# Advanced Programmable Calculator (APCalc)
# User Manual

**Configure it the way you like it**


**Scientific**


**Base Conversions**


**Financial**

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## Introduction

Introducing an Advanced Programmable Calculator (APCalc) using Algebraic Entry Notation. APCalc is now in color or black and white. If you have a color device, APCalc will load in color. If you have a black and white device, APCalc will load in black and white. The same program works for both screen types.

APCalc, in addition to providing normal calculator functions, allows you create your own custom programs and thereby customize APCalc to your own requirements. You can then save these custom programs in APCalc's built-in program database.

Programs can be grouped into any of nine different User Function Key Groups to allow quickly transforming APCalc from a scientific calculator to a financial, units conversion, currency conversion, base conversion or any other calculator configuration that you desire. Any custom calculator can be restored with two taps of the pen.

APCalc offers features of automatic prompting for new variables, popup selection lists and subroutine calls, branching, looping and comparison operators.

## Installation

APCalc consists of two files. APCalc.prc (the application) and APCalcDB.pdb (the program database). There is a third required file, MathLib (a public domain library), that is not part of APCalc.

These two files can be installed using the Desktop S/W or whatever installation program you currently use, just as you would any other application. These files can be installed in either order. APCalc.prc and MathLib are the only programs that must be installed. MathLib must be installed before you launch APCalc.prc, for the first time.

If you do not install APCalcDB.pdb, one will be created automatically when APCalc is executed the first time.

**NOTE: Once you have created your own programs, you should not install APCalcDB.pdb that comes with upgrades. If you do, you will overwrite your own saved programs.**

- **MathLib** is a **free** shared library that can be used by any OS 2.0+ Pilot program that needs IEEE 754 double precision math functions. It's distributed under the terms of the GNU Library General Public License, and is freely available with full source code and documentation at the MathLib Information web page. It's not a part of the APCalc program, and you're not paying anything for its use; a copy is simply included in this archive for your convenience.

## Launching APCalc for the first time

When you launch APCalc for the first time you will see the registration screen, like the one shown at the right. You have two options at this point.

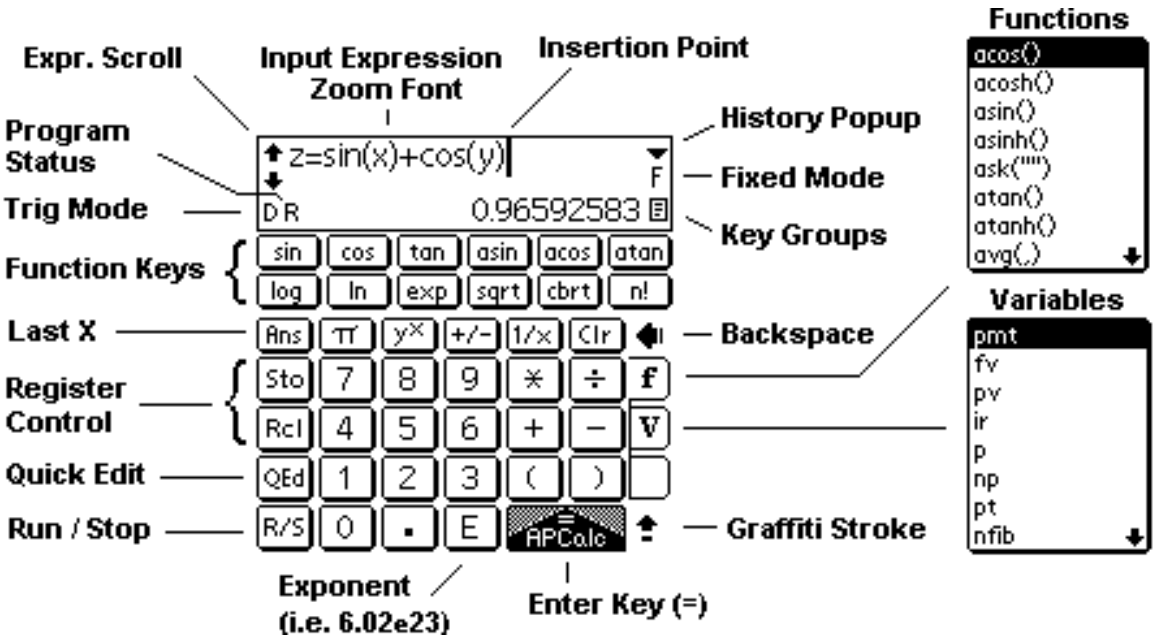

If you have registered APCalc, you should enter the Key that you received with your confirmation, into the Key field, and tap Register. User field and Reg. Code fields cannot be changed. Once the key has been recognized as valid, you will see the "Unregistered", at the top of the screen, change to "Registered" and a popup screen that says "Thank You". You will not be able to enter the key again, once you have successfully registered. Successful registration will remove this screen from being displayed each time APCalc is started.

Alternatively, you can tap Test Drive, without entering a Key, to use APCalc, in its demonstration mode, subject to the limitations of the demo version of APCalc. Demo mode limits the size and number of programs as well as the number of Function Keys. If you have already registered, use Test Drive to exit the screen.


You will then see a screen like the one to the right. This is how APCalc looks with no saved programs. The "Init" is just an initial blank program that is created as the first program name. You may tap Init button followed by QEd to begin editing this program. Programming will be covered later in this document.

## Quick Look

The following information should get you familiar with APCalc. The purpose of this document is to show you how to use APCalc and its functions. It is not aimed at teaching you how to program in general. I will handle, on a case by case basis, any specific questions on how to do specific calculations.



**Input Expression** – The field in which you enter the expressions you wish to evaluate. Expressions may contain signs, constants, numbers, variables, functions, operators and SPACES (spaces are ignored). You can 'Tap', 'Cut', 'Copy', 'Paste' and 'Select' any part of an expression. Expressions can now be up to 64 characters and may occupy up to three lines. Up/Down scroll buttons (left of input line) have been added to navigate within the expression. Up moves to the beginning of an expression, Down moves to end of expression line.

Matching parenthesis: As you tap the expression field, you will select data within matching parenthesis. This is useful for deleting parts of expressions within parenthesis.

**Status** – The current status of the calculator is displayed in this area. '**R**' indicates that a program is running. If a wait() function is executed, the '**P**' (paused) indicates that the calculator is still in run mode and must be continued with R/S. '**S**' indicates single-step mode and requires pressing R/S after each instruction. Single-step mode is set in preferences screen. There is also a Fixed Mode Status on the right side of the screen. It is display a bold '**F**' if the calculator is in a fixed point mode that is other than decimal. Be aware of this status or else you might not be aware that an answer is in some other base.

**Trig Mode** – '**D**' will displayed for degree mode, '**R**' will be displayed for radians. Tap the '**D**' status field and pop up a selection list (Deg, Rad).

**Function Keys (User Defined Keys)** – Two row of keys are allocated to built-in functions and User Programs. These function keys can display groups of functions, for easy access. Current function groups include 9 User Function Groups as well as, Trig/Sci, Misc/Hypr, Base 1 and Base 2.

The key label consists of the first 4 characters of the program name. (i.e. Program, will display 'Prog' on the function key associated with the program number).

The user program Function Keys Groups can be renamed using Menu→Edit→Edit Key Groups. Go to the edit screen and choose names you prefer for these groups.

Use the Hard Scroll buttons to change these keys. The state of these function keys is maintained between sessions. You may also change these via the function key popup trigger (to right of Answer) or on the Preference menu. These may be programmatically changed by the function fk(x) where x is between 0 and 13.

Note: Base 2 cannot be accessed via the Function Key Popup; it is an extension of Base 1 and is accessed via Base1, via the hard scroll buttons or with fk() function, in a program.

**Last X** – The Ans key will evaluate to the last calculated value. Use the 'Ans' variable, in an expression, when you want to refer to the last calculated value.

**Register Control** – These two keys (Sto and Rcl) are used to store and recall values to and from the 100 built-in APCalc registers. Syntax is Sto(x), where x is any value from 0 to 99. The last calculated value is stored to the specified register.

**Quick Edit** – This button brings up the currently loaded program, into the editing window. If there is no program currently loaded, tapping QEd will open with a blank program. Use this button to create and edit APCalc programs.

**Run / Stop** – This button is tapped to begin or halt execution of a previously loaded program. This button serves the same function as menu option, Menu→Program→Run Program (/R). It must be tapped to 'continue' a paused program (i.e. after a wait("label")). A paused program is indicated by a '**P**' in the status area. Tapping R/S can be used to break out of an infinite loop, in a program.

**Enter Key (=)** – Functions like the = key on any calculator. Tap this key to evaluate the expression, in the expression field.

**Graffiti Indicator** – APCalc accepts input from the Graffiti input area. Graffiti shift strokes are indicated in this area.

