Canon

https://global.canon/calmanual

ENGLISH

F-570X

SCIENTIFIC CALCULATOR
USER INSTRUCTIONS

Important Precautions Before Use

- Before using the product, please read this manual carefully. And keep it on hand for future reference.

RMN : ACH27
Regulatory Model Identification Number is assigned for regulatory identification purpose.

Contents

Contents

About this Manual

- The contents of this manual are subject to change without notice.
- The displays and illustrations shown in this manual are for illustrative purposes only and may differ from the actual products.

Advice and Precautions

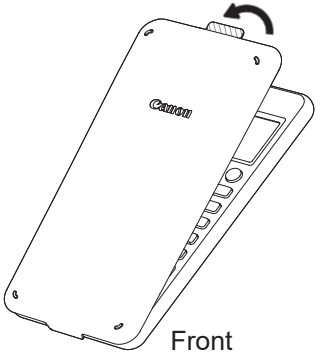
- This calculator contains precision components such as LSI chips and should not be used in places subject to rapid variations in temperature, excessive humidity, dirt or dust, or exposed to direct sunlight.
- The liquid crystal display panel is made of glass and should not be subjected to excessive pressure.
- When cleaning the device, do not use a damp cloth or volatile liquid such as paint thinner. Instead, use only a soft, dry cloth.
- Do not under any circumstances dismantle this device. If you believe that the calculator is not functioning properly, either bring or mail the device together with the guarantee to a service representative of the Canon Business office.
- Never dispose the calculator improperly such as burning; it can create risks of personal injury or harm. You are suggested to dispose this product according to your national law.
- Do replace the battery once every two years even if it is not used frequently.

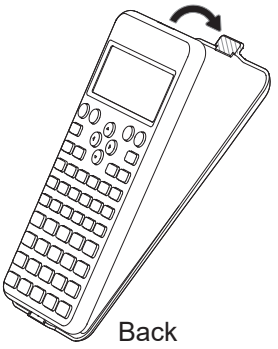
BATTERY CAUTION !

- There is a risk of explosion if an incorrect battery type is installed. Please dispose of used batteries according to their instructions.
- Keep the battery out of reach of children.
- Never expose the batteries to high temperatures, direct heat, or dispose by incineration.
- Do not allow metal objects to touch the battery terminals on the device; they can become hot and cause burns.
- Remove the battery if they are worn out or have been stored for an extended period of time.
- Always remove old, weak, or worn out batteries promptly and recycle or dispose of them in accordance with Federal, State, and Local regulations.
- If a battery leaks, remove all battery, taking care to keep the leaked fluid from touching your skin or clothes. If fluid from the battery comes into contact with skin or clothes, flush skin with water immediately.

How to Use the Cover

Open the cover as shown in the figure.





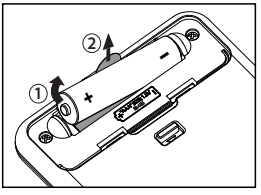
Getting Started

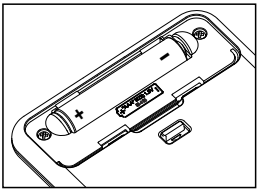
Power On, Off

First time operation:

1. Remove the battery insulation tab to load the battery.

(Fig. a)





(Fig. b)

2. Press ON Shift Clear 3 = CA to initialize the calculator.

Power ON: When ON is pressed.

Power OFF: Shift OFF are pressed.

■ **Auto Power off Function**

When the calculator is not used for approximately 7 minutes, it will automatically power off.

Display Contrast Adjustment

■ Press (Shift) Setup (▲) [2] to enter the Display Contrast Adjustment screen.

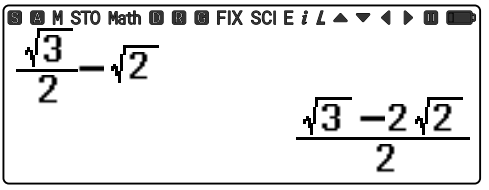
Press (▶) to darken the display contrast.

Press (◀) to lighten the display contrast.

Press [CA] or ON to confirm and clear the screen.

■ To initialize the LCD contrast, press (Shift) Clear [3] [=] [CA] outside the **Display Contrast Adjustment** screen.

Display



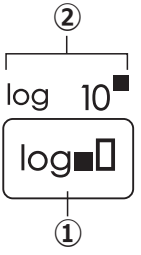
<Status Indicators>

S	: Shift Key
A	: Alpha Key
M	: Independent Memory
STO	: Store Memory
Math	: Math Display Mode
D	: Degree Mode
R	: Radian Mode
G	: Gradian Mode
FIX	: Fixed-decimal Setting
SCI	: Scientific Notation
E	: Engineering Symbol
i	: Answer display in imaginary format in Complex Mode
L	: Answer display in angular form in Complex Mode
II	: Multi-statements Display
	: Battery Level Indication

<Key Markings>

Pressing the (Shift) or (Alpha) key followed by a second key performs the alternate function of the second key the alternate function is indicated by the text printed above the key.

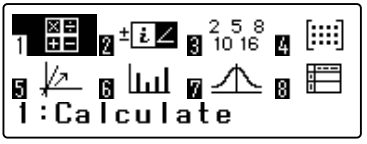
① Keycap function
② Alternate function



Calculation Mode

Specify the calculation mode that is suitable for the type of calculation you want to perform.

1. Press (Mode) to display the Main Menu.
2. Use the cursor keys to move the highlighting to the icon you want.
3. Press [=] to display the initial screen of the mode whose icon you selected.



Note: The initial default calculation mode is the Calculate Mode.

Key Binding	For
1	Normal calculations
2	Complex number calculations
3	Calculations involve specific number system
4	Matrix calculations
5	Vector calculations
6	Statistical and Regression calculations
7	Distribution calculations
8	Function table generation
9	Equation solution
A	Inequality solution
B	Verify calculation or statement
C	Ratio calculations

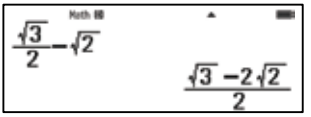
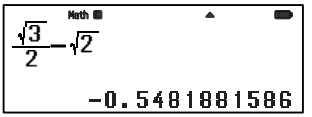
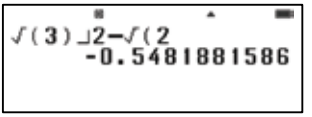
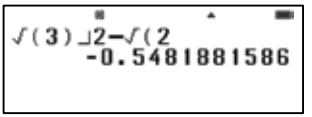
Calculator Set-up Menu

■ Press (Shift) Setup ○ to enter the **Calculator Set-up Menu**; press ▼ / ▲ for next / previous page.

Page	Key Binding
Page 1	1 Input/Output 2 Angle Unit 3 Number Format 4 Engineering Symbol
Page 2	1 Fraction Result 2 Complex 3 Statistics 4 Equation
Page 3	1 Table 2 Recurring Decimal 3 Decimal Mark 4 Digit Separator
Page 4	1 Multiline Font 2 Contrast

Input and Output Formats

Before starting a calculation on the calculator, you should first use the operations in the table below to sepecify the formats that should be applied for calculation formula input and calculation result output.

To specify this type of input and output:	**Press (Shift) (Mode) (SETUP) 1 (Input/Output) and then press:**
Input: Natural Textbook; Output: Format that includes a fraction, $\sqrt{\ }$, or π *1	1  (MathI / MathO)
Input: Natural Textbook; Output: Converted to decimal value	2  (MathI / DecimalO)
Input: Linear*2; Output: Decimal or fraction	3  (LineI / LineO)
Input: Linear*2; Output: Converted to decimal value	4  (LineI / DecimalO)

*1 Decimal output is applied when these formats cannot be output for some reason.

*2 All calculations, including fractions and functions are input in a single line. Same output format as that for models without Natural Textbook Display.

Note: The initial default input/output format setting is MathI/MathO.

Angle unit

[1] Degree : Angle unit in Degree

[2] Radian : Angle unit in Radian

[3] Gradian : Angle unit in Gradian

$90^{o} = \frac{\pi}{2}$ radians = 100grads

Number Format

[1] **Fix:** Fixed Decimal, [Fix 0~9?] appears, specify the number of decimal places by pressing [0] – [9].

Example: 220 ÷ 7 = 31.4286 (FIX 4)

= 31.43 (FIX 2)

[2] **Sci:** Scientific Notation, [Sci 0~9?] appears, specify the number of significant digits by pressing [0] – [9].

Example**:** 220 ÷ 7 = 3.1429×10^{1} (SCI 5)

= 3.143×10^{1} (SCI 4)

[3] **Norm:** Exponential Notation, [Norm 1~2?] appears, specify the exponential notation format by pressing [1] or [2] .

Norm 1: Exponential notation is automatically used for integer values with more than 10 digits and decimal values with more than **TWO** decimal points.

Norm 2: Exponential notation is automatically used for integer values with more than 10 digits and decimal values with more than **NINE** decimal places.

