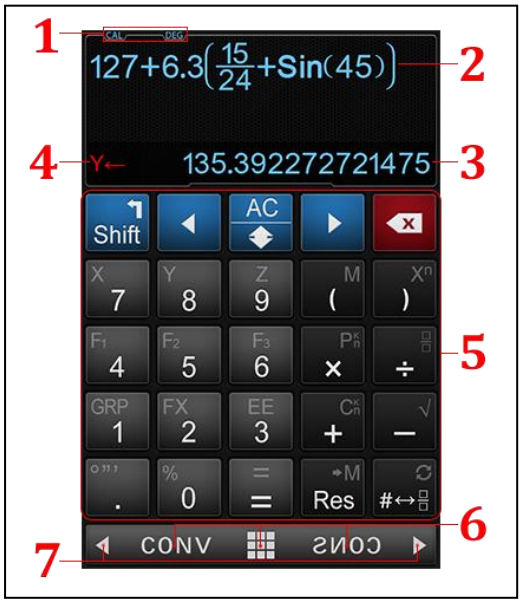
CALCULATOR INFINITY

Http://iPhone-Calculator.com/

User Manual

Contents

1. Graphic User Interface



1: Indicators.
2: Input Expression.
3: Calculation Result.
4: Notification.
5: Main Keyboard. Press key to pop up Sub-Keyboard.
6: Menu & Special Function Keys (Converter, Constant Table, Statistics).
7: Fast keyboard switching keys.

Figure01. Calculator ∞ Graphical user interface

2. Keyboard

The keyboard contains two panels; you can swap them by pressing keys or sliding the keyboard horizontally.

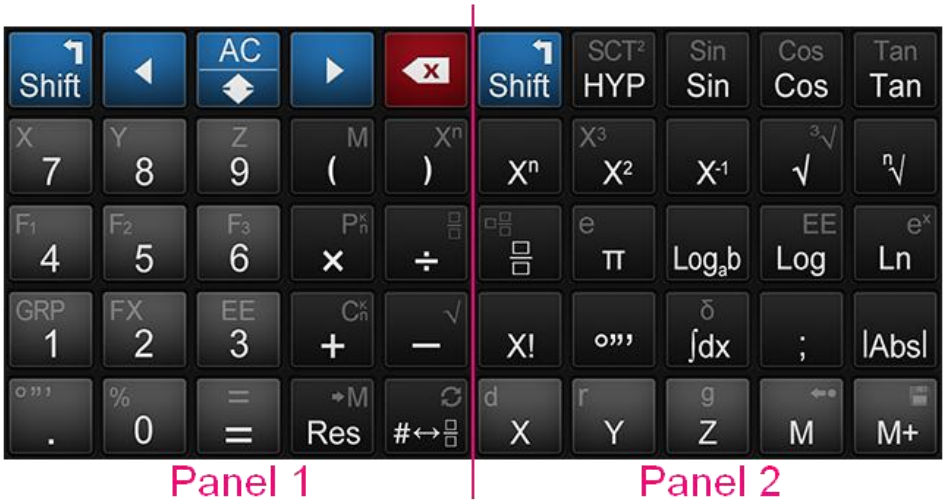


Figure02.1. Two panels of the main keyboard (Carbon+ Skin)

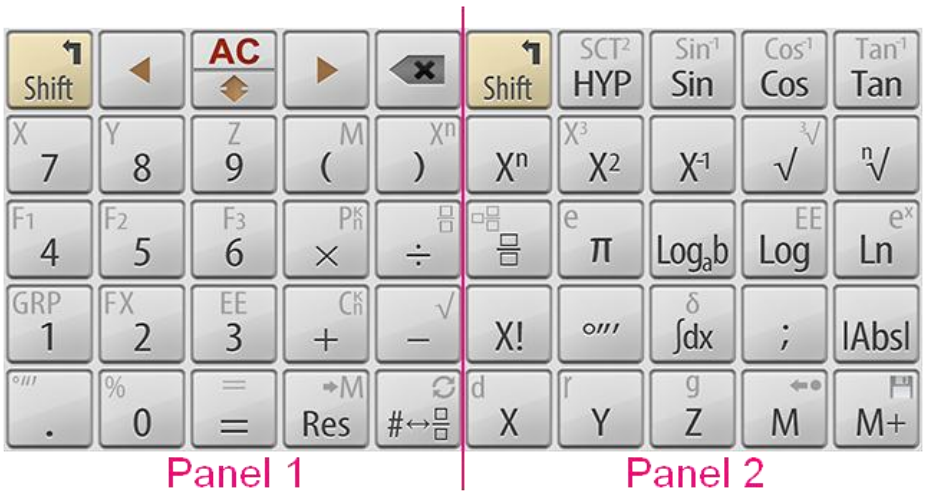


Figure02.2. Two panels of the main keyboard (Silver Light Skin)

Panel1: Numerical Panel with popular functions like Power, Square Root, Percent, Fraction…
Panel2: Advanced Functions Panel contains Trigonometric Functions (Sin, Cos, Tan…), Natural Logarithm (Log, Ln, $Log_a b$…), and Integral…