**Functions** – Tap this trigger and display a list of functions available for use in expressions. A few functions will be missing from this list because they have no use at the calculator level (outside of a program). Use the popup scroll button to navigate to the function of your choice. Tap that function and it will be inserted into the current expression.

**Variables** – Tap this button and display the last 20 variables available, for use in expressions. Use the popup scroll button to navigate to the variables of your choice. Tap the variable name and it will be inserted into the current expression. When the list reaches 20 variables, new variables are added to the list the oldest will be deleted. Variables are displayed in the order they were created. Variables consist of alpha, numeric and '_' with a maximum length of 20 characters.

**Backspace** – Tapping this key will delete the character to the left of the Insertion Point. Backspace will also set the pending data flag ('pflag').

**Expression Result** – Result of expressions are displayed in this area (left of Key Groups), whenever the [ = ] key ([APCalc=]) is tapped. Every function will return a value. Expressions like Clear History, Clh(1), will return the last calculated value (Ans). Tapping the Ans field will pop the result into the Expr field.

Note: 'Ans' variable uses the full precision of the previous result, while tapping the Ans field will only use the displayed value (i.e. truncated to displayed precision).

**Key Groups** – Tap this icon to display a list of Function Key Groups. Select the desired group to assign Function Keys.

Note: Base 2 cannot be accessed via the Function Key Popup; it is an extension of Base1 and is accessed via Base1.

**Fixed Mode Status** – This status will be '**F**' for any base other than 10. This is to remind you that you are not in the base 10 output format. You can use base(10) as an expression to return to base 10 or you can go to the base function key group and set it there.

**History Popup** – Tap this button to display the last 32 unique expressions. This can be used for repeat calculation of a recent expression. Tapping any history entry pops that expression to the expression field. The history buffer is maintained between sessions of APCalc.

**Insertion Point** – The insertion point is a blinking cursor that shows where new text will be entered or the point at which text will be deleted using the Backspace key. You can change the insertion point by simply tapping anywhere within the expression.

## Basic APCalc Operation

Basic calculations consist of entering expressions in the expression field, followed by tapping the [APCalc=] key. Expressions are entered just as you would write them on paper and may consist of a sequence of signs, numbers, constants, variables, functions, operators and parenthesis. Expressions are evaluated each time the [APCalc=] key is pressed. The following are examples of what simple expressions might look like in the expression field of APCalc.

| **Input Expression** | **Result** |
|---|---|
| 25*56 + 10*1000 [APCalc=] | 11,400.00000000 |
| 1/2*32*2^2 [APCalc=] | 64.00000000 |
| (24 + 23) * 3 + 4 * (15 - 16) [APCalc=] | 137.00000000 |

Note: [APCalc=] implies that the [APCalc=] key is to be tapped rather than writing "APCalc=" into the display.

The number significant decimal digits displayed may vary, depending on the previous preference settings. You may change this selection by activating the preference screen with either the Menu→Info→Preferences or using the shortcut Command (/I) to bring up the preference screen. Preference selections made are saved and are restored each time APCalc is launched.

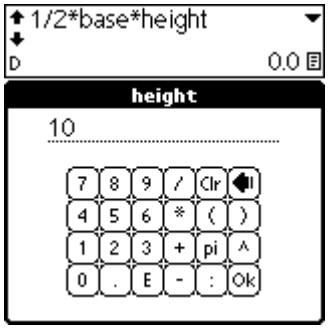
## Setting Preferences

| | |
|---|---|
| Deg \| Rad | Select degree or radian mode |
| Fix \| Sci \|Eng | Select Fixed Point (within 1e8 to 1e-8 limits) or Sci or Eng mode |
| Decimal | Select decimal display format (0 to 8 decimal places) |
| SS | Selects single-step mode, during program execution, if checked |
| TZeros | Trim trailing zeros, of decimal part of result, if checked |
| RVars | Reset variables each time APCalc= is pressed |
| Display Inst. | Display (animate) instructions, during program execution |
| Tap Speed | Select fast or slow tap speed for use with Multi-tap selection |
| Backup DB | Backs up APCalc program database, during Hot Sync, if checked |
| ProgHistory | Logs program steps, during program execution, if checked |


## Using variables in an expression

There may be times when you find it necessary to use variables within expressions, at the calculator level (that is, outside of a program).

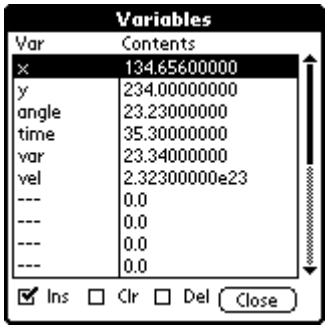
For instance, to calculate the area of a triangle use the formula ½*base*height. To perform this calculation you would enter:




`1/2*base*height` (or `.5*b*h`) and press APCalc=. You will be prompted for `base` and `height`, if these variables do not already exist.

Prompting for variables occurs automatically, the first time the variable is encountered. Simply enter the value for the variable and tap Ok. Calculation will continue until complete. The result of the calculation will be displayed in the `Ans` area next to the Key Group button.

Once the calculation is complete, you can review the variable values by tapping the **V** tab at the right of the screen. This list of variables will contain the last 20 variables used in all calculations. Tapping on any variable will pop that variable into the expression field. For instance to calculate the area of a rectangle (`base*height`), using the same values and only the variable popup and the APCalc '*' operator, you could tap: **V** `base` `*` **V** `height` APCalc=




To delete a specific variable (like `base`), just enter `base=` without a value, followed by the APCalc= key. This would delete `base` and removes it from the variable popup list. Or, check Del and tap variable name.

You may also assign the value of an expression to another variable. For instance you could have calculated these two areas and assigned it to new variables, Atri and Arect, by writing the original expression as follows:

`Atri = 1/2*base*height` and `Arect = base*height`

Another useful way of evaluating expressions is to evaluate a previously entered expression with different variable values. There are two simple ways to accomplish this. The method you use will depend you your personal preference.

The first method uses the ? operator. Any variable that has ? appended to the variable name, will automatically prompt for that variable, even if it already exists. You could have written the equation like:

`Atri = 1/2*base?*height?` and would have been prompted for `base` and `height` each time the APCalc= key is tapped. Or, `Arect = base*height?` and would have only been prompted for the first occurrence of `base` and subsequent values for `height`.

The second method of forcing prompting for variables is by setting the RVars (reset variables) preference. This will force the clearing of "all" variables each time the APCalc= key is tapped which will force prompting at variables.

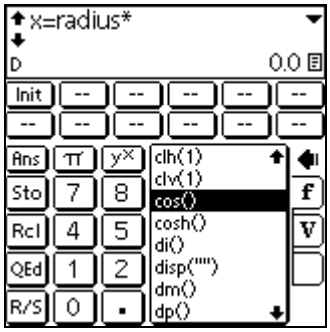
Note: Using RVars clears all variables each time APCalc= is pressed, use with caution. This applies even if you are not entering a variable. For instance, if RVars is checked and you simply calculate 2+2, all variables will be cleared. This is useful, if you have an equation in the expr field and you want to continually be prompted for input. If you do not use RVars and you are tap APCalc= with a previously calculated expression, you will see no change to the display since it has been calculated with previous variable values.

## Using functions in an expression

Using functions is very similar to using variables. Functions may be written into an expression, selected from the function list, **f** tab, or directly accessed via the Function Keys. To enter the equation, `x=radius*cos(angle)`, you could enter:

`x=radius*`

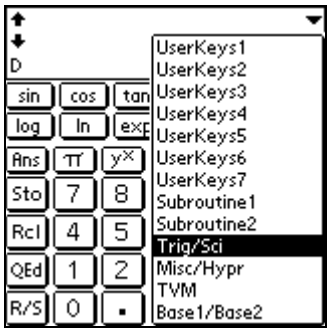
then select `cos()` from the popup function list. You will notice that the insertion point is positioned within the parenthesis. You then write in `angle` or select it from the variable popup, if it already exists from a previous calculation. You would finish the calculation by tapping the APCalc= key.




## Function Key Groups

Another way of using functions is by directly accessing them via the predefined Function Key Groups. Tap the Key Group icon, to the right of the Answer field, and see a screen similar to the one to the right. Tap Trig/Sci to select scientific functions. This will set the Function Keys to their scientific assignments. Tapping these any of these keys will insert that specific function into the expression field.

This screen shows the default Key Group names. Key Groups UserKeys1 - Subroutine2 can be renamed to anything you require. The last four, Trig/Sci, Misc/Hypr, TVM, and Base1/Base2 are pre-defined, APCalc functions and cannot be changed.

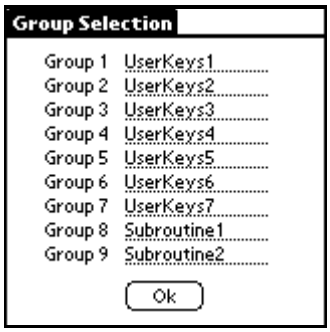


### Changing Key Group Names

As you add programs, you will want to change the User Key Group names per your configuration. These names are the names that are displayed in the group list, when you tap the key group icon, on the main calculator screen.