Example: 1 ÷ 1000 = 1×10^{-3} (Norm 1)

= 0.001 (Norm 2)

Engineering Symbol	
1 ON 2 Off	Calculation answer will automatically round up to nearest Metric prefix when this function is ON. LCD icon "E" will be displayed when the function is set to ON.
Fraction Result	
1 ab/c 2 d/c	Calculation answer will display in mixed fraction or improper fraction based on the selection.
Complex	
1 a+b*i* 2 r∠θ	Calculation answer will display in rectangular coordinates or polar coordinates for Complex Mode and Equation Mode.
Statistics	
1 ON 2 Off	Show frequency column in Statistics Mode data input screen.
Equation	
1 ON 2 Off	Calculation answer in Equation mode will show complex numbers when set to ON.
Table	
1 f(x) 2 f(x), g(x)	Support creating table with either one function f(x) or 2 function f(x), g(x) in Table Mode.
Recurring Decimal	
1 ON 2 Off	Calculation answer format support recurring decimal display when it is ON.
Decimal Mark	
1 Dot 2 Comma	Specifies calculation answer display decimal mark in dot or comma.
Digit Separator	
1 ON 2 Off	Specifies whether answer display should be separated with block in every metric prefix.
Multiline Font	
1 Normal Font 2 Small Font	Specifies the display font size in LineI/LineO or LineI/DecimalO format.

Inputting Expressions and Values

■ In Line mode, press ▲ to let the cursor jump to the beginning of input, press ▼ to jump to the end.

■ In Mathematics mode, press ▶ to let the cursor jump to the beginning of input when it is at the end of the input calculation. Or press ◀ to let the cursor jump to the end of input when it is at the beginning of the input calculation.

■ Omit the multiplication sign and final close parenthesis.

Example: 2 x log 100 x (1+3) = 16

	Operation 1	**Display 1**
Including [×] *1, [)] *2, [)] *3	[2] [×] (Shift) [log] [1] [0] [0] [)] *2 *1 [×] [(] [1] [+] [3] [)] [=] *3	2xlog(100) x (1+3) 16
	Operation 2	**Display 2**
Omitting [×] *1, [)] *3	[2] (Shift) [log] [1] [0] [0] [)] [(] [1] [+] [3] [=]	2log(100)(1+3 16

*1. Omit multiplication sign (x)
- Input before an open parentheses [(] : 1 x (2+3)
- Input before scientific functions that includes parentheses: 2 x cos(30)
- Input before Random number function [Rand]
- Input before Variable (A, B, C, D, x, y, z, M), π, e

*2. Scientific functions come with the open parenthesis.
Example: sin(, cos(, Pol(, LCM(…. You need to input the argument and the close parenthesis [)] .

*3. Omit the last close parenthesis before the [=] , [M+] , [M−] , (Shift) and [STO] .

Note : When the remaining input capacity is less than 10bytes, the input cursor will change from "▌" to "■" signaling that the memory is running low.

■ Insert and Overwrite Input mode

In Line mode, you can use insert or overwrite mode for inputting.

- In Insert mode (Default input mode), the cursor is a vertical flashing line " ▌" for inserting a new character.
- In Overwrite mode, press (Shift) (Insert) key to switch the cursor to a flashing horizontal " _ " and replace the character at the current cursor position.

In Mathematics mode, you can only use the Insert mode.

Whenever the display format changes from Line mode to Mathematics mode, it will automatically switch to the Insert mode.

■ Deleting and Correcting an Expression

In Insert mode: Move the cursor to the right of the character or function that needs to be deleted, then press [DEL].

In Overwrite mode: Move the cursor under the character or function being deleted, then press [DEL].

Example: 1234567 + 889900

(1) Replace an entry (1234567 ⟶ 1234560)

Mode Setting	Key In Operation	Display (input Line only)
Method 1: Line/Maths mode – Insert mode	1234567 [+] 889900 (◀) 7 times	1234567I+889900
	[DEL] [0]	1234560I+889900
Method 2: Line mode – Overwrite mode	(Shift) (Setup) [1] [3] 1234567 [+] 889900 (Shift) (Insert)	1234567+889900_
	(◀) 8 times	1234567+889900
	[0]	1234560+889900

(2) Deletion (1234567 ⟶ 134567)

Mode Setting	Key In Operation	Display (input Line only)
Method 1: Line/Maths mode – Insert mode	◀ 12 times	12I34567+889900
	DEL	1I34567+889900
Method 2: Line mode – Overwrite mode	Shift Insert	1234567+889900_
	◀ 13 times	1234567+889900
	DEL	134567+889900

(3) Insertion (889900 ⟶ 2889900)

Mode Setting	Key In operation	Display (input Line only)
Line/Maths mode – Insert mode	◀ 6 times	1234567+I889900
	2	1234567+2I889900

Inputting and Display Result in Mathematics Mode

In Mathematic Mode, the input and display result of fraction or certain functions (log, x^2, x^3, $x^{\blacksquare}$, $\sqrt{\blacksquare}$, $\sqrt[3]{\blacksquare}$, $\sqrt[\blacksquare]{\square}$, x^{-1}, $10^{\blacksquare}$, $e^{\blacksquare}$, Abs)
is shown in Handwriting/Mathematics format.

MATHI / MATHO MODE: Shift Setup 1 1

Example	Key in operation	Display
$\left\|\sqrt{3}-\frac{2}{\sqrt{2}}\right\|$	Abs $\sqrt{\blacksquare}$ 3 ▶ − 2 $\frac{\blacksquare}{\blacksquare}$ $\sqrt{\blacksquare}$ 2 =	$\left\|\sqrt{3}-\frac{2}{\sqrt{2}}\right\|$ $\sqrt{3}-\sqrt{2}$

NOTE

(1) Some input expressions cause the height of a calculation expression to be greater than one display screen. Maximum input capacity: 2 display screens (63 dots x 2).

(2) Calculator memory limits how many functions or parentheses can be input in any single expression. In this case, divide the expression into multiple parts and calculate separately.

(3) If part of the expression you input is cut off after calculation and in the result display screen, you can press ◀ or ▶ to view the full expression.

Order of Operations

This calculator will automatically determine the operation priority of each individual command as follows:

1st	Recall (memory recall), Rand
2nd	Parenthetical expression
3rd	Function with parentheses: Pol(, Rec(d/dx, $\int$dx, P(, Q(, R(, Det(, Trn(, Ide(, Adj(, Inv(, Arg(, Conjg(, Real(, Imag(, UnitV(, Angle(sin(, cos(, tan(, $\sin^{-1}$(, $\cos^{-1}$(, $\tan^{-1}$(, sinh(, cosh(, tanh(, $\sinh^{-1}$(, $\cosh^{-1}$(, $\tanh^{-1}$(log(, ln(, e^(, 10^(, $\sqrt{}$(, $\sqrt[3]{}$(Abs(ROUND(, LCM(, HCF(, Q…r(, i~Rand(, Pfact(, lim(, int(, intg(
4th	Functions that come after the input value preceded by values, powers, power roots: x^2, x^3, x^{-1}, x!, ° ' ", °, r, g, ^(, $\sqrt[x]{}$(Percent %, $\log_a b$, $x10^x$, ►t. engineering symbols (m, μ, n, p, f, k, M, G, T, P, E)
5th	Fractions: ab/c, d/c
6th	Prefix symbol: (–) (negative sign),base-n symbols (d,h,b,p,o,Neg,Not)
7th	Metric conversion commands (cm►in, etc.), Statistics mode estimated value calculation: $\hat{x}$, $\hat{y}$, $\hat{x}_1$, $\hat{x}_2$.
8th	Multiplication where sign is omitted: Multiplication sign omitted immediately before π , e, variables (2π , 5A,πA, etc.), functions with parentheses (2$\sqrt{}$(3), Asin(30), etc.)
9th	Permutations, combinations: nPr, nCr, Complex number polar coordinate symbol(∠).
10th	Dot: ▪
11th	Multiplication and division: ×, ÷
12th	Addition and subtraction: +, –
13th	Logical AND (and).
14th	Logical OR, XOR, XNOR (or, xor, xnor).
15th	Calculation ending instruction: =, M+, M–, STO(store memory), ►r∠Θ, ►a+bi

■ In the same precedence level, calculations are performed from left to right.

■ Operations enclosed within parentheses are performed first. When a calculation contains an argument that is a negative number, the negative number must be enclosed within the parentheses.

Example:

(−) 2 x^2 = $-2^2 = -4$

((−) 2) x^2 = $(-2)^2 = 4$

■ When same priority commands are mixed into one calculation:

Example 1:

1 ÷ 2 Shift π = $1 \div 2\pi = 0.1591549431$

Example 2:

2 STO (−) $2 \rightarrow A$

1 ÷ 2 Alpha [A] = $1 \div 2A = \frac{1}{4}$

Calculation Stacks

■ This calculator uses memory areas, called "stacks", to temporarily store numeric value (numbers) commands (+, –, x…) and functions according to their precedence during calculations.

■ The numeric stack has 10 levels and the command stack has 128 levels. A stack error [Stack ERROR] occurs whenever you try to perform a calculation that exceeds the capacity of stacks.

■ Calculations are performed in sequence according to "Order of Operations". After the calculation is performed, the stored stack values will be released.

Application Function Menu

Apps

The Apps menu contains mathematical functions. In each Calculation Mode, the listed functions are different.

■ Press Mode and corresponding number to enter the calculation mode.

■ Press Apps to enter the Apps menu.

■ Press ▼ / ▲ for next / previous pages.

■ Press Mode 1 to enter Calculate mode.

■ As the calculation is busy processing, the calculator shows the message [PROCESSING] (without any calculation result). Press CA key to interrupt the calculating operation.

Fraction Calculations

The calculator supports Fraction calculation and the conversions between Fraction, Decimal point, Mixed fraction and Improper fraction.