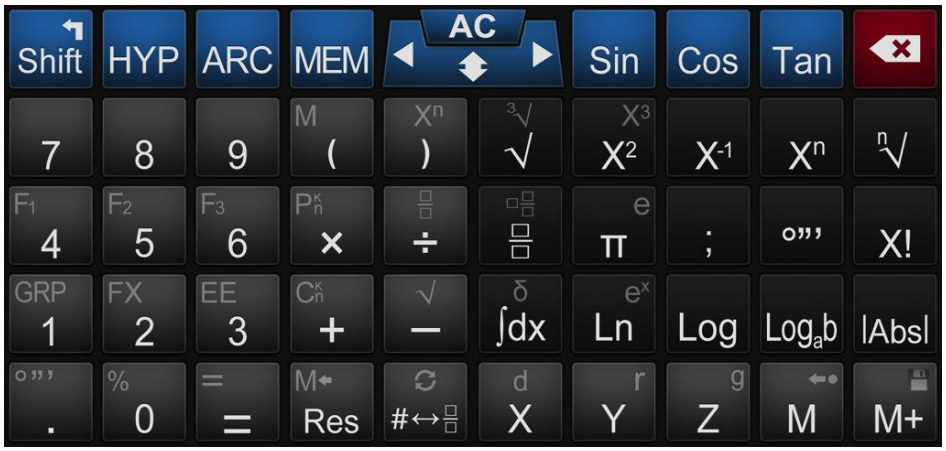


Figure02.3. Single Panel of the main iPad Keyboard

2.1. Shift Button

Each key on keyboard may contain two functions: Main Function and Shift Function.

Figure03. A key with two functions

Press Shift key followed by a second key to perform the Shift Function of the second key. You can also toggle between the Main Function and Shift Function by Long Pressing any key.

You can hold the shift key for a while to keep the shift scene, it helps you perform the Shift Function continuously.

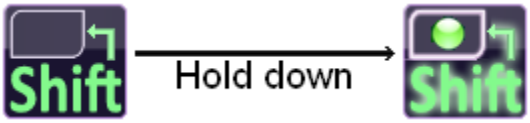


Figure04. Keep shift scene

2.2. Inputting Expressions and Values

2.2.1. Input Rules:

- The Expressions can be inputted in the same form as they are written.
- The multiplication symbol "x" can be omitted in some cases:
+ Before an opening parentheses (Ex.: 123(45+67)).
+ Between a number and a variable (Ex.: 4.5M mean: 4.5 multiply M).
- The closing parentheses can be omitted, the program will add the missing closing parentheses in same stack height (Ex.: "(15$^{(7}$").

2.2.2. Editing the Expression

The Cursor (I Beam) is the Vertical Red Line on the screen, this is where you will insert numbers, operators, or functions… to the expression.

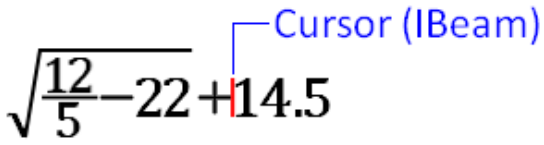


Figure05. Cursor (I Beam) in an Expression

Touch on the screen to change the position of cursor, you can also press  or  keys to move the cursor to the left or right.

Press  key to delete the symbol before the cursor.

2.2.3. Saving the Expression to Image

You can also save your expression to image by long pressing on it. Calculator ∞ can save the expression with size up to 1024x512.

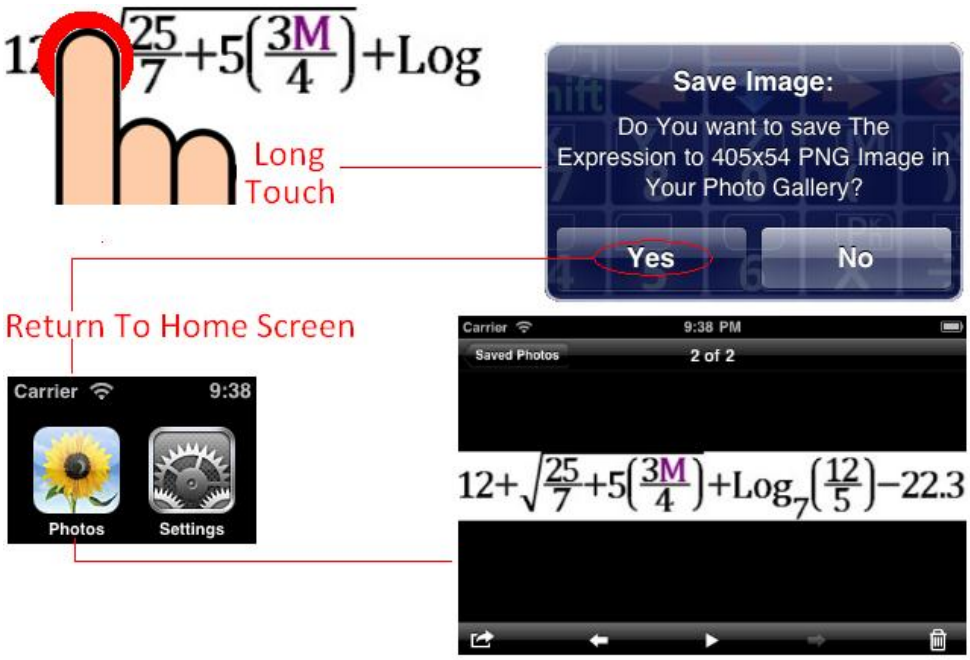


Figure06. Example of saving an expression to image

3. Calculations

3.1. Priority

The priority of inputted operations/functions/expression is evaluated according to the following table. The operation/functions/expression in the same priority will be performed from left to right.