To edit, select Edit→Edit Key Groups from the APCalc menu. You can then replace any default name to something more appropriate to your program groups.

Programs are divided into groups of 12 programs. Group 1 is applies to programs 1 through 12, Group 2 applies to programs 13 through 24, an so on.




## Creating/Editing APCalc Programs

Creating a program is just an extension of the basic operation of APCalc. A program is simply a sequence of basic APCalc calculator expressions that have been saved, as a program. Programs can be created within APCalc, using QEd (quick edit) or they can be written in MemoPad and imported (discussed later) into APCalc.

In addition to basic expression evaluation, programs can initialize variables, prompt for user input, jump to other locations within a program, call other programs and display results.

Creation of programs consists of a few simple steps.

Creating or Editing a program involves the same process. The only difference is that creating a new program opens the QEd screen with a blank instruction list.

Tap the QEd button to open the instruction list screen, shown at right, for the new or currently loaded program. An example is shown at right.


Check Edit, then tap instruction to open edit instruction screen, for that instruction.
Check Delete, then tap an instruction to delete the tapped instruction.
Check Insert, then tap instruction to insert instruction, in front of tapped instruction.
Tap the Ok button to end the editing session and return to the calculator screen.

Once in the Instruction Edit screen, you can use the function list, the keypad or the Palm keyboard to edit instructions. When the current expression is complete you may either tap Done, to return to the Instruction List screen, or you may tap one of the other buttons. Tapping Undo, restores the instruction to its original state.


To insert another new instruction, after the current instruction, check "Insert after instruction" before tapping Ins (insert). To insert before the current instruction, leave that box unchecked and tap Ins.

Next, Prev will display the next or previous instruction, if it exists.

## Saving APCalc Programs

After you have created your program, don't forget to save the program. At this point, the program is just in program space. If this is a new program, you must use SaveAs. If this is a 'loaded' program (via Load or after executing a

program), you can use Save to change, or SaveAs to save under a different name. If you don't perform a Save or Save As, the program will be lost when you exit APCalc or execute a different program.

All of the first 108 user generated programs are automatically assigned to the User1 through User 9, upon initial creation.

Changing the order of functions on keys requires moving the program location. See the "Import/Export to and from MemoPad" section for instructions in moving programs.

## Example Programs

### Example 1: Compute the area and circumference of a circle

Here is an example of a program that computes the area (A=pi*radius^2) and circumference (2*pi*radius) of a circle and prompts for circle radius. It will also pause and display a label before proceeding with the circumference calculation.

```
radius=
pi*radius^2
wait("Area =")
2*pi*radius
disp("Circumference =")
```

### Example 2: Convert between Fahrenheit and Centigrade

Example of a program to convert between Fahrenheit and Centigrade. This example uses the iff(expr, "label") function. Comments (//) are not entered into program. This program will display a popup that offers a choice of F to C or C to F. Select 1 to convert from F to C or 2 to convert from C to F.

```
:Temp Convert
F=                      // clears F; forces prompt of F
C=                      // clears C; forces prompt of C
in("1) FtoC  2) CtoF")  // prompts for choice
sto(1)                  // saves choice
iff(rcl(1)>1,"CtoF")    // tests for choice = 2
(F-32)*5/9              // executed if choice was 1
wait("C = ")            // displays C = label
jmp("done")             // Jump to done
:CtoF
9/5*C+32                // calculates F
wait("F = ")            // displays F = label
:done                   // done (comment)
```

### Example 3: Single-line programs

The User Keys have two modes. For multi-line programs, the program is **loaded and executed** as soon as the User Key is tapped. For single-line programs, the **= key must be pressed** before the expression is executed. This second mode is to allow you to store constants, or single line expressions for inclusion in other expressions. Any single line expression can be executed immediately simply by adding a comment line as the first line, thereby, making it a multi-line program.

To assign a User Key to perform a sin( ) function exactly like the sin( ) on the Trig/Sci group, you would create a single line program like:

```
sin()
```

as the only instruction. Assign it a name of, say, sin. 'sin' would then be assigned the next available User Key. When that key is tapped, sin() will be inserted at the insertion point in the expression. APCalc= would be required to evaluate the expression.

**Note: Because of limited number of programs and Function Keys, single-line behavior is not available in unregistered versions. Single-line programs behave just like multiple line programs, in unregistered versions.**

## Example 4: Multiple-line programs

To assign a User Key to perform a clv(1) function, and execute immediately by tapping the User Key, you could create a multi-line program like:

```
:begin
clv(1)
```

as the program. Assign it a name of, say, clv. 'clv' would then be assigned the next available User Key. When that key is tapped, clv program would be executed immediately.

## Example 5: Subroutine / Jump Examples

The four programs below illustrate the use of call("prog") function as well as one use of the ask("prompt") function. Also you will see an example of out("prompt", expr). Program 1 (PG1) calls program 2 (Sub2) to initialize two variables, then the program returns to program 1 to calculate x+y. Following that calculation, program calls program 3 (Sub3) to calculate x*y. Program 3 then calls program 4 to calculate x*y/x+y. Finally the programs return back through 3 to program 1. ##Names are not part of the programs, while in APCalc.

```
##PG1
:PG1
45*25
call("Sub2")
x+y
out("PG1: x+y=", x+y)
ask("Continue")
call("Sub3")
x*100+y
disp("PG1 End: x*100+y=")
```

```
##Sub2
:Sub2
x=45
y=25
disp("Sub2 (init): x=45, y=25")
ask("Continue")
```

```
##Sub3
:Sub3
out("Sub3: x*y=", x*y)
ask("Tap any key")
ans=Ans
call("Sub4")
ans
```

```
##Sub4
:Sub4
out("Sub4: (x*y)/(x+y)=",(x*y)/(x+y))
ans=Ans
ask("Exit")
ans
```

It is important to note that call() does not return a value that is the result of the called program. What call() returns is the last calculated value at the time of the call. So, for the PG1 example above, if 3rd instruction was `result=call("Sub2")`, the value of `result` would be 1125 (the result of 45*25). If an instruction like,

`result=Ans` were inserted right after the call(), the value of `result` would be zero, since that is the last calculated value, as a result of Sub2.

Call Variation
There is a variation of the call("program") that can be used in conjunction with the ask("") function. This function is callif(index, "prog0", "prog1", "prog2", "prog3", "prog4"). This variation uses an initial parameter index to select which program will be called. The index is zero based. If index is 2, then "prog2" will be called, and so forth. If callif() is called with a missing index parameter, it will execute exactly as call() but will use "prog0" name. Any program names may be used for program parameters.

Example (pick list to select running Sub 2 or Sub 3 above):

```
:callif test
a=ask("Run Sub2", "Run Sub3")
callif(a, "Sub2", "Sub3")
```

Jump Variation
There is also a similar variation to the jmp("program") function. The function jmpif(index, "label0", "label1", "label2", "label3", "label4") greatly simplifies branching using the ask() function or other ways that depend on an index.

## Executing APCalc Programs

To execute a program it must be loaded into the APCalc Program Area. This can include a program that is new and not yet saved, but more likely it is a program that is loaded using: Menu→Program→Load/Import or one that is in memory as the result of tapping a User Function Key.

Once a program is loaded into the program space, it can be executed, using R/S. A program is automatically executed (assuming it is a multi-line program), as soon as a Function Key is tapped.

That's about all there is to creating and running a program.

## APCalc Editing Tips

Graffiti Strokes:
APCalc uses graffiti strokes just like any other application. There are, however, a few strokes that are very useful to APCalc. These include:

| | |
|---|---|
| Move cursor one char right | right-left-right |
| Move cursor one char left | left-right-right |
| Delete last entry (char) | left stroke |
| APCalc= key | upper-right to lower-left |
| Select All | /S, selects the entire expression |
| Copy (with nothing selected) | Copies `Ans` to the clipboard. |

Tap Selecting Text:
I have added the ability to select within matching parenthesis. This is a multi-tap selection.

| | |
|---|---|
| Tap once: | Sets the insertion point |
| Tap twice: | Selects a word or number |
| Tap again: | Selects all text within matching parenthesis |
| And so on…. | |

If there are no matching parenthesis, all remaining text is selected.

This feature works on expression field on calculator, Full Screen Program Edit mode, and Instruction Edit Mode (QEd).

## APCalc Programming Tips

1) One of the first things I do is create dummy programs for all 108 locations. The dummy programs are nothing more than a comment. That way, I can just select the program I want to edit and avoid having to move programs around.

2) Using `var=`, at the beginning of a program, will clear the variable and force its prompting, if that variable appears later in the program. If it used at the end of a program, it will remove the variable from the variable popup list. You can use this to remove internal variables from the popup list.