- Specify the fraction calculation result display format by selecting either **mixed fraction (a b/c)** or **improper fraction (d/c)** in set-up menu.
- At the default setting, fractions are displayed as improper fractions.
- Mixed Fraction display results are only available after selecting (a b/c) in the setup menu.

	Improper Fraction (d/c)	Mixed Fraction (a b/c)
Maths Mode	$\frac{11}{3}$	$3\frac{2}{3}$
Line Mode	11_|3	3_|2_|3

■ Press F↔D to switch a calculation result between fraction and decimal format.

■ Press Shift a b/c↔d/c to switch a calculation result between improper fraction and mixed fraction format.

■ Results will be displayed in decimal format automatically whenever the total digits of a fractional value (integer + numerator + denominator + separator marks) exceeds 10.

■ When a fraction calculation is mixed with decimal values, the result will be displayed in decimal format.

Display Values Exchange

- In Maths mode, press [F↔D] to change the calculation result value between fraction form ⟷ Decimal form, π form ⟷ Decimal form, $\sqrt{}$ form ⟷ Decimal form.
- In Line mode, press [F↔D] to **ONLY** change the calculation result value between fraction form ⟷ Decimal form, the other π and $\sqrt{}$ calculation will display the decimal value only.

LINEI / LINEO MODE: [Shift] [Setup] [1] [3]

Example	Key in operation	Display
$\frac{2}{3}+2=\frac{8}{3}=2.666666667$	[2] [$\frac{\square}{\square}$] [3] [+] [2] [=]	2_|3+2 8_|3
	[F↔D]	2_|3+2 2.666666667

Fraction ⟷ Decimal point conversion

MATHI / MATHO MODE: [Shift] [Setup] [1] [1]

Example	Key in operation	Display
$1\frac{1}{2}+\frac{5}{6}=\frac{7}{3}$	[1] [Shift] [$\square\frac{\square}{\square}$] [1] [▶] [2] [▶] [+] [5] [$\frac{\square}{\square}$] [6] [=]	$1\frac{1}{2}+\frac{5}{6}$ $\frac{7}{3}$
$\frac{7}{3}\leftrightarrow 2.333333333$ (Fraction ⟷ Decimal)	[F↔D]	$1\frac{1}{2}+\frac{5}{6}$ 2.333333333
$2.333333333\leftrightarrow 2\frac{1}{3}$ (Decimal ⟷ Mixed Fraction)	[Shift] [$a\,b/c\leftrightarrow d/c$]	$1\frac{1}{2}+\frac{5}{6}$ $2\frac{1}{3}$

MATHI / MATHO MODE: Shift Setup 1 1

Example	Key in operation	Display
$\frac{2}{3}+2=\frac{8}{3}=2.666666667$	2 $\frac{\square}{\square}$ 3 ▶ + 2 =	$\frac{2}{3}+2$ $\frac{8}{3}$
	F↔D	$\frac{2}{3}+2$ 2.666666667
$\tan 30=\frac{\sqrt{3}}{3}$ $=0.5773502692$	tan 3 0 =	tan(30 $\frac{\sqrt{3}}{3}$
	F↔D	tan(30 0.5773502692
$\pi \div 8=\frac{1}{8}\pi$ $=0.3926990817$	Shift π ÷ 8 =	$\pi \div 8$ $\frac{1}{8}\pi$
	F↔D	$\pi \div 8$ 0.3926990817

NOTE:

- In some Calculation results, pressing F↔D will not convert the display value.
- Some display result conversions may take a long time.

Percentage Calculations %

Example	Key in operation	Display
To calculate 25% of 820	8 2 0 × 2 5 Shift % =	820x25% 205
The percentage of 750 against 1250	7 5 0 ÷ 1 2 5 0 Shift % =	750÷1250% 60

Degree-Minutes-Seconds Calculations

Use the degrees (hours), minutes and seconds key to perform a sexagesimal (base-60 notational system) calculation or convert the sexagesimal value into decimal value.

Degree-Minutes-Seconds ⟷ Decimal points

MATHI / MATHO MODE: Shift Setup 1 1

Example	Key in operation	Display
86°37'34.2" ÷ 0.7 = 123º45'6"	8 6 ° ' " 3 7 ° ' " 3 4 • 2 ° ' " ÷ 0 • 7 =	86º37º34.2º ÷ 0.7 123º45'6"
123º45'6" →123.7516667	° ' "	86º37º34.2º ÷ 0.7 123.7516667
2.3456 → 2º20'44.16"	2 • 3 4 5 6 = ° ' "	2.3456 2º20'44.16"

Engineering Notation and Symbols

Any normal results value can be transform to enineering notation by pressing Eng .

Example	Key in operation	Display
52700	5 2 7 0 0 = Eng	52700 52.7×10^3
	Shift Eng	52700 0.0527×10^6

When Engineering Symbol has turned to ON, There will be an "E" display on the top of the LCD. The results will automatically display in the best metric prefix.

Example	Key in operation	Display
52700	5 2 7 0 0 = Shift Eng	52700 52.7k 52700 0.0527M

Engineering Symbol can also been used for input by pressing Apps ▲ 3 .
Total 11 metric prefix can be used.

Example	Key in operation	Display
600000 + 500000	6 0 0 Apps ▲ 3 6 + 5 0 0 Apps ▲ 3 6 =	600k + 500k 1.1M
	Eng	600k + 500k 1100k

Absolute Value Calculation

MATHI / MATHO MODE: Shift Setup 1 1

Example	Key in operation	Display
$\lvert\sin(60-5)\times(-\pi)\rvert$	Abs sin 6 0 − 5) × ((−) Shift π) =	$\lvert\sin(60-5)\times(-\pi)\rvert$ 2.573442045

Replay & Multi-statements

■ Replay Memory Function

- Replay memory is only available in Calculate and Complex mode.
- After the calculation is executed, the calculation input and result will be stored in the replay memory automatically.
- Pressing ▼ (or ▲) can replay the performed calculation input and result history.
- After obtaining the calculation result on the display, press ◀ or ▶ to edit the input expression of that result.
- If the ▷ Indicator is on the right side of a calculation result display, you need to press [CA] and then ◀ or ▶ to scroll through the calculation.
- Replay memory is cleared when you:

1. Initialize calculator setting by (Shift) [Clear] [3] [=] [CA]
2. Change from one calculation mode or display mode to another.
3. Press (ON) key.
4. Press (Shift) [OFF] to power off the machine.

■ Multi-statements Function

- Use a colon [:] to put two or more calculation expressions together.
- The first executed statement will have " II " indicator; and the " II " icon will disappear after the last statement is executed.

MATHI / MATHO MODE: (Shift) [Setup] [1] [1]

Example	Key in operation	Display
1x12=12 2+25=27 using a multi-statement	[1] [×] [1] [2] (Alpha) [:] [2] [+] [2] [5]	1x12:2+25
	[=]	1x12 ▲ II 12
	[=]	2+25 ▲ 27
Replay the previous calculation history (1 x 12 = 12)	▲	1x12 ▼ 12

Memory Calculations

Ans M- M+ M STO Recall

Memory Variables

- There are 20 memory variables (0 – 9, A – F, M, X, Y and Z), which store data, results, or dedicated values.
- Store values into memory by pressing STO + Memory variable.
- Recall memory values by pressing Shift Recall .
- Memory content can be cleared by pressing 0 STO + Memory

Example: 23 + 7 → A (30 store into A), calculate 2 sinA and clear memory A.

MATHI / MATHO MODE: Shift Setup 1 1

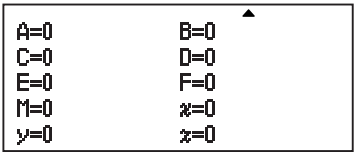
Example	Key in operation	Display
23 + 7 → A	2 3 + 7 STO rA1	23+7→A 30
2 x sin A = 1	2 sin Alpha rA1 =	2sin(A 1
Clear memory	0 STO rA1	0→A 0

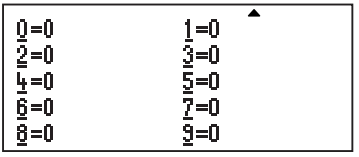
Independent Memory

- Independent memory M uses the same memory area as variable M. It is convenient for calculating cumulative totals by pressing M+ (add to memory) or M- (subtract from memory).
- Memory contents are retained even when the calculator is powered off.
- Clear independent memory (M) by pressing 0 STO M .
- Clear all memory values by pressing Shift 9 (Clear) 2 = CA .

Memory List Recall

- All memory can be recalled in a list by pressing Shift Recall and toggle between (A-F , X, Y, Z and 0-9) by pressing ▲ ▼ .





Answer Memory

- The input values or the most recent calculation result will be automatically stored into Answer memory whenever you press [=], [M+], [Shift] [M-], [STO]. Answer memory can hold up to 18 digits.
- Recall and use the latest stored Answer memory by pressing [Ans].
- Answer memory is not updated when an error operation has been performed.
- Answer memory contents can be maintained even after pressing [CA], changing the calculation mode, or turning off the calculator.

Example	Key in operation	Display
123 + 456 → M+, Ans² = 335,241	1 2 3 + 4 5 6 M+ x^2 =	Ans² 335241
789900 – Ans = 454,659	7 8 9 9 0 0 − Ans =	789900–Ans 454659

Previous Answer Memory

- Previous Answer Memory is only available in Calculate Mode.