Priority	Operations/Functions/Expressions
1st	Parenthetical Expressions.
2nd	The Functions need the special display. $\sqrt{x}$, $\sqrt[n]{x}$, $\text{Log}_a b$, $\lvert x \rvert$, $\frac{x}{y}$, $\int_d^u dx$, C_n^k, P_n^k.
3rd	Functions require an argument(s) and end with a closing parenthesis ")". Sin, Cos, Tan, Sin^{-1}, Cos^{-1}, Tan^{-1}, Sinh, Cosh, Tanh, Log, Ln…
4th	Functions come after input value X^2, X^3, X^n, X^{-1}, X!, °"' , d, r, g, %.
5th	Multiplication, Division (x, ÷).
6th	Addition, Subtraction (+, −).

3.2. Calculation limits

Function	Input Range
$\sin x$	$0° \le \lvert x\rvert° \le 1.8° \times 10^{10}$ $0 \text{ rad} \le \lvert x\rvert \text{ rad} < 314159265 \text{ rad}$ $0 \text{ grad} \le \lvert x\rvert \text{ grad} \le 2 \times 10^{10} \text{grad}$
$\cos x$	$0° \le \lvert x\rvert° \le 1.8° \times 10^{10}$ $0 \text{ rad} \le \lvert x\rvert \text{ rad} < 314159265 \text{ rad}$ $0 \text{ grad} \le \lvert x\rvert \text{ grad} \le 2 \times 10^{10} \text{grad}$
$\tan x$	$0° \le \lvert x\rvert° \le 1.8° \times 10^{10}, \lvert x\rvert \ne (2n+1) \times 90°$ $0 \text{ rad} \le \lvert x\rvert \text{ rad} < 314159265 \text{ rad}, \lvert x\rvert \ne (2n+1) \times \pi/2 \text{ rad}$ $0 \text{ grad} \le \lvert x\rvert \text{ grad} \le 2 \times 10^{10} \text{grad}, \lvert x\rvert \ne (2n+1) \times 100 \text{ grad}$ (n is integer)
$\sin^{-1} x$	$0 \le \lvert x\rvert \le 1$
$\cos^{-1} x$	
$\tan^{-1} x$	$0 \le \lvert x\rvert \le 1.797693 \times 10^{308}$
$\sinh x$	$0 \le \lvert x\rvert \le 710.47586$
$\cosh x$	
$\tanh x$	$0 \le \lvert x\rvert \le 1.797693 \times 10^{308}$
$\sinh^{-1} x$	$0 \le \lvert x\rvert \le 1.797693 \times 10^{308}$
$\cosh^{-1} x$	$1 \le x \le 1.797693 \times 10^{308}$
$\tanh^{-1} x$	$0 \le \lvert x\rvert < 1$
$\log x$ & $\ln x$	$0 < x \le 1.797693 \times 10^{308}$
$x!$	$0 \le x \le 170$ (x is an integer)
P_n^k	$0 \le k \le n \le 10^{10}$ (k, n are integers); $1 \le \dfrac{n!}{(n-k)!} \le 1.797693 \times 10^{308}$
C_n^k	$0 \le k \le n \le 10^{10}$ (k, n are integers); $1 \le \dfrac{n!}{k!\,(n-k)!} \le 1.797693 \times 10^{308}$
x^y	$x > 0: x^y < 1.797693 \times 10^{308}$ $x = 0: y > 0$ $x < 0: y$ is integer or $y = \dfrac{m}{2n+1}$ (m, n are integers); $\lvert x^y\rvert \le 1.797693 \times 10^{308}$
$\sqrt[y]{x}$	$x > 0: \sqrt[y]{x} < 1.797693 \times 10^{308}$ $x = 0: y > 0$ $x < 0: y = 2n+1$ or $y = \dfrac{2n+1}{m}$ ($m \ne 0; m, n$ are integers); $\sqrt[y]{\lvert x\rvert} \le 1.797693 \times 10^{308}$
$\dfrac{a}{b}$	Total of numerator and denominator must be equal or less than 9 digits however some 12 digit fractions can be displayed.

3.3. History and Calculated Data

3.3.1. History

Calculator ∞ can remember up to 31 newest calculated expressions. You can scroll through calculation history content by pressing  to pop up sub keyboard then pressing  or  to scroll to the previous or next expression.

3.3.2. Result (Res), Variable (X, Y, Z, M) and Extension Variables

- Res:

The last calculation result is stored in Res memory, the Res memory content is updated whenever a new calculated expression is displayed. Res memory helps your calculation continuing. You can also input it by pressing  .

Figure07. Example of continuous calculation

- Variable (X, Y, Z, M):

Calculator ∞ has four variables named X, Y, Z, M. You can assign the values to a variable from the calculated expression or the roots of solved equations. Pressing  followed by the variable key you want to assign value. In Equations Solving Result Screen, press  to store the root to variable. In Converter and Constant Table, you have to select the variable first then select the value to assign.

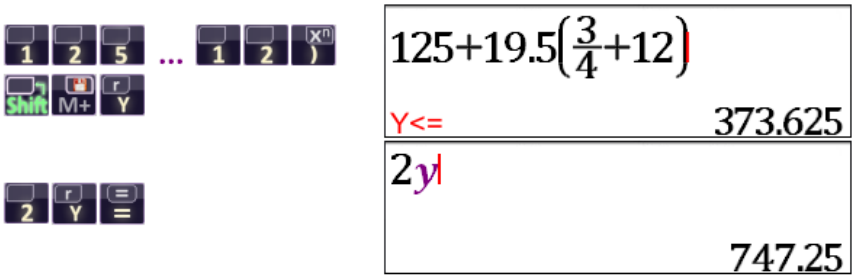


Figure08. Example of saving & using Variable

- Extension Variables (A…E, M_1…M_5):

From version 1.2, Calculator ∞ has more ten extension variables named A...E and M_1…M_5.