3) Using `var?,` prompts immediately for a variable input. This does not delete the variable first. The result is that if the variable already exists, its place in the variable popup list, will not change. If it does not exist, one will be created and placed at the top of the list. Use this to control the order of prompting of variables in a program or equation. var? can also be used within an expression (i.e. z =x?+y?)

4) The purpose of expr(1) is to grab a pending expression from the input field. There are two cases where you may wish to do this. You can use this to have a program be dual function (store a value, calculate a result).

   a) Case1 (to grab input at beginning of program): The expr(1) function should be the first instruction. If it is not the first instruction, the Prefs→Display Instructions set to YES, can change the input and you will get an undesired result.

   b) Case2 (to grab input in the middle of a program): The expr(1) instruction must be preceded with a wait("prompt").

   Note: If you intend to grab pending data, you must include this function as the first instruction. You should also always use iff(pflag, “label”) to test for the existence of pending data.

5) Use something like x=Ans, as the first instruction in a program, to have one program continue with (and save) a calculation from a different program. You can have programs who’s input is dependent on the result (output) of another program.

6) Other examples can be found at http://www.halcyon.com/ipscone/apcalc/ Just navigate to Documentation→Program→Examples.

## Base Conversions

APCalc offers flexibility in the way you can handle base conversions and fixed point math. There are two distinct ways to handle base conversions and fixed point math and operations.

You can perform all fixed point operations and conversions using the Base Conversion Function Keys. This mode provides you with the greatest precision. You have the use of the full 64 bit fixed point number system.

You may also mix fixed point calculations and floating point operations using a special notation discussed below. Using this mode, you are limited to fixed point numbers less than 1e53-1. All fixed point numbers are unsigned 64 bit numbers.

Number bases from 2 to 36 can be handled by APCalc. Numbers larger than base 16 use alphabetic letters g-z. All base numbers are displayed using this character set. 0123456789ABCDEFghijklmnopqrstuvwxyz

"**F**" just below the history popup trigger, indicates that you are still in some Fixed Point Base other than 10.

### Base Conversion Key Group Definitions

**Base 1**


**A-F** Hex characters used to input Hex numbers, for numbers 10 to 15.

**F10** **FromBase** Key: Sets the input mode. Enter a number between 2 and 36 and tap the F10 key (FromBase) key. It will rename itself to denote the current From Base setting.

**T10** **ToBase** key: Sets the output (Ans) mode. Enter a number between 2 and 36 and tap the F16 (ToBase) key. It will rename itself to denote the To current base Setting.

**:** This is a special operator, used in floating point mode, to provide limited base conversion capability in floating point mode. Use it to enter numbers in a particular base like: 10:255, 16:3FF, 2:10110, etc. In floating point mode, that is when you use APCalc= to evaluate an expression, all expressions contain functions, constants and decimal input. You cannot input numbers in Hex, for instance, without using this operator.

**CVT** Converts a number, in proper format, according to FromBase setting to a result displayed in the ToBase format. Enter a number in the proper format and tap CVT to convert it.

**→** Switch to other base Function Key Group.


**B+** Adds 'expr' to the last displayed value. 'expr' is in the FromBase format selected with the FromBase key.

**B-** Subtracts 'expr' to the last displayed value. 'expr' is in the FromBase format selected with the FromBase key.

**B*** Multiplies 'expr' to the last displayed value. 'expr' is in the FromBase format selected with the FromBase key.

**B/** Divides the last displayed value by 'expr'. 'expr' is in the FromBase format selected with the FromBase key.

<< Shifts the last displayed value, left, by n bits. Enter 'n' then tap the << key to shift left n bits.

>> Shifts the last displayed value, right, by n bits. Enter 'n' then tap the >> key to shift right n bits.

**and** Performs a bitwise 'and' operation of the last input value and the 'expr' displayed in the input field.

**or** Performs a bitwise 'or' operation of the last input value and the 'expr' displayed in the input field.

**xor** Performs a bitwise 'xor' operation of the last input value and the 'expr' displayed in the input field.

**not** Negates the last displayed value. Does not require an input value. Just tap to negate last Ans.

## Fixed Point Calculations/Conversions

All conversions and fixed point math are performed using a FromBase value and a ToBase value. Before a conversion can take place, you should enter the correct FromBase and ToBase, using the Fxx (temporary name) and the Txx (temporary name) keys. The FromBase (Fxx) and ToBase (Txx) are reset to F10 and T10 each time APCalc is started.

**Example 6: To convert 3FF from HEX to DEC, you would enter the following:**

```
1) 16       // base 16
2) Tap F10  // key is renamed to F16 (FromBase)
3) 10       // base 10
4) Tap T10  // key is renamed to T10 (ToBase)
5) 3FF
6) Tap CVT  // Convert - see results (1023) displayed
```

To continue and convert 3DACE from HEX to DEC, just:

```
1) 3DACE
2) Tap CVT  // no need to reenter FromBase and ToBase values.
```

To then see what this value might be in BINARY, just change the ToBase value:

```
1) 2
2) Tap ToBase key // ToBase key is renamed to T2
```

To return to base 10 output:

```
1) 10
2) Tap ToBase key // to return to DEC output display
```

To then see what this value might be when 3FF added to it:

```
1) 3FF
2) Tap the --> key      // switch button groups
3) Tap the B+ key // result of expr + previous value
```

NOTE: B+, B-, and, <<, etc expect the input data in the FromBase format. (i.e. FF would not be an acceptable input if the FromBase was F10).

To then shift the results left by two bits:

```
1) 2  // shift left 2 bits
2) Tap the <<     // results displayed in Ans field
```

'and', 'or', 'xor' operate in a similar manor. The 'not' functions does not require an input. Just tap the 'not' key to calculate the inverse of the displayed value.

Note: All of these operations expect the input expression in the correct format as determined by the FromBase and ToBase input, using the FromBase and ToBase keys.

## Mixed Fixed Point and Floating Point operations using the ':' operator and the Equal key:

This mode allows limited use fixed point numbers, in various bases, to be intermixed in the basic floating point calculator mode. **In this mode ONLY the ToBase format is used.** You can use this mode to calculate a mix of base values and display the results in another base. The syntax for this operator is:

`base:number` where base is a number between 2 and 36 and number is the number in that base, in the proper format.

**Example 7: Using base operator ':'**

```
1) 10:255         // 255 as a base 10 number (DEC)
2) 16:3FF         // HEX number 3FF
3) 16:255         // HEX number 255
4) 2:101010       // BINARY number 101010
5) 27:g3F2        // g3F2 in base 27 (whatever that is good for)
```

You can mix and match these numbers and evaluate expressions using this notation.

**Example 8: Mixing bases; 118(DEC) + 3FF (HEX) + 101010 (BINARY) and display as a HEX**

```
1) 16
2) Tap ToBase key       // F16 in legend, sets output to HEX
3) 10:118+16:3FF+2:101010
4) APCalc=
```

This may seem awkward at first but I think you will find this very useful and provides a great deal of flexibility when dealing with math operations on mixed, fixed point numbers.

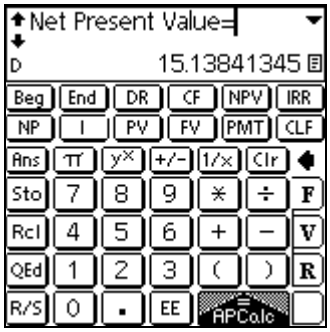
Note: If you type FE3 (what you think is a HEX number) and tap **APCalc=**, APCalc will think this is a variable. You must use the ':' operator if you wish to use the basic calculator with fixed point numbers.

This mode is limited to Fixed Point Numbers < 1e53-1. That is the highest fixed point number that can be accurately represented by the floating point format used my the palm.

## Financial Programs

The example demonstrates the use of the built-in Time Value of Money (TVM) functions

### Financial Key Group Definition




| | |
|---|---|
| Beg | tap if payment is at the beginning of the month. |
| End | tap if payment is at the end of the month |
| DR | Discount Rate (used with Net Present Value functions) |
| CF | Cash Flow input (used with Net Present Value functions) |
| NPV | Net Present Value (calculates NPV given CF inputs) |
| IRR | Internal Rate of Return (calculates IRR given CF inputs) |
| NP | enter or calculate the total number of payments to be made |
| IR | enter or calculate the periodic interest rate (i.e. 7.5 is entered as 7.5/12 if the period is monthly) |
| PV | enter or calculate the present value of a loan |
| FV | enter or calculate the future value of a loan |
| PMT | enter or calculate the periodic payment of a loan. Payments are negative while cash received is positive. |
| CLF | Clears financial parameters. |

To use these programs, make sure RVARS is UNCHECKED.