Example	Key in operation	Display
123 + 456 → M+, Ans² = 335,241	1 2 3 + 4 5 6 M+ x^2 =	Ans² 335241
789900 – Ans = 454,659	7 8 9 9 0 0 − Ans =	789900–Ans 454659
Previous Answer	[Alpha] [PreAns] =	PreAns 335241

Recurring Decimal Calculations

You can directly input a recurring decimal format values to the calculation.

Note : Recurring decimal display is only available when the setting for recurring decimal has been switched to ON. You can change the answer display format by pressing [F↔D]. Recurring decimal input is possible only when the input mode is selected to either MathI/ MathO or MathI/DecimalO.

MATHI / MATHO MODE: (Shift) (Setup) [1] [1]

Example	Key in operation	Display
To input 0.33333.... ($0.\dot{3}$)	[0] [•]	Math 0.I
	(Alpha) [□̇]	Math 0.I□̇
	[3]	Math 0.3̇I
To input 1.428571428571... $1.\dot{4}2857\dot{1}$	[1] [•] (Alpha) [□̇]	Math 1.I□̇
	[4] [2] [8] [5] [7] [1]	Math 1.428571̇I
To calculate $1.0\dot{2}1 + 2.3\dot{1}\dot{2}$	[1] [•] (Alpha) [□̇] [0] [2] [1] [▶] [+] [2] [•] (Alpha) [□̇] [3] [1] [2] [=]	Math 1.021̇+2.312̇ $\frac{10}{3}$
Calculation result displayed as recurring decimal value:	[F↔D]	Math 1.021̇+2.312̇ $3.\dot{3}$

Conditions for Displaying a Calculation as a Recurring Decimal

If a calculation result satisfies the following conditions, pressing [F↔D] will display it as a recurring decimal value.

- The total number of digits used in the mixed fraction (including integer, numerator, denominator, and separator symbol) must not be more than 10.
- The data size of the value when displayed as a recurring decimal must not be larger than 99 bytes, calculated as: [number of digits (1 byte each)] + [1 byte for the decimal point] + [3 bytes for recurring decimal management code]. for example, the data size of $0.1\dot{2}3$ would be 4 bytes for digits, 1 byte for the decimal point, and 3 bytes for recurring decimal management code, for a total of 8 bytes.

Functional Scientific Calculations

- Press (Mode) 1 to enter Calculate mode.
- π = 3.1415926535897932385
- e = 2.7182818284590452353

Square, Root, Cube, Cube Root, Power, Power Root, Reciprocal and Pi

MATHI / MATHO MODE: (Shift) (Setup) 1 1

Example	Key in operation	Display
$\left(\sqrt[3]{2^2 + 5^3}\right)^{-1} \times \pi$ = 0.6217559776	((Shift) $\sqrt[3]{}$ 2 x^2 + 5 (Shift) x^3 ▶) x^{-1} × (Shift) π =	$\left(\sqrt[3]{2^2 + 5^3}\right)^{-1} \times \pi$ 0.6217559776
$\sqrt[3]{2^6} + \sqrt[5]{243}$ = 7	(Shift) $\sqrt[3]{}$ 2 $x^{\blacksquare}$ 6 ▶ ▶ + $\sqrt{}$ 5 ▶ 2 4 3 =	$\sqrt[3]{2^6} + \sqrt[5]{243}$ 7

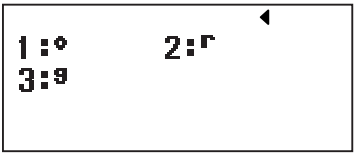
Logarithm, Natural Logarithm, Antilogarithm and $\text{Log}_a b$

MATHI / MATHO MODE: (Shift) (Setup) 1 1

Example	Key in operation	Display
$e^{-3} + 10^{1.2} + \ln 3 =$ 16.99733128	(Shift) $e^{\blacksquare}$ (−) 3 ▶ + (Alpha) $10^{\blacksquare}$ 1 • 2 ▶ + ln 3 =	$e^{-3} + 10^{1.2} + \ln(3$ 16.99733128
$\log_3 81 - \log 1 = 4$	$\log_{\blacksquare}\square$ 3 ▶ 8 1 ▶ − (Shift) log 1 =	$\log_3(81) - \log(1$ 4

Angle Unit Conversion

Convert an angle unit between "Degree", "Radian" and "Gradian" by pressing [Apps] [▲] [2] .



MATHI / MATHO MODE: [Shift] [Setup] [1] [1]

Example	Key in operation	Display
$\sin(\frac{\pi}{2}^{r})$	[sin] [Shift] [π] [▪/□] [2] [▶] [Apps] [▲] [2] [2] [)] [=]	Math D $\sin(\frac{\pi}{2}^{r})$ 1
	[sin] [1] [0] [0] [Apps] [▲] [2] [3] [)] [=]	Math D $\sin(100^{g})$ 1

Trigonometry Calculations

■ Before using the trigonometric functions (except hyperbolic calculations), select the appropriate angle unit (Degree/Radian/Gradian) by pressing [Shift] [Setup] [2] .

Angle Unit Setting	Angle Value Input
Degree	15º
Radian	$\frac{1}{12}\pi$ Radians
Gradian	$\frac{50}{3}$ Gradians

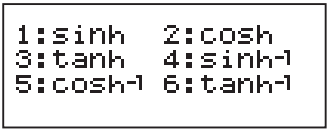
■ 90º = $\frac{\pi}{2}$ Radians = 100 Gradians.

MATHI / MATHO MODE: Shift Setup 1 1

Example	Key in operation	Display
Degree Mode	Shift Setup 2 1	D
$\sin 60 = \frac{\sqrt{3}}{2}$	sin 6 0 =	sin(60 $\frac{\sqrt{3}}{2}$
$\frac{1}{\sin 45°} = \text{cosec } 45° = \sqrt{2}$	sin 4 5) x^{-1} =	$\sin(45)^{-1}$ $\sqrt{2}$

Hyperbolic (sinh/ cosh/ tanh), Inverse Hyperbolic ($\sinh^{-1}$/$\cosh^{-1}$/$\tanh^{-1}$) functions.

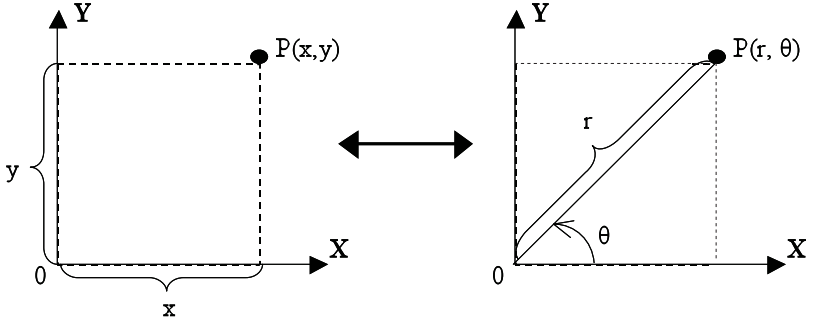
■ Press Apps ▲ 1 .



Example	Key in operation	Display
sinh2.5 – cosh 2.5 = –0.08208499882	Apps ▲ 1 1 2 • 5) − Apps ▲ 1 2 2 • 5) =	sinh(2.5)–cosh(2.▷ – 0.08208499862
$\cosh^{-1}45$ = 4.499686191	Apps ▲ 1 5 4 5) =	$\cosh^{-1}(45)$ 4.499686191

Coordinate Conversion

- With polar coordinates, you can calculate and display θ within the range of $-180^{o} < \theta \leq 180^{o}$. (Same as Radian and Gradient)
- In MathI / MathO mode, press ◀ or ▶ to scroll through the calculation result.
- In Line mode, (x,y) or (r, θ) will be shown over 2 lines.
- After conversion, the results will be assigned to memory variables X and Y. Press Shift Recall to show the results.



Rectangular Coordinates (Rec) Polar Coordinates (Pol)

Shift Pol(: Convert rectangular coordinates (x, y) to polar coordinates (r, θ); press Shift Recall for r (x) and θ (y).

MATHI / MATHO MODE: Shift Setup 1 1

Example	Key in operation	Display
With rectangular coordinate (x=1, y=√3). Find Polar coordinate (r, θ) at degree mode	Shift Pol(1 Shift , √■ 3 =	Pol(1,√3 r=2, θ=60
	Shift Recall	A=0 B=0 C=0 D=0 E=0 F=0 M=0 x=2 y=60 z=0

Shift Rec(: Convert polar coordinates (r, θ) to rectangular coordinates (x, y); press Shift Recall for x and y.

LINEI / LINEO MODE: Shift Setup 1 3

Example	Key in operation	Display
With Polar coordinate (r=2, θ=60º). Find Rectangular coordinate (x, y) at degree mode	Shift Rec(2 Shift , 6 0 =	Rec(2, 60 X= 1 Y= 1.732050808
	Shift Recall	A=0 B=0 C=0 D=0 E=0 F=0 M=0 x=1 y=1.7320508 z=0

Permutation, Combination, Factorials and Random Number Generation

Permutation : $nPr = \frac{n!}{(n-r)!}$

Combination : $nCr = \frac{n!}{r!(n-r)!}$

Factorial : $x! = x(x-1)(x-2)\ldots(2)(1)$

Example	Key in operation	Display
${}_{10}P_3 = 720$	1 0 Shift nPr 3 =	10**P**3 720
${}_5C_2 = 10$	5 Shift nCr 2 =	5**C**2 10
5! = 120	5 Shift x! =	5! 120

Random Number Generation

Shift Rand : Generate a random number between 0.000 and 0.999. The display result will be in fraction format in MathI/MathO mode.