On iPhone: Slide 1st keyboard to the right or the 2nd to the left side to open the extension variables keyboard.

On iPad: Press MEM button to pop up the variables window.

Pressing the variable key right after calculate the expression or Dragging and Dropping the results to the variable you want to assign value to.

3.3.3. Result Drag and Drop

Drag and Drop the result of calculated expression to the keyboard key is the easiest way to save or make the new expression of its value.

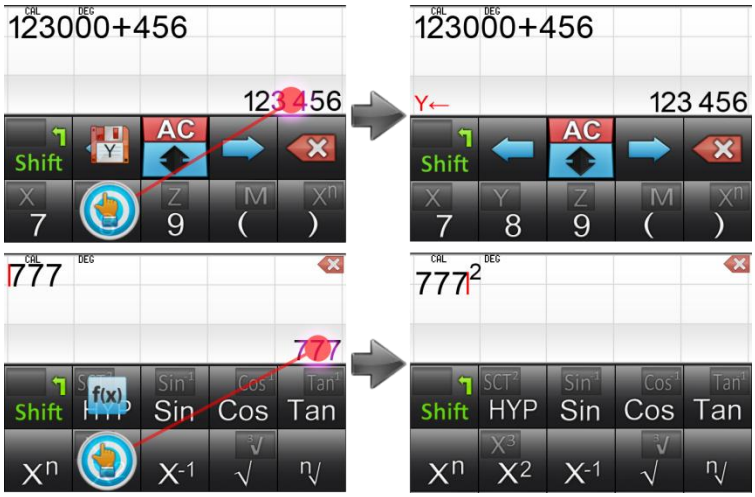


Figure09. Example of Dragging & Dropping the result

3.4. Assignment Operator & Number Sequence Calculation

- Assignment Operator:

You can use Assignment Operator (←) to assign a specific value or a calculation result to a variable(s).

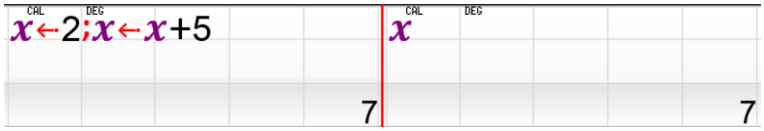


Figure10. Assignment Example using Assignment Operator

Figure09 – Explanation: First, Assign 2 to X, then calculate X+5 and save the result to X.

+ Notice: X←2; X←X+5 is a multi-statement expression, only the result of last sub-expression(statements) will be shown.

- Number Sequence Calculation:

You can calculate the F(n) or F(…) of a number sequence with assignment operator, multi-statements technique (using ";") and pressing [=] many times. Please take a look the examples below to have the basic knowledge in number sequence calculation.

- Example 1: let's define the Fibonacci series to be one-indexed (call it like-Fibonacci):

$$\begin{cases} F_1 = 0, F_2 = 1 \\ Fn = F_{n-1} + F_{n-2} \end{cases}$$

0, 1, 1, 2, 3, 5, 8, 13, 21…

Calculate F_{11} of the Fibonacci sequence.

Solution:

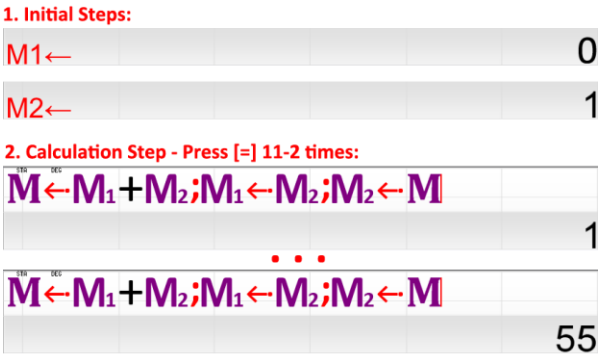


Figure11. Solution of Fibonacci Calculation

Figure10 – Explanation: In the Initial Steps, let's assign the initial value for F_1 and F_2. M is considered as F_n but now M is F_3, $F_3 = F_1 + F_2$. Then we re-assign the value for F_1 and F_2.

Press the [=] in the 1st time, F_3 is calculated.

Press the [=] 2nd time, F_4 is calculated.

….

Press the [=] nth time, F_{n+2} is calculated. So Press[=] 11 – 2 times to calculate F_{11}.

- Example 2: Given the number sequence

$$x_{n+1} = \frac{4 + x_n}{1 + x_n}$$
$$(where\ n \geq 1\ \&\ x_1 = 1)$$

Calculate X_3 and $\sum_{i=1}^{5} x_i$ (Sum of X_1 to X_5).

Solution:

Let's call A the Sum of X_1 to X_5. M is as X_n and M_1 is as X_{n-1}.