Assume a 150,000 loan at 6% for 30 years and you wish to know the monthly payments, with payments made at the beginning of the month. What is the monthly payment?

| | | |
|---|---|---|
| Number of payments | 360 | enter 360 and tap 'NP' |
| Yearly Interest | 6.5% | enter 6.5/12 and tap 'IR' |
| Present Value | 150,000 | enter 150000 and tap 'PV' |
| Future Value | 0 | enter 0 and tap 'FV' |
| Pmt at beginning of mo. | | tap 'Beg' |
| Payment | ? | tap 'PMT' to calculate –942.99 |

The result will show payments of –942.99. Remember payments to you are positive and payments from you are negative. So, when entering 'PV' and 'FV' the values are positive and your monthly payment is negative.

To see what the payment would be, if the interest was 6% instead of 6.5%, just enter 6/12 and tap 'IR' followed by tapping 'PMT' and see that the new payment is, -894.85.

If the payment was at the end of the month, just tap 'End' followed by 'PMT' and see, -899.33.

### Example 9: TVM programs (NP, IR, PV, FV, PMT, BEG, END)

While the TVM programs are built into APCalc, the following examples show how APCalc can be used to create specialized programs to perform just about any task you have. The example below, was developed to fit on one Key Group but you can assign the programs to any keys you like. These example programs require APCalc version 1.98f or above.

The following programs can be entered into APCalc to provide baseline TVM calculations that can be modified to add additional financial enhancements.

```
##Beg       // name not part of program
:beg
pt=1
```

```
##End       // name not part of program
:end
pt=0

##NP        // name not part of program
np=expr(1)
iff(pflag,"done")
np=np(ir,pmt,fv,pv,pt)
:done
disp("Number of pmts=")


##IR        // name not part of program
p=expr(1)
iff(pflag,"in")
disp("wait...")
ir=ir(np,ir,pv,fv,pmt,pt)
jmp("done")
:in
ir=p
:done
disp("Interest Rate (per period)")


##PV        // name not part of program
pv=expr(1)
iff(pflag,"done")
pv=pv(np,ir,pmt,fv,pt)
:done
disp("PV=")


##FV        // name not part of program
fv=expr(1)
iff(pflag,"done")
fv=fv(np,ir,pmt,pv,pt)
:done
disp("FV=")

##PMT       // name not part of program
pmt=expr(1)
iff(pflag,"done")
pmt=pmt(np,ir,fv,pv,pt)
:done
disp("Payment=")
```

## NPV Calculations

Both NPV and IRR calculations require inputting Cash Flow data. This cash flow data is loaded into APCalc registers, beginning with Register 1 and continuing until all cash flows are entered, up to 98 values. Begin all NPV and IRR calculations by clearing the financial registers (CLF). Note: this does not clear the registers but only the financial parameters, pv, ir, ect.

**Register locations:**

| | |
|---|---|
| Register 1: | Initial investment (usually a negative number, since cash if flowing away from you). |
| Register 2: | First cash flow input |
| Register 3: | Second cash flow input |
| Register N: | Nth cash flow input |
| Register N+1: | Net Present Value (also displayed in the APCalc Ans field. |

To look at an Investments. Using a 10% cost of capital (discount rate, DR) , the present values of inflows you would begin this calculation by clearing the financial registers with CLF. Then input the discount rate of 10% by entering 10 followed by tapping the DR key. Then input each of these inflows below, followed by the CF key.

**Investment**

| **Year** | **End of year cash flow** | **Value at end of year** |
|---|---|---|
| 2000 | -1,000,000 | -1,000,000 |
| 2001 | 400,000 | 363,636 |
| 2002 | 400,000 | 330,569 |
| 2003 | 400,000 | 300,526 |
| 2004 | 400,000 | 273,206 |
| 2005 | 400,000 | 248,369 |

Now that these values are entered, tap the NPV key to compute the Net Present Value. You want to see a positive for good investments. Larger, in general, is better than smaller NPV.

| | |
|---|---|
| NPV | 516,315 |

### IRR Calculations

To determine the Internal Rate of Return, simply tap the IRR key. This calcualtion uses an iteration process of 20 loops and produces an approximate result that should be good enough for any use but does not return the precise exact IRR. It would be too slow, if I processed it to conclusion and would add no value, in doing so.

## Statistical Functions

The statistical key group provides functions including standard deviations and linear regression as well as correlation coefficients. This section will show how to use the key group to provide this capability. APCalc statistical group can handle 1 and 2 variable statistics.

Keys:

| | |
|---|---|
| Init | Sets 1 or 2 variable statistics. Select 1 for 1 variable statistics and 2 for 2 variable statistics. You may or may not want to clear data. |
| x,y+ | Adds each data point to the set OR displays sum of x values. |
| x,y- | Removes data point(s) from set OR displays sum of y values. |
| n! | Computes n factorial |
| Regs | Display the statistical registers |
| n | Displays the total number of data points |
| avg | Displays the avg of x and y |
| SD-S | Computes the standard deviation of x and y, using the Sample method |
| SD-P | Computes the standard deviation of x and y, using the Population method |
| L.R. | Computes the linear regression of a set of data. Computes the slope and intercept of the best matching line. |
| y,r | Computes the estimate of y given x as an input. Also, displays the correlation coefficient for the point. |

Example 1: Compute the standard deviation of a given set of numbers using single variable statistics.
Begin by initializing the statistic functions. For 1 variable statistics, enter 1 and tap Init.

Data set: x= 5.5, 6.9, 10.3, 15.6, 21.2

Enter each of these values followed by tapping the x,y+ key to enter each piece of data. When all of the data is entered, you can compute:

SumX = 59.5 by tapping x,y+
avg(x) = 11.9 by tapping the avg button
SD-S = 6.49422821 by tapping the SD-S button
SD-P = 5.80861429 by tapping the SD-P button

Example 2:
Given data set:
x = 5.5, 6.9, 10.3, 15.6, 21.2
y = 7.8, 8.2, 10.2, 18.7, 20.3

Begin by initializing the statistical group to handle 2 variable statistics. Enter each x followed by tapping x,y+. The y value is entered at the popup. When finished entering all data you can compute:

SumX = 59.5 by tapping x,y+
SymY = 65.2 by tapping x,y-
avg(x) = 11.9 by tapping avg, avg(y) = 13.04 by tapping the popup pause indicator
SD-S for x = 6.49422821 by tapping SD-S, and SD-S for y = 5.99357990 by tapping the S.D.(y) popup
SD-P for x = 5.80861429 by tapping SD-P, and SD-P for y = 5.36082083 by tapping the S.D.(y) popup
Slope of closest matching line = .89353883 by tapping the L.R. button,
Intercept (B) = 2.40688797 by tapping the popup

To estimate y given an x, enter the x value followed by y,r. Tap the popup to get the correlation coefficient.

To display all of the statistical registers, tap the Regs key.

## Import/Export to and from MemoPad

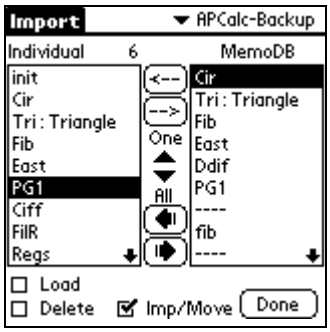
Beginning with version 2.0, APCalc includes Import/Export functionality. This has been combined with the Open/Delete (now called Load/Inport) screens. This provides backup of APCalc programs to MemoPad. Programs can be transferred to/from and edited on PC desktop computer, using any software that will allow creation of MemoPad files. These programs can be imported into APCalc. This capability also allows programs to be directly created within MemoPad and imported into APCalc.

The Import/Export screen is accessed via the Menu in APCalc. Select Menu→Import/Export to bring up the import/export screen. When the import/export screen is displayed you will see two lists. The list on the left contains all the programs in APCalc database. The list on the right is titled MemoDB and displays up to 108 programs in the selected category.

Note1: When the import screen opens, it will open with the first key of the current key group selected. This makes it easy to install individual programs. Just select the Key Group to which a program will be added and when you open Import that key group is displayed in the left list.

**Note2: If you have MemoPad records marked as <u>private</u>, they will not show up in the import side of the screen.**

To Import a single program, check Imp/Move checkbox, select category, tap the MemoDB file to import, tap the group/button destination, then tap the ← button to import a single program.




To Import All within a category, select the category, tap the start group/button destination, then tap the BOLD ← button, to import (Restore) the entire category.

To Export a single program, select Category, tap the Group and Button to export, then tap →. Program is appended to the current category.

To Export All, select Category, tap the BOLD → button, to append all to current category. Use Export All, to back up your current configuration.

To Delete a program from the APCalc database, check the Delete checkbox, then tap the program name in the left program box. To Delete a program from MemoPad database, check the Delete checkbox, then tap the MemoDB list on the right.

To Delete All APCalc or MemoPad programs use the Menu→Clear All Programs or Menu→Clear All Import

If you wish to move any program to a different Function Key, check Imp/Move and use the up/down arrows in the center of the screen. This is suitable for short moves. If you have to move, say, from Conversion Group 1 to Conversion Group 7, you might find it easier to export to MemoPad and then import directly to the desired button.

Loading a program, for editing, can be accomplished by checking Load and tapping the desired program. This will pop you out of the Import screen and back to the calculator screen. You may then tap QEd to edit the program or R/S to execute the program.