Alpha i-Rand : Generate a random number between two specified positive integers. The entry is divided by " , "

MATHI / MATHO MODE: Shift Setup 1 1

Example	Key in operation	Display
Generate a random number between 0.000 & 0.999	Shift Rand =	Rand $\frac{139}{1000}$
Generate an integer from a range of 1 to 100	Alpha i-Rand 1 Shift , 1 0 0 =	i~Rand(1,100 33

* The value shown here is only a sample, results will differ each time.

Product (∏) Calculation

■ **a** = start, **b** = end, **c** = formula

Math mode: $\prod_{x=a}^{b}(C)$ Line mode: **∏ (c, a, b)**

Example: Product of (x+1) from 0 to 5

MATHI / MATHO MODE: Shift Setup 1 1

Key in operation	Display
Alpha $\square^{\square}$ x + 1 ▲ 5 ▼ 0 =	$\prod_{x=0}^{5}(x+1)$ 720

Summation (∑) Calculation

■ **a** = start, **b** = end, **c** = formula

Math mode: $\sum_{x=a}^{b}(C)$ Line mode: ∑**(c, a, b)**

Example: Summation of (x+1) from 1 to 5

LINEI / LINEO MODE: Shift Setup 1 3

Key in operation	Display
Shift ∑□ x + 1 Shift , 1 Shift , 5 =	∑(x+1, 1,5 20

Solve Function

■ Solve functions use Newton's Method to obtain the approximate solution of equations.

Note: SOLVE function can be used in the Calculation Mode only.

■ The following describes the types of equations whose solutions can be obtained by using SOLVE function.

- **Equations that include variable X,**
  SOLVE function solves for X, for example, **$X^2 + 2X - 2$, X = Y + 3, X – 5 = A + B, X = tan(C)**,
  - Variable X to be solved should be put at the left hand side of the equation. For example, an equation is input as $X^2 + 5X = 24$ or $X^2 + 5X - 24 = 0$ or $X^2 + 5X - 24$.
  - An expression like $X^2 + 5X - 24$ will be treated as $X^2 + 5X - 24 = 0$, not necessary to input " = 0 ".

Important precaution when using "Solve" function:

- The following functions $\int$, $\frac{d}{dx}$, $\sum$, $\prod$, Pol, Rec, Q…r, Rand, i-Rand or multi-statement are not allowed to input into an equation for SOLVE function.
- Since SOLVE function uses Newton's Method to obtain the solution, even if there are multiple solutions, only one of them will be shown as the solution.
- SOLVE function may not be able to obtain a solution because of preset initial value of the solution variable. In case this happens, try to change the initial value of the solution variable.
- SOLVE function may not be able to find the correct solution, even if the solution(s) exists.
- If an equation contains input functions that include an open parenthesis, do not omit the closing parenthesis.
- It will show "Variable ERROR" when the expression does not contain the variable that you want to solve.
- Newton's Method may have problems for solving the following types of functions, for example $y = e^x$, $y = \frac{1}{X}$, $y = \sin(x)$, $y = \sqrt{x}$, etc.
- In case the equation takes long time for solving, the calculator will display "PROCESSING" screen, you can cancel the processing of SOLVE operation by pressing the [CA] key.

Example: To solve $\frac{1}{5}X^2 = 30$

MATHI / MATHO MODE: [Shift] [Setup] [1] [1]

Key in Operation	Display
[1] [a b/c] [5] [▶] [x] [x²] [Alpha] [=] [3] [0]	$\frac{1}{5}X^2 = 30$
[Shift] [Solve]	$\frac{1}{5}X^2 = 30$ x = 0
[1] [=]	$\frac{1}{5}X^2 = 30$ x = 1
[=]	$\frac{1}{5}X^2 = 30$ x = 12.24744871 L–R= 0

- The Precision of Solution shows the result when the obtained solution is assigned to the solution variable. The precision of the obtained solution is higher if this value is closer to zero.
  However, if the precision of solution does not equal to zero, the results would not be the real solution of the equation.

CALC Function

- CALC function is a memory zone to store a single calculation expression which can be recalled and calculated a number of times with different values.
- After inputting the calculation expression and pressing [Calc], the calculator will request for the current value of your input variables.
- CALC function can only be used in **Calculate mode** or **Complex mode**.

Example: For the equation $Y = 5x^2 - 2x + 1$, calculate the value of Y if x = 5 or x = 7.

LINEI / LINEO MODE: (Shift) (Setup) [1] [3]

Key in operation	Display
(Mode) [1]	
(Alpha) [y] (Alpha) [=] [5] [x] [x^2] [−] [2] (Alpha) [x] [+] [1]	$y=5x^2-2x+1$
[Calc] [5] [=] [=]	$y=5x^2-2x+1$ 116
[Calc] [7] [=] [=]	$y=5x^2-2x+1$ 232

! The [Calc] stored expression will be cleared when you start a new calculation, change into another mode, or turn off the calculator.

Differential Calculations

■ Differential Calculations can be used in the Calculate mode only.

■ To perform a differential calculation, you have to input the expression in the form of: (Shift) $\frac{d}{dx}$■ f(x) , a , Δx)

- f(x) : Function of X. (All non-X variables are treated as constants.)
- a : Differential point.
- Δx : Tolerance (calculation precision); for Line mode only

■ Your calculator performs differential calculations by aprroximating the derivative based on centered difference approximation.

Example: To determine the derivative at point x = 10, $\Delta x = 10^{-8}$, for the function f(x) = sin(3x + 30)

LINEI / LINEO MODE: (Shift) Setup 1 3

Key in operation	Display
(Mode) 1	
(Shift) $\frac{d}{dx}$■ sin 3 X + 3 0) (Shift) , 1 0 (Shift) , 1 ×10^x (−) 8) =	d/dx(sin(3x+30),1 0,1x10−8) 0.02617993878

! You can leave out the Δx in the differential expression and the calculator will automatically substitute a value for Δx.

! The smaller the entered value Δx is, the longer the calculation time will be with more accurate results, the larger the entered value Δx is, the shorter the calculation time will be with comparatively less accurate results.

! Inaccurate results and errors can be caused by the following :
- Discontinuous points in x values
- Extreme changes in x value
- Inclusion of the local maximum point and local minimum point in x values.
- Inclusion of the inflection point in x values
- Inclusion of undifferentiable points in x values
- Differential calculation results approaching zero

! When performing differential calculations with trigonometric functions, select radian (Rad) as the angle unit setting.

! i~Rand(, Rec(, Pol(, ∫(, d/dx(, ∑(, and ∏(functions cannot join in differential calculations.

! You can cancel the processing of differential calculation by pressing the CA key.

Integration Calculations

- Integration Calculations can be used in the Calculate mode only.
- To perform an integration calculation you are required to input the following elements:

$\int$ **f(x)** , **a** , **b** , **n**)

  - f(x) : Function of X. (All non-X variables are treated as constants.)
  - a, b : The integration range of the definite integral.
  - n : Tolerance; for Line Mode only

- The integration calculation is based on Gauss-kronrod method.

- The internal integration calculations may take considerable time to complete. For some cases, even after considerable time is spent performing a calculation, the calculation results may be erroneous. Particularly when significant digits are less than 1, an ERROR might occur.

Example: Perform the integration calculation for, with n = 4.

$$\int_2^3 (5x^4 + 3x^2 + 2x + 1)dx$$

LINEI / LINEO MODE: Shift Setup 1 3

Key in operation	Display
Mode 1	
$\int$ 5 x $x^{\blacksquare}$ 4) + 3 x x^2 + 2 x + 1 Shift , 2 Shift , 3 Shift , 4) =	$\int$(5x^(4)+3x²+2x+1 ,2,3,4) 236

! When performing integration calculations with trigonometric functions, select radian (Rad) as the angle unit setting.

! i~Rand(, Rec(, Pol(, $\int$(, d/dx(, Σ(, Π(functions can not join to integration calculations.

Apps Function in Calculate Mode

Prime Factorization

■ Factor a positive integer of up to 10 digits into prime factors of up to 3 digits.

PFact Number : 0 < X < 99999 99999 (X is integer)

■ The reminder that cannot be factored will be enclosed in parentheses on the display.

Example: 99999 99999 = 3^2 x 11 x 41 x 271 x (9091)

MATHI / MATHO MODE: (Shift) (Setup) 1 1

Key in Operation	Display
Apps 4 9 9 9 9 9 9 9 9 9 9 =	Math D PFact(9999999999 3^2x11x41x271x(909▶
Apps 4 1 7 7 7 =	Math D PFact(1777 (1777)

NOTE:

- [Math ERROR] will be shown if decimal value, fraction, negative value, or Pol, Rec has been input.

Quotient and Remainder Calculations

- "Quotient" (Q) is the result in a division problem, "Remainder" (r) is the value remaining in an integer division problem.
- The calculated quotient value (Q) and remainder (r) will be stored into memory variables "C" and "D", automatically assigned.
- In Maths mode, press ◀ or ▶ to scroll through a long calculation result.
- In Line mode, the quotient value (Q) and remainder (r) will be shown over 2 lines.
- Only the Quotient Value (Q) can be used for continue calculation.