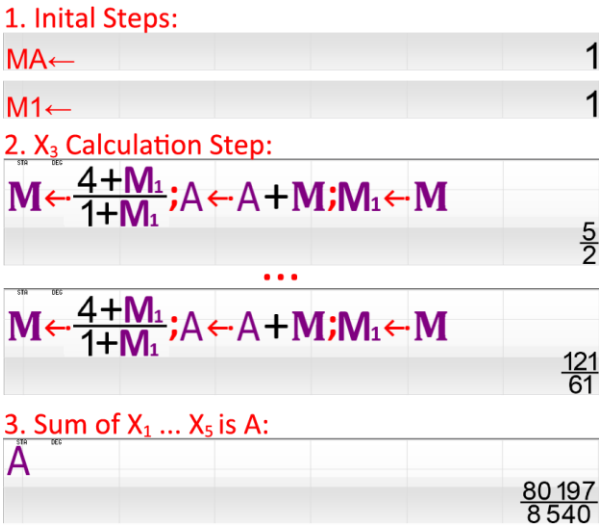


Figure12. Example 2 Solution

3.5. Unit Converter and Constant Table

Pressing CONV or 2ND to open Unit Converter or Constant Table. If current expression is calculated, its value will be used as base value in converter, otherwise it will be "1".To convert a unit, select the Unit Category, then select the base unit and the base value will be converted to destination units, you can also select the value to input it back to expression or save it to the selected variable.

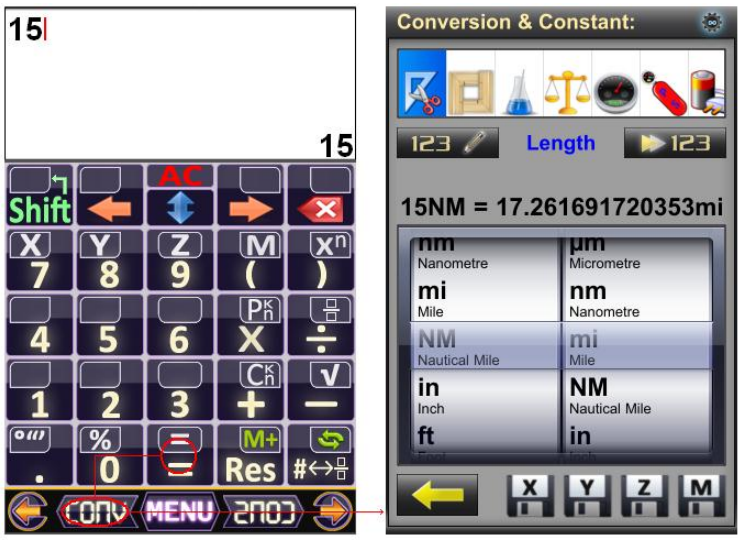


Figure13. Example of Convert 15NM to other length units

3.6. Toggling Result

Press  to toggle the current result from decimal to fraction, mixed fraction and from faction to sexagesimal (Degree, minutes, second).

- Only fractions with less than 9 digits (and some 12 digits fractions) of numerator and denominator can be displayed- Only the decimal with absolute less than 2147483647 can be displayed in sexagesimal.

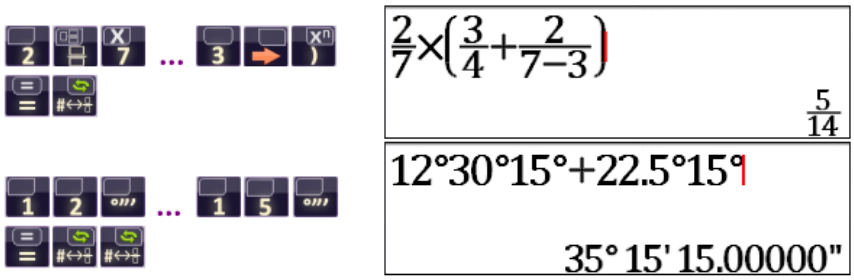


Figure14. Example of toggling result to fraction and sexagesimal

4. Equation Calculations

4.1. Quadratic and Cubic equations

You can solve Quadratic & Cubic equations any time and in any mode (except Equation mode) by inputting it directly and pressing  key to solve. Press Shift→  to input "=" symbol.

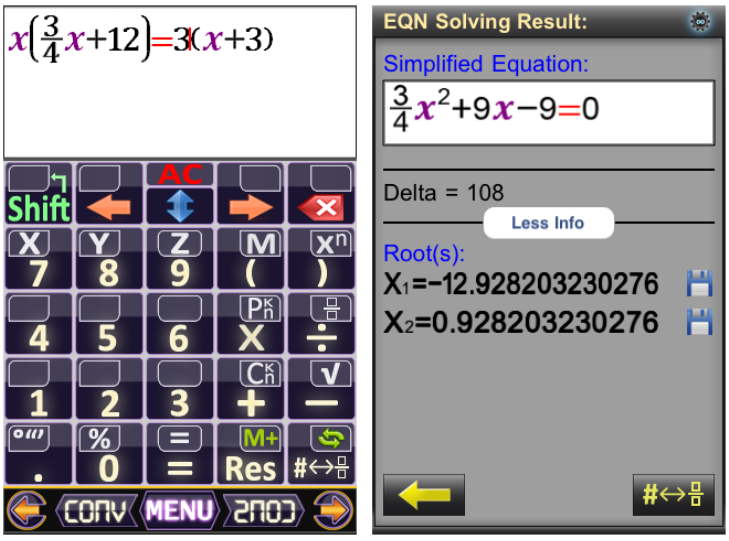


Figure15. Example of solving Equation

Important: after the equation is simplify, all of its coefficients' absolute value must be greater than 10^{-6} and the difference among those coefficients must not exceed 10^{12} times

4.2. Simultaneous Linear Equations

You can solve the system of 2 or 3 equations any time and in any mode (except Equation mode) by inputting it directly and pressing key to solve. Press Shift→ key to input "=" symbol. Each Equation must be separated by ";", using key to input it.