Import/Export allows use of MemoPad categories so that backup can be performed to any category that you like. You can even edit, add, delete and rename any of the categories and they will be saved to the MemoPad database.

Any number of programs may be saved to each category, **But only 108 are displayed in a particular category**. You can backup to a single (or multiple) categories.

Buttons are numbered from 1 to 6 on top row and 7-12 on 2nd row. Group numbers consist of 1 to 9 (currently).

**Note: This capability (import/export) is only available to registered users.**

## Editing APCalc programs in MemoPad

Programs may be edited on a PC, using any software that will allow files to be saved to MemoPad, and transferred to the Palm using Desktop.

There is a format that you must follow to allow programs to be transferred from MemoPad to APCalc. There is no format required for programs edited within APCalc.

The first line of a program, edited in MemoPad or on the PC, must begin with two number symbols (#) then the program name, like:

##program name
instruction 1
instruction 2
instruction 3

**NOTE: When editing within MemoPad, let MemoPad wrap long lines. Do not use newline until you are ready to begin a new instruction. Just let MemoPad warp the long line for you.**

Sample program created in MemoPad or on a PC should look like this:

```
##Sine
:computes sine of expr
x=expr(1)
sin(x)
```

This program will calculate the sine of any number entered into expression when the program is executed.

In APCalc the same program would look like this:

```
:computes sine of expr
x=expr(1)
sin(x)
```

The Function Key Button would be named ‘Sine’.

## Specifications

| | |
|---|---|
| Floating Point | 64 bit |
| Display Resolution | 16 digits |
| Memory Req. | 78k, plus space for saved programs |
| Functions | 85 (58 APCalc, 27 MathLib) minimum; others to be added |
| Program Steps | 64 steps |
| Expression Length | 64 chars, 3 lines, Zoom Font |
| Storage Registers | 100 |
| Variables | 20 total |
| History Buffer | 32 expressions |
| User Keys | 108, First 12 programs available on User 1 Function Keys<br>Second group of 12 programs are on User 2 Function Keys<br>Third group of 12 programs are on User 3 Function Keys<br>Forth group of 12 programs are on User 4 Function Keys<br>Fifth group of 12 programs are on User 5 Function Keys<br>Etc.<br>(All the Function Key Groups can be renamed) |

## Limitations (Unregistered Users)

| | |
|---|---|
| Programs | 3 |
| Program steps | 6 |
| User Function Keys | 3 |
| Cannot Save New programs | |

## Registration


In order to have full use of all features of APCalc, registration is necessary. You can register by following the instructions on the registration screen. You access registration screen with: Menu→Info→How To Register

If you have registered APCalc, you should enter the Key that you received with your confirmation, into the Key field, and tap Register. User field and Reg. Code fields cannot be changed. Once the key has been recognized as valid, you will see the "Unregistered", at the top of the screen, change to "Registered" and a popup screen that says "Thank You". You will not be able to enter the key again, once you have successfully registered. Successful registration will remove this screen from being displayed each time APCalc is started.

Alternatively, you can tap Test Drive, without entering a Key, to use APCalc, in its demonstration mode, subject to the limitations of the demo version of APCalc Demo mode limits the size and number of programs as well as the number of Function Keys. If you have already registered, use Test Drive to exit the screen.

You may register at:

PalmGearHQ
http://www.palmgear.com/

or

Handango (formerly GoPDA, formerly PalmCentral)
http://www.handango.com

## Appendix A - License

The author of this software grants to the Licensee a non-exclusive, non-transferable, license to use this product in accordance with this agreement. This software is supplied "as it", without warranty of any kind. The author assumes no liability for any damages incurred by its use.

The license policy is very simple. You are entitled to use the Demo version in the manner intended. That is, you are not entitled to use the extended features without registering the application. Registering the application gives you the right to use all features of the application, on one device. The use of the demo is limited to a reasonable time (15 days) to evaluate the program.  After that time, you must register APCalc to continue with its use.

The following applies to all versions of this software: You may not reverse engineer, decompile, disassemble, modify, distribute, sell, give away, or post, this software, on any web site without written permission, of the author.

You may not use this software unless you agree to these terms. Using this software implies agreement with these terms.

## Appendix B - Functions & Operators

Parameters used in the following functions use the following notation. dblReference, intReference and strReference. The prefixes 'dbl', 'int' and 'str' represent double, integer and string types. The 'Reference' part of the parameter is a descriptive label for the type of input parameter expected (i.e. dblAngle means an Angle, using type double, is expected as an input). String types must be surrounded by double quotes.

**acos(dblValue)** Return type: double

Returns the arc cosine, of dblValue, as a floating point value. The return value is the angle expressed in either degrees or radians, depending on the Trig Mode selected.

**acosh(dblValue)** Return type: double

Returns the hyperbolic arc cosine, of dblValue, as a floating point value. The return value is the angle expressed in either degrees or radians, depending on the Trig Mode selected.

**and(intVal1, intVal2)** Return type: integer

Returns the binary anding of intVal1 and intVal2. intVal1 and intVal2 are integer values. If you use floating point numbers, they will be truncated to the integer part of the value. Valid integers must be less than 2^52-1.

**asin(dblValue)** Return type: double

Returns the arc sine, of dblValue, as a floating point value. The return value is the angle expressed in either degrees or radians, depending on the Trig Mode selected.

**asinh(dblValue)** Return type: double

Returns the hyperbolic arc sine, of dblValue, as a floating point value. The return value is the angle expressed in either degrees or radians, depending on the Trig Mode selected.

**ask("strChoice0", "strChoice1", "strChoice2", "strChoice3", "strChoice4")** Return type: integer

Displays a popup of list choices. Returns an integer value (0 - 5), depending on the selection made. A maximum of 5 parameters (choices) may be used. You may use less than 5 choices.

**atan2(dblY, dblX)** Return type: double

Returns the arc tangent, of dblY/dblX, as a floating point value. The return value is the angle expressed in either degrees or radians, depending on the Trig Mode selected.

**atan(dblValue)** Return type: double

Returns the arc tangent, of dblValue, as a floating point value. The return value is the angle expressed in either degrees or radians, depending on the Trig Mode selected.

**atanh(dblValue)** Return type: double

Returns the hyperbolic arc tangent, of dblValue, as a floating point value. The return value is the angle expressed in either degrees or radians, depending on the Trig Mode selected.

**avg(intFromReg, intToReg)** Return type: double

Returns the mean of all values from intFromReg and intToReg (inclusive). intFromReg and intToReg can be any values between 0 and 99. intToReg must be larger than intFromReg for this function to give correct results.

**base(intBase)** Return type: integer

Converts the last calculated value (Ans) to a new value and displays it, as intBase. intBase can be any integer between 2 and 36 inclusive.

**beep(intFreq, intDur, intVol)** Return type: double

Plays a sound of varying frequencies, duration and volume. intFreq is specified as hertz, intDur is specified in mili-seconds and intVol is an integer from 0 to 64. 0 is no sound. Returns Last Calculated Value (Ans).

**BtB(intFromBase, intToBase)** Return type: integer

Convert the number in the expression field, in intFromBase format (i.e. if intFromBase is 10, then expression cannot contain non decimal values), to a number represented in intToBase. intFromBase and intToBase can be any integers between 2 and 36 inclusive. Note: Because this works on the expression field, it cannot be used outside of a program.

**call("strProgram")** Return type: double

Executes a program call to strProgram. Up to 5 programs can be called before a rtn(1) or end of program (i.e. call stack is 5). Use of rtn(1) is optional. rtn(1) can be used to execute a program before the end of the program. This function returns the value of the last calculated value (Ans), at the time of the call instruction. It does not return a value as the result of the called program.

**callif(intIndex, "strProg0", "strProg1", "strProg2", "strProg3", "strProg4")** Return type: double

Executes a program based on an index. If index is 0, then strPgm0 is executed. Index is zero based. Parameters are optional except that at least one program must be specified. If index is blank or missing, callif() executes the same as call and uses strPgm0.

**cbrt(dblValue)** Return type: double

Calculates the cube root of dblValue and returns it as a double.

**ceil(dblValue)** Return type: integer

Computes the smallest integral value not less than dblValue.

**clh(1)** Return type: double

Clear history buffer. Dummy parameter (1) required. Returns 'Ans'.

**cls(1)** Return type: double

Clears the input expression field. Returns 'Ans'.

**clv(1)** Return type: double

Deletes all variables. Dummy parameter (1) required. Returns 'Ans'.

**comp(intVal1, intVal2)** Return type: integer

Compares two values. if intVal1 is larger than intVal2, a value of 1 is returned. If intVal2 is larger that intVal1, a value of -1 is returned. If the two values are equal, a 0 is returned. intVal1 and intVal2 are integer values. If you use floating point numbers, they will be truncated to the integer part of the value. Valid integers must be less than 2^52-1.

