next popup window.



Press [1] to toggle angle unit.

Press [2] to toggle complex results format.

Press [3] to toggle auto/exact/approximate arithmetic.

Press [4] to toggle decimal/hexadecimal/binary base.

Press [5] to toggle between medium and large fonts. Operating with medium fonts is faster.

Press [6] to toggle between left and right align. Operating with left align is faster.

Press [7] to toggle between 1 and 2 keys access to trigonometric functions. In 1 key mode are functions sin, cos and tan called with keys [Y], [Z], [T] and corresponding letters with [2nd][Y],[2nd][Z], [2nd][T]. In 2 keys mode is this inverted.

Press [8] to toggle between displayed or hidden names of operations.

Press [ESC] to exit without a mode change.

Edit, stack and other operations

Edit operations:

- The key [←] in the display mode clears the X register. The same key in the entry mode clears the rightmost character in the entry line.
- The key [DEL] ([♦] [←], delete X) deletes value in X register and drops the stack.
- The key [CLEAR] clears the X register.
- The key [♦] [CLEAR] clears all stack registers.

Stack operations:

- The key [ENTER] lifts the stack and replicates the contents of the X register into the Y register.
- The key [►] swaps the contents of the X and the Y registers.
- The key [▲] rolls up the contents in the stack registers.
- The key [▼] rolls down the contents in the stack registers.
- The key [2nd][▲] duplicates the X and the Y register in the Z and in the T register.
- The key [ANS] ([2nd][(-)], last X) restores the value in the X register as it was before last executed mathematical function.

Other operations:

- The key [STO] stores a value in the X register to the variable. Enter variable name in the dialog box and press [ENTER] twice.
- The key [RCL] ([2nd][STO], recall var.) copies selected variable to the X register. Enter variable name in the dialog box and press [ENTER] twice.
- The key [♦][STO] deletes a variable. Enter variable name in the dialog box and press [ENTER] twice.
- The key [QUIT] ([2nd][ESC]) exits the Program and returns to the Home Screen.

Mathematical functions and conversions

- For the mathematical functions and conversions with one argument enter the argument first and then the command.

Directly from the keyboard are accessible next functions:

1/x, x ² , √x,	[F1], [F2], [F3]
e ^x , ln x, 10 ^x , log x,	[F4], [F5], [2nd][F1], [2nd][F2]
sin x, cos x, tan x,	[Y], [Z], [T] or [2nd][Y], [2nd][Z], [2nd][T]
sin ⁻¹ x, cos ⁻¹ x, tan ⁻¹ x,	[♦][Y], [♦][Z], [♦][T]
-x, x! or gamma(x+1), approx x	[(-)], [♦][/], [♦][ENTER]

- For the mathematical functions with two arguments enter argument y first and then press [ENTER]. Then enter the argument x and at last the command.

When the command is executed, the command's arguments are removed from the stack and replaced by the result of the operation. And the stack drops.

Directly from the keyboard are accessible next functions:

+, -, *, /,	[+], [-], [*], [/]
y^x , $\sqrt[x]{y}$,	[^], [2nd][F3]

- The key [I] ([2nd][7]) opens next popup window with five variants of integrations. Function integrate always integrates the expression in the X register per variable x.

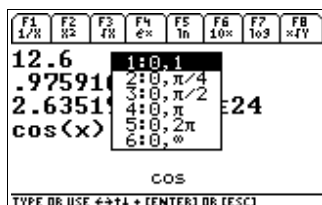


Press [1] to calculate the indefinite integral.

Press [2] to calculate the indefinite integral of the order Y (order must be an integer in the Y register).

Press [3] to calculate the definite integral. The lower limit must be in the Y register and the upper limit must be in the Z register.

Press [4] to open secondary popup window with predefined limits:



Press [1]...[6] to call integration with selected limits or [ESC] to return to the primary window.

Press [5] to numerically calculate the definite integral. The lower limit must be in the Y register and the upper limit must be in the Z register.

Press [ESC] to exit without a calculation.