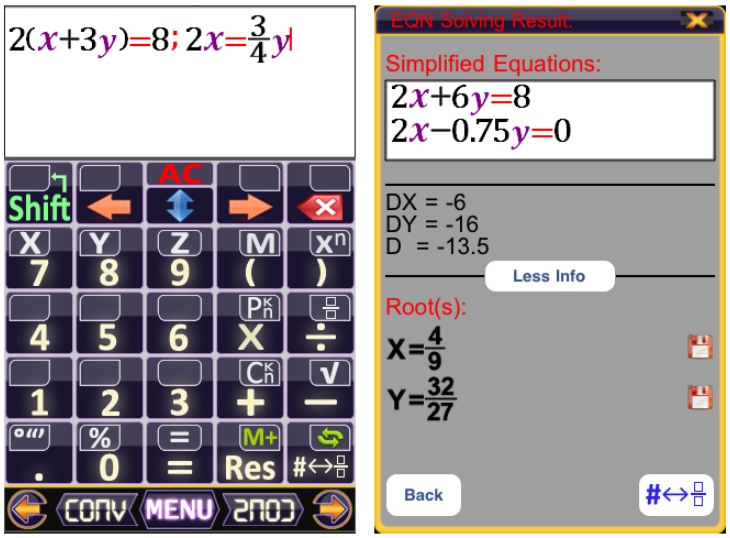


Figure16. Example of solving Equations

Important: after the system of equations is simplify, all of its coefficients' absolute value must be greater than 10^{-6} and the difference among those coefficients in each equation must not exceed 10^{12} times

4.3. General Equation

You can solve the general equation (F(X)) by Newton's law. You can also select X_0 in Newton's law by input ";X=..." otherwise X_0 will be zero.

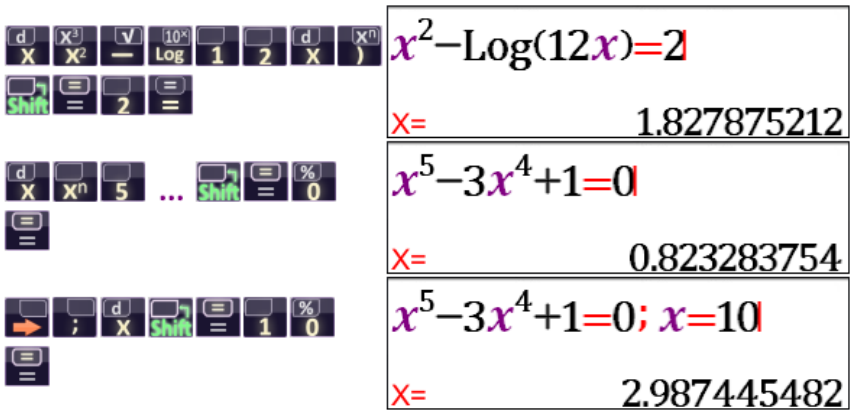
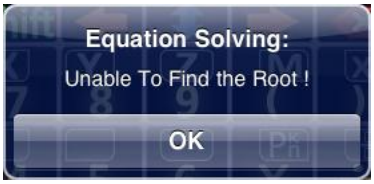
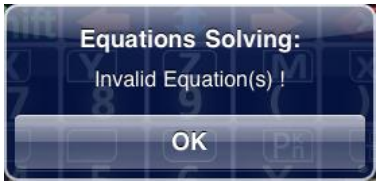


Figure17. Example of solving general equation by Newton's law

Important: Newton's law is able to find only one root each calculation, so the result is displayed may not contain all roots of the equation.

4.4. Equation Calculation Errors

Error Message	Details
	- The Equation or Simultaneous Linear Equations are too complex to simplify and solve - The Equation or Simultaneous Linear Equations don't have any root or has infinity roots.
	- Equation contains invalid variable. Equation must contain only X. - Simultaneous Linear Equations with two unknowns must contain only X and Y. - Simultaneous Linear Equations with three unknowns must contain only X, Y and Z. - Important: if Expression contains "=" symbol, it will be considered as an equation and all variables (X, Y, Z) will be considered as the unknowns, but you can use M as a variable.

5. Graphing & Fx Funtions Calculation

5.1. Graphing

5.1.1. Plot an Equation

Input an F(x) equation then press  →  and select the equation (F1, F2 or F3) which you want to plot as.

Example:

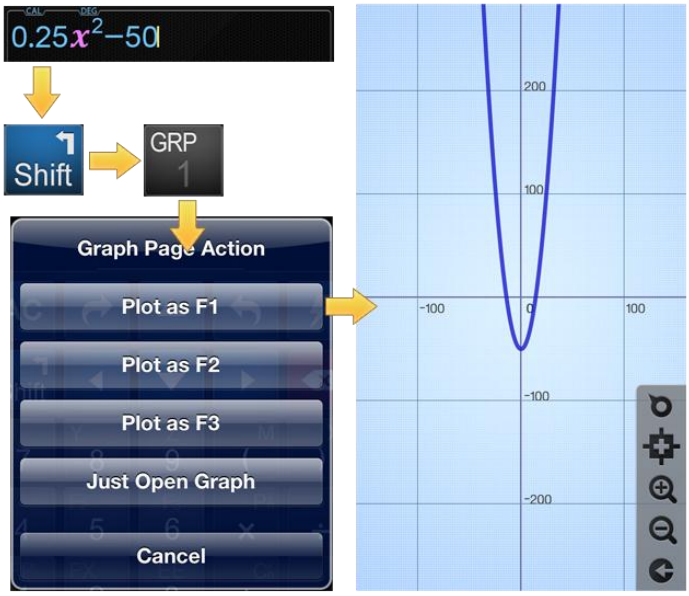


Figure 18. Example of plotting an equation

5.1.2. Edit Equations

In Graph Page, Press  to control your equation.