**cos(dblAngle)** Return type: double

Returns the cosine, of dblAngle, as a floating point value. The dblAngle specified is in degrees or radians depending on the current Trig Mode.

**cosh(dblAngle)** Return type: double

Returns the hyperbolic cosine, of dblAngle, as a floating point value. The dblAngle specified is in degrees or radians depending on the current Trig Mode.

**di(intValue)** Return type: double

Set Display Instructions preference, 0 = don't display instructions, 1 = display instructions, 0 and 1 return the last calculated value returns current setting, -1 returns the current setting.

**disp("strLabel")** Return type: double

Display a strLabel to the expression field. Returns the last calculated value (Ans).

**dm(intValue)** Return type: double

Set Display Mode preference, 0 = Fixed, 1 = Scientific, 2=Engineering. 0 and 1 return the last calculated value, -1 = returns the current setting

**dp(intValue)** Return type: double

Set Display Mode preference, 0 - 8 as an input, sets the number of decimal places. 0 to 8 return the last calculated value, -1 returns the current decimal point preference.

**exp(dblValue)** Return type: double

Calculates exponential of x ($e^x$ ).

**expr(1)** Return type: double

Returns the numeric value of the expression in the input field. Use this as the first instruction to grab pending data. Us in the middle of a program, after a wait("prompt") to return the value of a newly input value or expression. You should use iff(pflag, "label") to test for the existence of pending data, before using it.

See pend(1)

**fabs(dblValue)** Return type: double

Return the absolute value of dblValue.

**fact(intValue)** Return type: integer

Calculates the factorial (dblValue!) of intValue.

**fill(intFromReg, intToReg, dblValue)** Return type: double

Fills registers, starting with intFromReg and continuing to intToReg (inclusive) with the value dblValue. fill(0,99,0) would clear all registers. intToReg must be larger than intFromReg.

**fk(intValue)** Return type: double

Set Function Key Mode preference, 0 - 13 as an input, and displays the current function key set. 0 to 13 return the last calculated value, -1 returns the current function key preference.

**floor(dblValue)** Return type: integer

Returns the largest integral value not greater than dblValue.

**fmod(dblValue1, dblValue2)** Return type: double

Computes the modulo remainder of dblValue1 divided by dblValue2.

**frac(dblValue)** Return type: double

Returns the fractional part of a double value.

**fv(intNP, dblIR, dblPMT, dblPV, intPT)** Return type: double

This function performs two functions. If there is new data input, the value is stored internally in the fv variable. If there is no new data pending the function returns the future value, of a time value of money calculation. intNP is entered as the number of periods in the loan. dblIR is the periodic interest rate. dblPMT is the amount of the payment (use - for payment and + for cash received). dblPV is the present value of the loan. intPT is zero for payments at end of the month and 1 for payments at the beginning of the month.

**hypot(dblX, dblY)** Return type: double

Calculates the hypotenuse of right triangle.

**iff(dblExpr, "strLabel")** Return type: integer

Evaluates 'expr' and if TRUE, transfers program execution to strLabel. TRUE is any non-zero result. Zero is FALSE. Expressions can contain comparison operators such as x>3, etc. Returns the Last Calculated Value at the time the instruction is executed.

**iff(dblExpr, expr1, expr2)** Return type: integer

Evaluates 'expr' and if TRUE, returns expr1 else returns expr2. 'expr1' and 'expr2' are both evaluated regardless of which is returned. For example you can use it in this way: iff(expr, x=3, y=4). If expr is TRUE 3 is returned, if expr is FALSE, 4 is returned. In both cases, x and y are assigned their respective values. TRUE is any non-zero result. Zero is FALSE. Expressions can contain comparison operators such as x>3, etc. This function requires 3 parameters.

**in("strPrompt")** Return type: double

Pauses execution, displays an input field and asks for input (quotes required. Returns value input.

**ir(intNP, dblIR, dblPV, dblFV, dblPMT, intPT)** Return type: double

This function performs two functions. If there is new data input, the value is stored internally in the ir variable. If there is no new data pending the function returns the periodic interest rate, of a time value of money calculation. intNP is entered as the number of periods in the loan. dblFV is the future value. dblPMT is the amount of the payment (use - for payment and + for cash received). dblPV is the present value of the loan. intPT is zero for payments at end of the month and 1 for payments at the beginning of the month. dblIR is initial guess use 1.

**jmp("strLabel")** Return type: double

Absolute jump to strLabel. Note: Labels must start with : (ex. :loop1). Returns the last calculated value.

**jmpif(intIndex, "strLbl0", "strLbl1", "strLbl2", "strLbl3", "strLbl4")** Return type: double

Absolute jump to label, depending on the value of index. If index is 0, then program execution transfers to strLbl0. Index is zero based. Parameters are optional. If index is blank or missing, jmpif executes the same as jmp and uses strLbl0. Returns the last calculated value.

**ln(dblValue)** Return type: double

Computes the natural log of a double.

**load("strProg")** Return type: double

Loads (chains) a new program. ‘strProg’ and Program name must match exactly. This function does not return to the calling program. Returns the last calculated value.

**log(dblValue)** Return type: double

Computes log10 of a dblValue.

**loop(intReg, "strLabel")** Return type: double

Program instructions between strLabel and the instruction loop() will be executed until intReg equals zero, at which time program execution continues with the instruction following the loop() instruction. intReg is the index register. Valid values, for intReg, are 0 to 99 inclusive. Load intReg prior to executing loop(), when loop() is executed, the intReg will be automatically decremented. The strLabel instruction must precede the loop() instruction. Returns last calculated value.

**lset(intIndex, "strLabel1", "strLabel2", "strLabel3", "strLabel4", "strLabel5")** Return type: double

This label set function sets a group of five labels that will be displayed in the Registers Popup List. The function will return the Last Calculated Value. The first parameter specifies which label set is being set and the next five parameters are the labels. The first parameter, intIndex can be either 1 or 2. intIndex = 1 sets the first five labels and intIndex = 2 sets the next five labels. Only 10 labels can be set in this version and they will be contiguous. This will be changed in later versions to use a single function. This function in used in conjunction with regs() below. Label names can consist of up to 9 characters.

These labels are an array that will apply to any registers displayed with regs() with the second parameter set to 1. That means if you display registers 20-29 these labels will apply. If you display 40-49 the same labels will apply unless you change these. So you must change labels if you wish a different set for a different set of registers.

**max(intVal1, intVal2)** Return type: double

Returns the maximum of the two values. intVal1 and intVal2 are integer values. If you use floating point numbers, they will be truncated to the integer part of the value. Valid integers must be less than 2^52-1.

**min(intVal1, intVal2)** Return type: double

Returns the minimum of the two values. intVal1 and intVal2 are integer values. If you use floating point numbers, they will be truncated to the integer part of the value. Valid integers must be less than 2^52-1.

**nCr(intN, intR)** Return type: integer

Returns combinations of intN objects taken intR at a time where intN and intR are integers.

**not(intVal1)** Return type: integer

Returns the one's complement of intVal1. intVal is an integer value. If you use floating point numbers, they will be truncated to the integer part of the value. Valid integers must be less than 2^52-1.

**np(dblIR, dblPMT, dblFV, dblPV, intlPT)** Return type: double

This function performs two functions. If there is new data input, the value is stored internally in the np variable. If there is no new data pending the function returns the number of payment periods, of a time value of money calculation. intIR is entered as the periodic interest rate of the loan. dblFV is the future value. dblPMT is the amount of the payment (use - for payment and + for cash received). dblPV is the present value of the loan. intPT is zero for payments at end of the month and 1 for payments at the beginning of the month.

**nPr(intN, intR)** Return type: integer

Returns permutations of intN objects taken intR at a time. Where intN and intR are integer. Order matters.

**or(intVal1, intVal2)** Return type: integer

Returns the binary oring of intVal1 and intVal2. intVal1 and intVal2 are integer values. If you use floating point numbers, they will be truncated to the integer part of the value. Valid integers must be less than 2^52-1.

**out("strLabel", dblExpr)** Return type: double

Display a strLabel, in the expr field and a value in the answer field. Similar to disp except that it displays label and value, even when the display instructions' is set to no, in preferences. dblExpr can be any expression that returns a value. Returns dblExpr.

**pend(1)** Return type: integer

Similar to expr(1) except that it returns the pending data at the time the program was first executed, regardless of where it is used within a program.

**pmt(intNP, dblIR, dblFV, dblPV, intPT)** Return type: integer

This function performs two functions. If there is new data input, the value is stored internally in the pmt variable. If there is no new data pending the function returns the payment, of a time value of money calculation. intIR is entered as the periodic interest rate of the loan. dblFV is the future value. dblNP is the number of payments. dblPV is the present value of the loan. intPT is zero for payments at end of the month and 1 for payments at the beginning of the month.