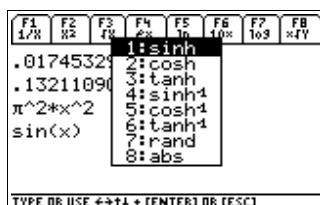
- The key **[d]** ([2nd][8]) opens next popup window with four variants of derivatives. Function derivative allways calculates the derivative of the expression in the X register per variable x.



- Press [1] to calculate the derivative.
 - Press [2] to calculate the derivative of the order Y (order must be an integer in the Y register).
 - Press [3] to calculate the derivative in the point Y (point must be in the Y register).
 - Press [4] to calculate the numeric derivative in the point Y (point must be in the Y register).
- Step value is 0.00001.
- Press [ESC] to exit without a calculation.

Other functions and conversions are accessible with the keys [CATALOG], [◀] and [APPS].

- The key **[CATALOG]** opens next popup window with mathematical functions.

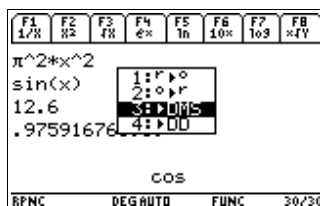


Press [1]...[6] to call selected hyperbolic function, [7] to call rand, [8] to call abs(x) or [ESC] to exit without a call.

- The key **[◀]** opens primary popup window with mathematical conversions and functions.



- Press [1]...[4] to call evaluate(x), exact(x), iPart(x) or fPart(x).
- Press [5] to call $r, \theta \rightarrow x, y$ and [6] to call $x, y \rightarrow r, \theta$. These conversions require two arguments and calculate two results (both in the Y and in the X register).
- Press [7] to open secondary popup window with angle conversions.



Press [1]...[4] to call selected conversion or [ESC] to return to the primary window.

Appendix

Table 1: Review of the results of the stack operations

Stack reg.	Initial state	Enter	Clear X	Swap X, Y	Roll up	Roll down	Dup X, Y	Last X	Delete X	Recall var
T	d	c	d	d	c	a	b	c	d	c
Z	c	b	c	c	b	d	a	b	d	b
Y	b	a	b	a	a	c	b	a	c	a
X	a	a	0	b	d	b	a	last X	b	var.

Table 2: Different meanings of the keys in the simple RPN environment

Key	Without Modifier	[2nd]	[♦]
[F1]	1/x	[F6] 10^x	unused
[F2]	x^2	[F7] $\log x$	unused
[F3]	\sqrt{x}	[F8] $x\sqrt{y}$	unused
[F4]	e^x	e^x	unused
[F5]	$\ln x$	$\ln x$	unused
[ESC]	Escape	[QUIT] Exit	unused
[►]	Swap X, Y	Dup X, Y	unused
[▲]	Roll up	unused	unused
[▼]	Roll down	unused	unused
[◀]	Math. conversions, Angle conversions, Base/logic operations	unused	unused
[APPS]	Units conversions	unused	unused
[MODE]	Angle, ComplexFormat, Exact/Approx., Base, Fonts, Align, 1/2 key trig. func., Names	unused	unused
[CATALOG]	Hyperbolic functions, rand, abs	i	unused
[←]	Clear X / BackSpace	unused	[DEL] Delete X
[CLEAR]	Clear X	Clear X	Clear stack
[Y]	\sin / y	y / \sin	\sin^{-1}
[Z]	\cos / z	z / \cos	\cos^{-1}
[T]	\tan / t	t / \tan	\tan^{-1}
[STO]	Store variable	[RCL] Recall variable	Delete variable
[(-)]	+/-	[ANS] Last X	unused
[ENTER]	Enter	unused	[≈] approx

General information

The program write.89z (output for large fonts) must be on the same directory as rpns(). This program was downloaded from the page <http://tiger.towson.edu/~bbhatt1/ti>.

Values are stored on the stack as numbers (FP values using up to 14 digits) or as expressions. Because they are not stored as strings full calculator FP accuracy is preserved.

This program is developed from the program rpne(). The code is completely rewritten and simplified. Rpns() has less possibilities and functions, but is much faster and easier to use as it's predecessor.

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