Press  to hide the equation then press  to delete the equation.

Press to show that hiden equation.

5.1.3. Camera Movement, Zooming and Snal to Intersection

In Graph Page, You can use two - fingers pinch to zoom in or out like the default Photo Library of iOS Devices. You can also press  /  to zoom in / out in a faster and more stable way.

Press  to setup the position you want to move to, It's very useful in case the position is far away from your current position.

Press  to turn on Snap mode, move your finger on the screen to get the Y Value of F(X) functions, you can also move to the intersection and release your finger to get the coodinate of intersection.

Example:

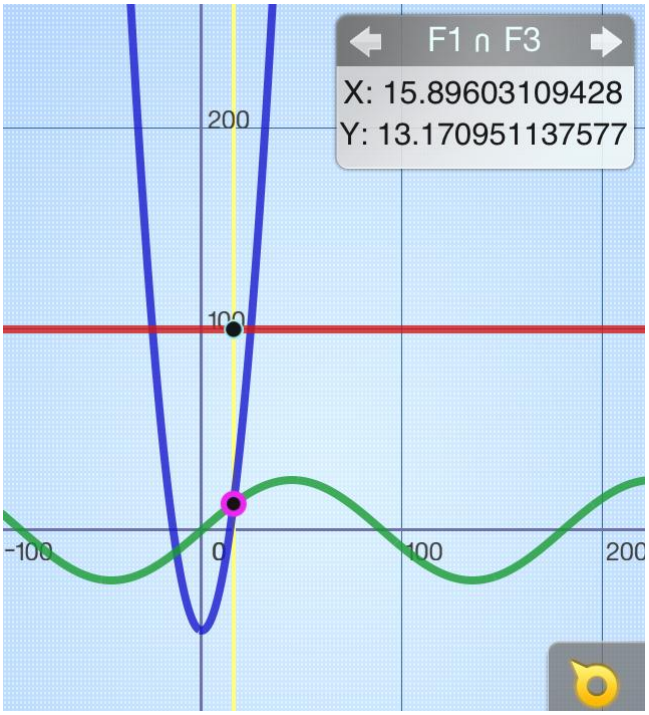


Figure 19. Example of snapping to intersection

5.2. Fx Functions Calculation

5.2.1. Assign an Equation to Fx Function

Input an F(x) equation then press 

→ 

and select the Fx equation (F1, F2 or F3) which you want to assign to.

Example:

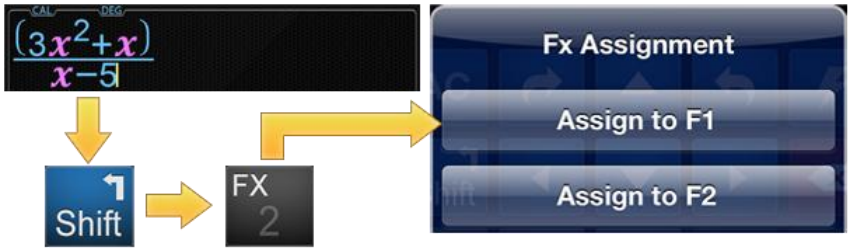


Figure 20. Example of Fx Functions Assignment

5.2.2. Recall, Edit & Synchonized Fx Functions

Use the Fx Function as well as a normal function after assigned it.

Figure 21. Recall F1 from Figure 20

You can check the Fx Function by pressing equal to know the equation after inputting it

Figure 22. Get the equation from F1 Function

+ Notice: The equation will be synched with the Graph Page's equation If it is valid to graph and vice versa.

6. Function Menu (Mode)

6.1. Calculator

Press Menu and select Calculator.

Basic Scientific Calculator, this is the default mode of Calculator ∞.

Basic Calculator's Functions: Basic numeric calculations(+ ,– ,x ,÷), Fraction, Mixed Fraction($a\frac{b}{c}$), Sexagesimal (Degree, minutes, second) calculations, Power(x^y), Exponent(E), Square Root &Real Root($\sqrt{x}, \sqrt[x]{y}$),Trigonometric functions(Sin, Cos, Tan, ArcSin (Sin^{-1}), ArcCos(Cos^{-1}), ArcTan(Tan^{-1}), Sinh, Cosh, Tanh, Sin^2, Cos^2, Tan^2), Logarithm (Log, Ln, $Log_a b$), Factorial(X!), Permutation(P_n^k) and Combination(C_n^k), Abs(|X|), Integral($\int_b^a dx$), Derivative(d/dx), Variable(X, Y, Z, M), Fx Functions(F1, F2, F3), Unit Conversion (Length, Area, Volume, Mass, Speed, Velocity, Acceleration, Angular Acceleration, Volume Flow, Pressure, Force, Density Common, Energy, Electronic Charge, Power, Illumination, Radioactivity, Temperature, Data, Fuel Compusion, Time), Constant Table(44 popular constants),Convert the integer number to BIN, OCT, HEX Base, Export Expression to pictures, Graph / Plot, Equation and Simultaneous Linear Equations Solving.