LINEI / LINEO MODE: Shift Setup 1 3

Example	Key in operation	Display
35 ÷ 10 = 3 x 10 +5 Q=3 R=5	Apps 1 3 5 Shift , 1 0 =	Q…R(35, 10 Q= 3 R= 5
Quotient value (Q) + 3 = 6	+ 3 =	Ans+3 6

HCF and LCM

- Higest Common Factor and Least Common Multiple functions.

MATHI / MATHO MODE: Shift Setup 1 1

Example	Key in operation	Display
HCF(35 , 125)	Apps 3 3 5 Shift , 1 2 5) =	HCF(35 , 125) 5
LCM(20 , 36)	Apps 2 2 0 Shift , 3 6) =	LCM(20 , 36) 180

Integer Part of Value and Largest Integer that does not exceed a Value

MATHI / MATHO MODE: Shift Setup 1 1

Example	Key in operation	Display
Int(–2.5)	Apps 6 (–) 2 • 5) =	Int(–2.5) –2
Intg(–2.5)	Apps 7 (–) 2 • 5) =	Intg(–2.5) –3

Limit Calculations

- You can find the limit existance and the limit value of a equation by using this function.
- When the limit value does not exist, the answer will be displayed as "Infinity".

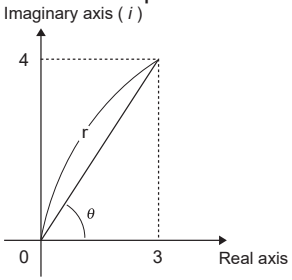
Example: $\lim_{x\to 3}\left(\frac{\frac{1}{x}-\frac{1}{3}}{x-3}\right)$

MATHI / MATHO MODE: Shift Setup 1 1

Key in operation	Display
Apps 5 ÷ 1 ÷ x ▶ − 1 ÷ 3 ▶ ▶ x − 3 ▶ ▶ 3 =	$\lim\left[\frac{\frac{1}{x}-\frac{1}{3}}{x-3}\right]_{x\to 3}$ $-\frac{1}{9}$

Complex Number Calculations

Complex numbers can be expressed in rectangular form (z = a + bi) or polar form (r∠θ). Where " a " is the real number, " bi " is the imaginary number (and i is the imaginary unit equal to the square root of –1, $\sqrt{-1}$), " r " is the absolute value, and " θ " is the argument of the complex number.

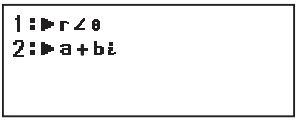


■ Press Mode 2 to enter Complex Number Calculations mode.

■ Press Apps to select the calculation type.

Complex Number Type Selection

There are 6 types of complex number calculations in the Complex Number Type screen. Press Apps the number to select the type of Complex Number Calculation:



■ Check the current angle unit setting (Degree, Radian, Gradian).

■ [i] indicates the display result is the imaginary number;
[∠] indicates the display value is the argument value θ.

■ Imaginary numbers will use up replay memory capacity.

Rectangular Form and Polar Form Conversion

MATHI / MATHO MODE: Shift Setup 1 1

Example	Key in operation	Display
Find the polar form of $3+4i$	3 + 4 $\leftarrow i$ Apps ▼ 1 =	$3+4i$ ▶r∠θ $5\angle 53.13010235$
Find the Rectangular Form of $\sqrt{2}\angle 45$	$\sqrt{\blacksquare}$ 2 ▶ Shift $r\angle\theta$ 4 5 Apps ▼ 2 =	$\sqrt{2}\angle 45$ ▶a + bi $1+i$

Absolute Value Calculation and Argument Calculation

With the rectangular form complex number, you can calculate the corresponding absolute value (r) or argument (θ) by pressing [Abs] or [Apps] [1] respectively.

LINEI / LINEO MODE: [Shift] [Setup] [1] [3]

Example	Key in operation	Display
Find the absolute value (r) and argument (θ) of Complex number 6 +8i	[Abs] [6] [+] [8] [$\leftarrow i$] [)] [=]	Abs(6 + 8i) 10
	[▶] [DEL] [Apps] [1] [=]	Arg(6 + 8i) 53.13010235

Conjugate of a Complex Number

If the complex number is z = a + bi, the conjugate value of this complex number should be z = a – bi.

LINEI / LINEO MODE: [Shift] [Setup] [1] [3]

Example	Key in operation	Display
Find the conjugate value of 3+4i	[Apps] [2] [3] [+] [4] [$\leftarrow i$] [)] [=]	Conjg(3+4i) 3 –4i

Determine the Real/Imaginary Values of a Complex Number

MATHI / MATHO MODE: [Shift] [Setup] [1] [1]

Example	Key in operation	Display
Find the Real and Imaginary values and a complex number 23∠54	[Apps] [3] [2] [3] [Shift] [$r\angle\theta$] [5] [4] [)] [=]	Real(23∠54) 13.5190608
	[▶] [DEL] [Apps] [4] [=]	Imag(23∠54) 18.60739087

Calculations Involve Specific Number System

- Press (Mode) 3 to enter Calculations involve specific number system mode.
- Decimal (Base 10), hexadecimal (Base 16), pental (Base 5), binary (Base 2), octal (Base 8), or logical calculations.
- To select a specific number system in base mode, simply press DEC Decimal, HEX Hexadecimal, PEN Pental, BIN Binary , or OCT Octal.
- To input hexadecimal values A through F, press the corresponding buttons: rA1 , rB1 , rC1 , rD1 , rE1 , rF1 .
- Press Apps key to perform logical calculations including: Logic connection [and] / [or], exclusive or [xor], exclusive nor [xnor], argument complement [Not] and negation [Neg].
- In Calculations involve specific number system mode all the scientific function cannot be used, and you cannot input the value with decimal places or exponents.

Example	Key in operation	Display
In Binary Mode 10101011+1100– 1001x101÷10 =10100001	BIN 1 0 1 0 1 0 1 1 + 1 1 0 0 − 1 0 0 1 × 1 0 1 ÷ 1 0 =	[Bin] 1×101÷10 0000 0000 0000 0000 0000 0000 1010 0001
In Hexadecimal Mode (77A6C+D9)xB÷F =57C87	HEX (7 7 rA1 6 rC1 + rD1 9) × rB1 ÷ rF1 =	[Hex] (77A6C+D9) ×B÷F 00057C87

Base-n Transformation

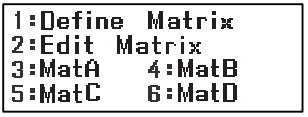
Example	Key in operation	Display
Find 12345+101 in Decimal mode, and then convert the result to Hexadecimal	DEC 1 2 3 4 5 + 1 0 1 =	[Dec] 12345+101 12446
	HEX	[Hex] 12345+101 0000309E

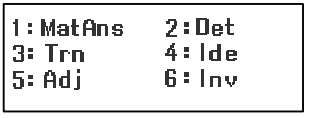
Logical Operation

Example	Key in operation	Display
In Hexadecimal Mode, find the logical Xnor of 789ABC and 147258 ($789ABC_{16}$ Xnor 147258_{16})	HEX 7 8 9 rA rB rC Apps 4 1 4 7 2 5 8 =	[Hex] 789ABCxnor147258 FF93171B
In Hexadecimal Mode, find the logical OR of calculation result and 789ABC ($FF93171B_{16}$ OR $789ABC_{16}$)	Ans Apps 2 7 8 9 rA rB rC =	[Hex] FF93171B Ansor789ABC FFFB9FBF
In Hexadecimal Mode, find the negative vale of $789ABC_{16}$	HEX Apps 6 7 8 9 rA rB rC =	[Hex] Neg(789ABC FF876544

Matrix Calculations

- In Matrix mode, you can store a maximum of four matrices (MatA, MatB, MatC, and MatD) simultaneously. Matrix dimensions are limited to a maximum of 4 rows by 4 columns (4x4).
- Matrix calculation results are automatically saved to the MatAns memory. You can use the MatAns value in subsequent matrix calculations.
- Press (Mode) [4] to enter Matrix Calculations mode.
- Press [CA] [Apps] to use the Matrix Application, and press (▲) or (▼) for the next or previous pages.





Item	Description
Define Matrix	Specify the matrix memory of MatA to MatD, and specify the dimension (up to 4x4)
Edit Matrix	Select a specific matrix (MatA to MatD) to edit its element values.
MatA to MatD	Select one of matrix (MatA to MatD)
MatAns	Automatically stores the results of the last matrix calculation. This memory can be recalled for subsequent use.
Det	Calculate the determinant of a selected matrix
Trn	Generate the transpose of a selected matrix
Ide	Create an identity matrix of a specified dimension
Adj	Calculate the adjugate (adjoint) of a selected matrix
Inv	Calculate the inverse of a selected matrix

Create a Matrix

- Example: $\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}$
- Press (Mode) [4] to enter Matrix Calculations mode.
- Press [1] (MatA), [2] (2rows), [2] (2coulmns)
- Input the elements of MatA: [1] [=] [2] [=] [3] [=] [4] [=]
- Press [CA] to exit the matrix creating screen.

Edit Matrix data

- Press [CA] [Apps] [2] (Edit Matrix),
- Select the target matrix (MatA to MatD) for editing, and navigate to the desired element.
- Input the new value and press [=] to save the edit.
- Press [CA] to exit the matrix editing screen.

Matrix Calculation

Example: $MatA = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$, $MatB = \begin{bmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{bmatrix}$, calculate MatA x MatB=?