Ex: 'ir' is the periodic interest rate (i.e. 9.9% with payments every month would be 9.9/12, as input for 'ir'). You may input the result of 9.9/12 or the expression itself.

np = total number of payments (i.e.: 360 for a 30 year mortgage)
ir = periodic interest rate (a yearly interest would be entered as xx/12
pv = present value (ie. 70000)
fv = future value (ie. 0)
pmt = monthly payment (use – for a payment to someone else and + for a payment received).
pt = payment at beginning of month=1, end of month=0

**pow(dblX, dblY)** Return type: double

Computes dblX to the dblY power.

**pv(intNP, dblIR, dblPMT, dblFV, intPT)** Return type: integer

This function performs two functions. If there is new data input, the value is stored internally in the pmt variable. If there is no new data pending the function returns the payment, of a time value of money calculation. intIR is entered as the periodic interest rate of the loan. dblFV is the future value. dblNP is the number of payments. dblPMT is the loan payment amount. intPT is zero for payments at end of the month and 1 for payments at the beginning of the month.

**rcl(intReg)** Return type: double

Returns the value stored in register intReg. Valid values for intReg are 0 to 99 inclusive.

**regs(intReg, intShowLabelsFlag)** Return type: double

This function launches a popup list of the storage registers. The first item in the list is intReg. If the intShowLabelsFlag is set to 1, then labels will be used instead of register numbers. if intShowLabelsFlag is set to zero, then register numbers will be used. Within this 10 registers a ---- will be displayed if there are ther is no label and the contents of the register is zero. Labels are setup using set1 and set2 below. Tapping the register number will pop the register into the expression window. Tapping the register contents will select that register. Use lset() to specify the labels.

**rint(dblValue)** Return type: integer

Returns the integral value nearest dblValue in direction of prevailing rounding mode.

**round(dblValue)** Return type: integer

Round x to nearest integral value away from zero.

**rtn(1)** Return type: double

Return function. Optional use. End of a program also returns to calling program or ends a program, depending on whether or not it is a subroutine. Use this to exit from a routine before coming to the end of the routine (early exit).

**rv(intValue)** Return type: integer

Set Reset Variables preference, 0 = don't reset variables, 1 = reset variables, 0 and 1 return the last calculated value returns current setting, -1 returns the current setting. If RVars is checked, all variables will be reset each time the APCalc= key is tapped.

**sin(dblAngle)** Return type: double

Returns the sine, of dblAngle, as a floating point value. The dblAngle specified is in degrees or radians depending on the current Trig Mode.

**sinh(dblAngle)** Return type: double

Returns the hyperbolic sine, of dblAngle, as a floating point value. The dblAngle specified is in degrees or radians depending on the current Trig Mode.

**slb(intVal1, intVal2)** Return type: integer

Shifts intVal1 left by intVal2 bits. intVal1 and intVal2 are integer values. If you use floating point numbers, they will be truncated to the integer part of the value. Valid integers must be less than 2^52-1.

**sqrt(dblValue)** Return type: double

Computes the square root of dblValue.

**srb(intVal1, intVal2)** Return type: integer

Shifts intVal1 right by intVal2 bits. intVal1 and intVal2 are integer values. If you use floating point numbers, they will be truncated to the integer part of the value. Valid integers must be less than 2^52-1.

**ss(intValue)** Return type: integer

Set Single Step preference, 0 = no single-step, 1 = single-step, 0 and 1 return the last calculated value returns current setting, -1 returns the current setting. If single-step is checked, a program will require R/S to be pressed between instructions, to continue execution.

**sto(intReg)** Return type: double

Stores the last calculated value into register intReg. Valid values for intReg are 0 to 99 inclusive.

**sum(intFromReg, intToReg)** Return type: double

Returns the sum of all values from intFromReg to intToReg (inclusive). intFromReg and intToReg can be any values between 0 and 99. intToReg must be larger than intFromReg for this function to give correct results.

**tan(dblAngle)** Return type: double

Returns the tangent, of dblAngle, as a floating point value. The dblAngle specified is in degrees or radians depending on the current Trig Mode.

**tanh(dblAngle)** Return type: double

Returns the hyperbolic tangent, of dblAngle, as a floating point value. The dblAngle specified is in degrees or radians depending on the current Trig Mode.

**tick(1)** Return type: integer

Returns the number of clock ticks. This is a relative number. Compare one tick value to another to determine the number of ticks that have elapsed. Dummy parameter (1) required.

**time(1)** Return type: integer

Returns the time to registers 93 to 99, in the following format.

| | |
|---|---|
| Register 93 | seconds |
| Register 94 | minutes |
| Register 95 | hours |
| Register 96 | day |
| Register 97 | month |
| Register 98 | year |
| Register 99 | days of week from Sunday (0 to 6) |

**tm(intValue)** Return type: double

Set Trig Mode preference, 0 = Degrees, 1 = Radians, 0 and 1 return the last calculated value returns current setting, -1 returns the current setting.

**trunc(dblValue)** Return type: integer

Round x to nearest integral value not larger than x.

**tz(intValue)** Return type: double

Set Trim Zeros preference, 0 = Don't trim, 1 = Trim Zeros, 0 and 1 return the last calculated value returns current setting, -1 returns the current setting

**var("strVariable")** Return type: integer

Tests for the existence of a given variable, where “x” is any variable name. If the variable already exists a 1 is returned. If the variable is NEW, a 0 is returned. Use this in the iff() as follows: iff(var(“x”), “calc-x”).

**vars(1)** Return type: double

Programmatically pops up the variable list in a modal form. Select variable that will be returned to the executing program.

**wait("strLabel")** Return type: double

Pauses execution and displays a label. Label is string (quotes required). Returns 'Ans'.

**xor(intVal1, intVal2)** Return type: integer

Returns the binary exclusive oring of intVal1 and intVal2. intVal1 and intVal2 are integer values. If you use floating point numbers, they will be truncated to the integer part of the value. Valid integers must be less than 2^52-1.

**xrt(dblX, dblY)** Return type: double

Calculate the x th root of y where x and y are doubles. Ex. 3rd root of 64 would be calculated with xrt(3,64) would evaluate to 4.

## Constants

Constants represent fixed values. If you try to use a constant as a variable, you will get an error. For example, you cannot use: e=23 without generating an error. 'e' cannot be a variable.

**pflag** Return type: N/A

pflag is actually a constant. The value of this variable is dependent on whether or not an expression is waiting to be processed (ie. APCalc= has not yet been pressed). pflag is TRUE (1), if an expression is pending and FALSE (0), if APCalc= has been pressed.

**TRUE** Return type: integer

TRUE is actually a constant. The value of TRUE is 1.

**FALSE** Return type: integer

pflag is actually a constant. The value of FALSE is 0.

**e** Return type: couble

same as exp(1)

**Ans** Return type: double

Last calculated value

**FAns** Return type: integer

Last fixed point value

## Operators

**+/-** Return type: N/A

Changes the sign of whatever is in the expression window. Example: if sin(x)+cos(y) is in the expression field, tapping +/- changes the input to -(sin(x)+cos(y)). To change the sign of an individual value or variable, just use the '-' sign.

**1/x** Return type: N/A

Computes the reciprocal of whatever is in the expression field. That is, if sin(x) is in the expression field, and you tap 1/x, you will see 1/(sin(x)).

**!** Return type: double

Computes the factorial of the number it is appended to. n! is equivalent to fact(n).

***NOTE:*** *Remember: all functions return a value. Some functions (such as sto()) return 'Ans' (last calculated value). That is: 2*sto(1) returns 2*Ans and also stores the previous 'Ans' to register 1. All functions that do not return a specific value as a function, behave this way.*

## Appendix D - Operator Precedence

| | |
|---|---|
| **?** | This simultaneously declares and forces prompting of a variable, even if the variable already exists. Use ? to initialize a variable at the beginning of a program. |
| **^, ~, #,%** | Raise to power, equality (~) for == , inequality (#) for !=, mod |
| ***, /, \, ~, = =, #, != , <, <=, >, >=,** | Multiply, Divide, Integer Divide (trunc), Less Than, Greater Than<br># and != are equivalent. ~ and = = are equivalent. |
| **+,-** | Add, Subtract |
| **=** | Not really an operator. This is useful for assignments within a program. You an use assignments like: a=5, a=cos(x), a=cos(45), etc.<br>***Note:*** *the result of the expr is stored, not the expression. That is, a=cos(x) stores the value of cos(x), depending on value input; not the expression of cos(x). If you use var= without a value, the variable is deleted from the variable list.* |

Operator precedence is from left to right within a precedence level.

| | |
|---|---|
| 2*3^3*4 | Is the same as 2*(3^3)*4, which produces the result of 216. |
| a*b<c*d | Is the same as: ( (a*b)<c )*d, if a=2, b=3, c=7, d=9 the result is nine. (2*3)<7 returns TRUE or (1), (1)*9 returns 9. If c were 5, the result would be 0. |
| <, > | Are useful within some equations and especially suited for 'iff' instruction. |