6.2. Statistics

Press Menu and select Statistics. Press 

key to calculate current expression and insert its result to the data set.

To delete the inputted value in the dataset, select it on the top-left column of the screen and choose Yes.

To obtain the statistical data, press 

to open statistical Data Table and select the statistical value you want to input back to expression. In Data Table, you can edit the inputted data by select Variable.

6.3. Polynomial Equation Solver

To Solve Polynomial Equation, you have to input all of necessary coefficients (one by one).

To change coefficients, press  or  to scroll back to the previous coefficients. You can also restart the Solver by pressing 

.

Important: Solving equations in Equation Solver Mode is the same as solving equations in Calculator mode, but the roots in Equations Solver mode will be more accurate when coefficients are too big or too small, or the equations are too complex to simplify.

6.4. Simultaneous Linear Equations Solver

To solve Simultaneous Linear Equations, you have to input all of necessary coefficients (one by one).

To change coefficients, press  or  to scroll back to the previous coefficients. You can also restart the Solver by pressing 

.

Important: Solving equations in Equation Solver Mode is the same as solving equations in Calculator mode, but the roots in Equations Solver mode will be more accurate when coefficients are too big or too small, or the equations are too complex to simplify.

6.5. Base Calculation – Programming Mode

Base Calculation – Programming Mode let you calculate the number in variety base and convert the result among them. Calculator ∞ support all base from 2 to 16 and many logical operators such as NOT, AND, OR, XOR, SHIFT LEFT, SHIFT RIGHT, DIV, MOD with powerful 64 Bit Integer (–9,223,372,036,854,775,808 to 9,223,372,036,854,775,807 for the signed number and 0 to 18,446,744,073,709,551,615 for unsigned number).

Press 

to change the default base.

Press 

to insert the custom bases other than **BIN**, **OCT**, **DEC**, **HEX**.

Press NEG to display the negative binary number in computer-store style (How the negative number is saved on standard computer memory).

Press 2's to display the negative value of a positive number.

+ Notice: NEG and 2's are only available in BINARY Default Base.

+ Example: -50 is -110010 in BIN Base, But computer use 11001110 to present -50

+ Example & Explanation:

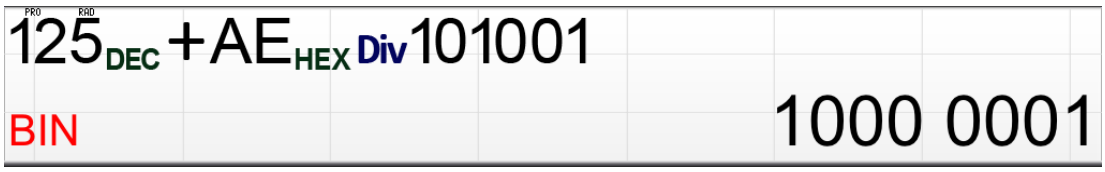


Figure23. Example of Base Calculation

Figure 14 – Explanation: AE in **HEX** base divide by 101001 in default base (**BIN**), then add the result by 125 in **DEC** base. Display the result in Default base (**BIN**) = "10000001".

+ Notice: When input the number of default base, you don't need to input the followed base indicator (The Green small text/number).

+ Base Operator Priority:

Priority	Operations/Functions/Expressions
1st	Base indicator (Green small text followed by the number)
2nd	Parenthetical Expressions.
3rd	NOT Operator
4th	Multiplication, Division, Modulo (x, ÷, mod)
5th	Addition, Subtraction, Shift Left, Shift Right (+, –, <<, >>)
6th	AND Operator
7th	OR, XOR Operator

6.6. Tutorial

Tutorial is very useful for new users, select it from Menu screen. Press [<<Back] or [Next>>] to scroll to previous or next tutorial page and [Skip] to exit.

7. Scheme URL (For Integration Developer)

- "CalculatorInfinity://AC": Launch Calculator Infinity and clear Display
- "CalculatorInfinity://Menu": Launch Calculator Infinity and open Main Menu
- "CalculatorInfinity://EXP/<Expression>": Launch Calculator and input "<Expression>"
  Ex: "CalculatorInfinity://EXP/12+4-(5x2)

Figure 24. Result of Example Scheme URL

+ Notice: Only Numbers & Basic Operator is supprted in Scheme URL.

8. Settings

Select Settings in Menu screen to configure your Calculator ∞. The configurations data will be applied when you touch [Apply] buttons. The current configurations data will be saved when you exit the program.

- Angle Unit: Select the current angle unit (Deg: Degree, Rad: Radian, Grad: Gradian).

- Auto Convert To Fraction: When a new expression is calculated, Calculator will try to convert its result to fraction automatically.

- Auto Return to NumPad after Sin,Cos,Tan… iPhone only: Keyboard will change to Panel 1 automatically for the number input follow Sin, Cos, Tan, Log, etc… functions.

- Sounds: Turn On/Off keyboard's sound, message box's sound.

- Long Press: Hold down response time.

- Clear All Data: Clear All Current Data (History, Variable, Statistical Data).

- Main Skin (iPhone/iPod only): There are two skins Violet and Titanium, Titanium is default

- Reset Default: Reset the configuration to default.

- Apply: Apply and Save the configuration data.

- Cancel: Cancel all configurations.

THE END