Example	Key in operation	Display
Create MatA	[Mode] [4] [1] [3] [3]	MatA = $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ 0
Input element value of MatA	[1] [=] [2] [=] [3] [=] [4] [=] [5] [=] [6] [=] [7] [=] [8] [=] [9] [=]	MatA = $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ 9
Create MatB	[CA] [Apps] [1] [2] [3] [3]	MatB = $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ 0
Input element value of MatB	[9] [=] [8] [=] [7] [=] [6] [=] [5] [=] [4] [=] [3] [=] [2] [=] [1] [=]	MatB = $\begin{bmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{bmatrix}$ 1
Calculate MatA x MatB	[CA] [Apps] [3] [×] [Apps] [4] [=]	MatAns = $\begin{bmatrix} 30 & 24 & 18 \\ 84 & 69 & 54 \\ 138 & 114 & 90 \end{bmatrix}$ 30

- When performing matrix addition, subtraction, or multiplication, all matrices involved must be compatible in size (have the same dimensions). An error will occur if you attempt to calculate with matrices of different dimensions. For example, you cannot add or subtract a 2x3 matrix and a 2x2 matrix.

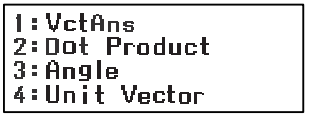
Example: $MatC = \begin{bmatrix} 10 & -5 \\ -4 & 9 \end{bmatrix}$ $MatD = \begin{bmatrix} 9 & 5 \\ 6 & -2 \\ 8 & 4 \end{bmatrix}$

Example	Key in operation	Display
Calculate the scalar product of MatC (MatC ×2)	Apps 5 × 2 =	MatAns = $\begin{bmatrix} 20 & -10 \\ -8 & 18 \end{bmatrix}$ 20
Calculate the determinant of MatC	Apps ▼ 2 Apps 5) =	Det(MatC) 70
Generate the transpose of MatD	Apps ▼ 3 Apps 6) =	MatAns = $\begin{bmatrix} 9 & 6 & 8 \\ 5 & -2 & 4 \end{bmatrix}$ 9
Subtract a 2x2 identity matrix from MatC (MatC – Identity (2x2))	Apps 5 − Apps ▼ 4 2) =	MatAns = $\begin{bmatrix} 9 & -5 \\ -4 & 8 \end{bmatrix}$ 9
Calculate the adjoint of MatC	Apps ▼ 5 Apps 5) =	MatAns = $\begin{bmatrix} 9 & 5 \\ 4 & 10 \end{bmatrix}$ 9
Calculate the inverse of MatC	Apps ▼ 6 Apps 5) =	MatAns = $\begin{bmatrix} 0.1285 & 0.0714 \\ 0.0571 & 0.1428 \end{bmatrix}$ 9⌋70
Calculate the square of MatC	Apps 5 x^2 =	MatAns= $\begin{bmatrix} 120 & -95 \\ -76 & 101 \end{bmatrix}$ 120
Calculate the cube of MatC	Apps 5 Shift x^3 =	MatAns = $\begin{bmatrix} 1580 & -1455 \\ -1164 & 1289 \end{bmatrix}$ 1580
Calculate the absolute vale of MatC	Abs Apps 5) =	MatAns = $\begin{bmatrix} 10 & 5 \\ 4 & 9 \end{bmatrix}$ 10

- When using the Identity Matrix command (Ide), you can input a value from 1 to 4 as the argument (number of dimensions).

Vector Calculations

- In Vector mode, you can store a maximum of four vectors (VctA, VctB, VctC, and VctD) simultaneously, each having two or three dimensions.
- Vector calculation results are automatically saved to the VctAns memory. You can use the VctAns value in subsequent vector calculations.
- Press Mode 5 to enter Vector Calculations mode.
- Press CA Apps to use the Vector Application, and press ▼ or ▲ for the next or previous pages.



Item	Description
Define Vector	Specify the vector memory of VctA to VctD, and specify the dimension (2D or 3D)
Edit Vector	Select a specific vector (VctA to VctD) to edit its element values.
VctA to VctD	Select one of vectors (VctA to VctD)
VctAns	Automatically stores the results of the last vector calculation. This memory can be recalled for subsequent use.
Dot Product	Use the "•" command to obtain the dot product of two vectors
Angle	Calculate the angle formed between 2 specific vectors
Unit Vector	Calculate the unit vector in the same direction

Create a Vector

- Example: VctA(1,2)
- Press Mode 5 to enter Vector Calculations mode.
- Press 1 (VctA), 2 (2 dimensions)
- Input the element of VctA: 1 = 2 =
- Press CA to exit the vector creating screen.

Edit Vector data

■ Press [CA] [Apps] [2] (Edit Vector).

■ Select the target vector (VctA to VctD) for editing, and navigate to the desired element.

■ Input the new value and press [=] to save the edit.

■ Press [CA] to exit the vector editing screen.

Vector Calculation

Example: VctA = (9,5), VctB= (7,3)

Example	Key in operation	Display
Create VctA	[Mode] [5] [1] [2]	VctA = $\begin{bmatrix}0\\0\end{bmatrix}$ 0
Input element value of VctA	[9] [=] [5] [=]	VctA = $\begin{bmatrix}9\\5\end{bmatrix}$ 5
Create VctB	[CA] [Apps] [1] [2] [2]	VctB = $\begin{bmatrix}0\\0\end{bmatrix}$ 0
Input element value of VctB	[7] [=] [3] [=]	VctB = $\begin{bmatrix}7\\3\end{bmatrix}$ 3
Calculate VctA – VctB	[CA] [Apps] [3] [−] [Apps] [4] [=]	VctAns = $\begin{bmatrix}2\\2\end{bmatrix}$ 2

- When performing vector addition or subtraction, all vectors involved must be compatible in size (have the same dimensions). An error will occur if you attempt to calculate with vectors of different dimensions. For example, you cannot add or subtract a 2-dimensinal vector and a 3-dimensinal vector.

Example: VctC = (4,5,–6), VctD = (–7,8,9)

Example	Key in operation	Display
Calculate the scalar product of VctC (VctC × 5)	Apps 5 × 5 =	VctAns = $\begin{pmatrix} 20 \\ 25 \\ -30 \end{pmatrix}$ 20
Calculate the inner product of VctC and VctD (VctC • VctD)	Apps 5 Apps ▼ 2 Apps 6 =	VctC • VctD –42
Calculate the outer product of VctC and VctD (VctC x VctD)	Apps 5 × Apps 6 =	VctAns = $\begin{pmatrix} 93 \\ 6 \\ 67 \end{pmatrix}$ 93
Calculate the absolute value of VctC	Abs Apps 5) =	Abs(VctC) 8.774964387
Calculate angle of VctC and VctD	Apps ▼ 3 Apps 5 Shift , Apps 6) =	Angle(VctC, VctD) 110.0987671
Calculate the unit vector of VctC	Apps ▼ 4 Apps 5) =	VctAns = $\begin{pmatrix} 0.4558 \\ 0.5698 \\ -0.683 \end{pmatrix}$ 0.4558423058

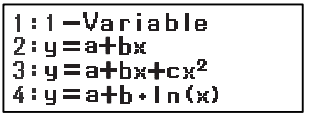
- An error will occur if you attempt to calculate the dot product or cross product of two vectors that have incompatible dimensions.

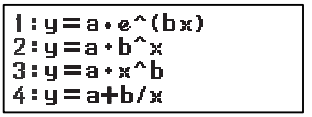
Statistical Calculations

- Press (Mode) [6] to enter Statistical Calculation mode.
- Press [Apps] [1] (Select Type) to select the calculation type.

Statistical Type Selection

There are 8 types of statistical calculation, after entering the statistic type selection screen, press the number to selection the type of statistic calculation.





Key in operation	Type of statistical calculation
[1] 1-Variable	One-variable statistics (x)
[2] y = a + bx	Two-variable, Linear regression
[3] y = a + bx + cx²	Two-variable, Quadratic regression
[4] y = a + b • ln (x)	Two-variable, Logarithmic regression
(▼) [1] y = a • e^(bx)	Two-variable, e Exponential regression
(▼) [2] y = a • b^x	Two-variable, ab Exponential regression
(▼) [3] y = a • x^b	Two-variable, Power regression
(▼) [4] y = a+b/x	Two-variable, Inverse regression

Statistical Data Input

- You can access the Statistical Data Input screen using any of the following methods.
  - For 1-Variable type, press [Apps] [3] to edit the data.
  - For 2-Variables type, press [Apps] [4] to edit the data.
- Use the Freq (frequency) column to input the quantity (frequency) of identical data items. Enable this column by press (Shift) (Setup) (▼) [3] [1].

■ The following table is the maximum number of data lines available for input.

Statistic	Freq ON	Freq OFF
1-Variable (only x input)	80	160
2-Variables (x & y input)	53	80

■ After entering a data value, press [=] to store the value in the statistical registers and save to the current cell. Use the cursor keys to navigate between cells.

■ All the data currently input in statistical data input screen will be deleted if you perform any of the following actions:
- Exit the Statistical Calculations mode
- Switch between the single-variable and a paired-variable statistical calculation type
- Change the statistics setting on the setup menu.

Editing statistical sample data

■ To replace the data in a cell
(1) In the statistical data input screen, use the cursor key to highlight the cell you want to edit.
(2) Input the new data value or expression, and press [=] to save the edit.

■ To delete a data line
(1) In the statistical data input screen, use the cursor key to highlight the cell you want to delete.
(2) Press [DEL]

■ To insert a data line
(1) In the statistical data input screen, use the cursor key to highlight the line you want to insert the new line above.
(2) Press [Apps] [2] [1]

■ To delete all statistical data input
(1) Press [Apps] [2] [2]

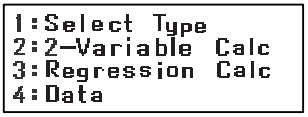
Statistical Calculation Screen

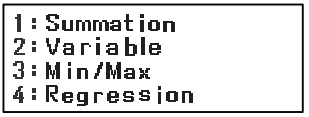
■ After inputting the data, press [CA] to enter the statistical calculation screen.

■ Statistical Calculation screen is in LineI / LineO Mode.

■ Use the Statistical Menu to calculate the Statistical result.

Statistical Menu





Item	Description
Select Type	Enter the statistical calculation type screen
1-Variable Calc / 2-Variable Calc	Show the statistical calculation result
Regression Calc	Enter the regression calculation result screen (for 2 variables only)
Data	Enter the statistical data input screen
Summation	Enter the Summation sub-menu (calculating sum)
Variable	Enter the Variable sub-menu (calculating variable)
Min/Max	Enter the Min/Max sub-menu (calculating descriptive statistics)
Norm Dist	Enter the Distribution Calculation (for 1 variable only)
Regression	Enter the regression calculation result screen (for 2 variables only)

Statistical calculation result

STAT sub-menu	STAT Type	Value	Symbol	Key in operation
Summation	1 & 2 variable STAT	Summation of all x value	$\sum x$	Apps ▼ 1 1
		Summation of all x^2 value	$\sum x^2$	Apps ▼ 1 2
	2 variable STAT	Summation of all x^3 value	$\sum x^3$	Apps ▼ 1 3
		Summation of all x^4 value	$\sum x^4$	Apps ▼ 1 4
		Summation of all y value	$\sum y$	Apps ▼ 1 5
		Summation of all y^2 value	$\sum y^2$	Apps ▼ 1 6
		Summation of all xy pairs	$\sum xy$	Apps ▼ 1 7
		Summation of all x^2y pairs	$\sum x^2y$	Apps ▼ 1 8
Variable	1 & 2 variable STAT	Number of data sample	n	Apps ▼ 2 1
		Mean of the x values	$\bar{x}$	Apps ▼ 2 2
		Population standard deviation of x	σx	Apps ▼ 2 3
		Sample standard deviation of x	sx	Apps ▼ 2 4
		Population Variance of x	$\sigma^2 x$	Apps ▼ 2 5
		Sample Variance of x	$s^2 x$	Apps ▼ 2 6
	2 variable STAT	Mean of the y values	$\bar{y}$	Apps ▼ 2 7
		Population standard deviation of y	σy	Apps ▼ 2 8
		Sample standard deviation of y	sy	Apps ▼ 2 ▼ 1
		Population Variance of y	$\sigma^2 y$	Apps ▼ 2 ▼ 2
		Sample Variance of y	$s^2 y$	Apps ▼ 2 ▼ 3

STAT sub-menu	STAT Type	Value	Symbol	Key in operation
Min/Max	1 & 2 variable STAT	Minimum value of x	min(x)	Apps ▼ 3 1
		Maximum value of x	max(x)	Apps ▼ 3 2
	1 variable STAT	Median	med	Apps ▼ 3 3
		Mode	mode	Apps ▼ 3 4
		1st Quartile value	Q_1	Apps ▼ 3 5
		3rd Quartile value	Q_3	Apps ▼ 3 6
		Range	range	Apps ▼ 3 7
	2 variable STAT	Minimum value of y	min(y)	Apps ▼ 3 3
		Maximum value of y	max(y)	Apps ▼ 3 4
Regression	2 variable STAT, non-Quadratic Regression	Regression coefficient a	a	Apps ▼ 4 1
		Regression coefficient b	b	Apps ▼ 4 2
		Correlation coefficient r	r	Apps ▼ 4 3
		Estimate value of x	$\hat{x}$	Apps ▼ 4 4
		Estimate value of y	$\hat{y}$	Apps ▼ 4 5
	2 variable STAT, Quadratic Regression	Regression coefficient a	a	Apps ▼ 4 1
		Regression coefficient b	b	Apps ▼ 4 2
		Regression coefficient c	c	Apps ▼ 4 3
		Estimate value of x_1	$\hat{x}_1$	Apps ▼ 4 4
		Estimate value of x_2	$\hat{x}_2$	Apps ▼ 4 5
		Estimate value of y	$\hat{y}$	Apps ▼ 4 6

1-Variable Statistical Calculation

Example: Calculate $\sum x^2$, $\sum x$, n, $\bar{x}$, σx, min(x) and max(x) for data 75, 85, 90, 77, 79. (Freq: OFF)

Key in operation	Display
Mode 6 1	x 1 2 3 4
7 5 = 8 5 = 9 0 = 7 7 = 7 9 =	x 3 90 4 77 5 79 6
CA Apps ▼ 1 2 =	$\sum x^2$ 33120
Apps ▼ 1 1 =	$\sum x$ 406
Apps ▼ 2 1 =	n 5
Apps ▼ 2 2 =	$\bar{x}$ 81.2
Apps ▼ 2 3 =	σx 5.528109984
Apps ▼ 3 1 =	min(x) 75
Apps ▼ 3 2 =	max(x) 90

Quadratic Regression Type Statistical Calculation

Example: ABC Company investigated the effectiveness of its advertisement expenses (in coded units) using the following data:

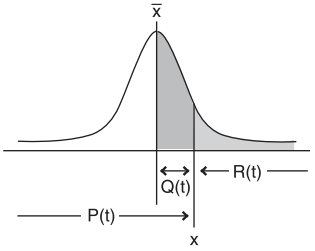
Advertisement expenses: X	18	35	40	21	19
Effectiveness: y (%)	38	54	59	40	38

Please estimate the value of y (effectiveness percentage) when the advertisement expenses X=30, also estimate the value of X_1, X_2 (advertisement expenses level) when the effectiveness is y = 50 by quadratic regression.

Key in operation	Display
Mode 6 3	x y 1 2 3 4
1 8 = 3 5 = 4 0 = 2 1 = 1 9 = ▼ ▶ 3 8 = 5 4 = 5 9 = 4 0 = 3 8 =	x y 3 40 59 4 21 40 5 19 38 6
CA 3 0 Apps ▼ 4 6 =	$30\hat{y}$ 48.69615715
5 0 Apps ▼ 4 4 =	$50\hat{x}_1$ 31.30538226
5 0 Apps ▼ 4 5 =	$50\hat{x}_2$ –167.1096731

Normal Distribution Calculations using 1-Variable data

After entering the sample data within 1-Variable Statistical mode, you can perform the normal distribution or probability distribution calculation such as P(t), Q(t) and R(t) in which t represents the variate of the probabilistic experiment.



$$t = \frac{x - \bar{x}}{x\sigma^n}$$

x : Random variable

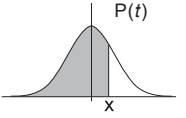
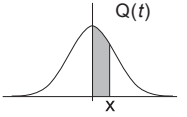
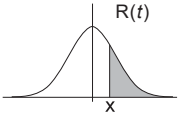
$\bar{x}$: Mean of sample

$x\sigma^n$: Standard deviation

- Press [Apps] [1] [1] to enter 1-Variable Statistical mode.
- Press [CA] [Apps] [▼] [4] to display distribution calculation screen.

1: P(	**2: Q(**
3: R(	**4: ▶t**

- Press [1], [2], [3] or [4] for the corresponding calculations.

P(t): Probability below a given point x	$P(t)=\int_{-\infty}^{x} \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{t-u}{\sigma}\right)^2} dt$, 
Q(t): Probability below a given point x and above the mean	Q (t) = 0.5 – R (t), 
R(t): Probability above a given point x	R (t) = 1 – P (t), 

- ▶t is used to calculate the standardized t-score (Z-score) for a specific raw data point (x) that you provide. It uses the mean ($\bar{x}$) and population standard deviation (σx)of the data you entered the calculator's statistics editor.

Example: Calculate the probability distribution P(t) for the sample data: 20, 43, 26, 46, 20, 43 when x = 26.

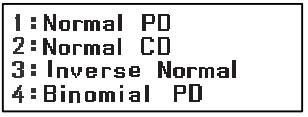
Key in operation	Display
Mode 6 1	x 1 2 3 4
2 0 = 4 3 = 2 6 = 4 6 = 2 0 = 4 3 =	x 4 46 5 20 6 43 7
CA 2 6 Apps ▼ 4 4 =	26▶t –0.6236095645
Apps ▼ 4 1 =	P(Ans 0.26644

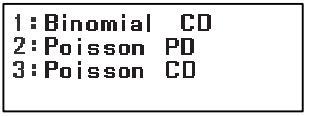
Distribution Calculations

- Press (Mode) 7 to enter Distribution mode.
- Press Apps 1 to then select the calculation type.

Distribution Type Selection

There are 7 types of distribution, after entering the distribution type selection screen, press the number to selection the type of statistic calculation.





Key in operation	Type of distribution calculation
1 Normal PD	Normal probability density
2 Normal CD	Normal cumulative distribution
3 Inverse Normal	Inverse normal cumulative distribution
4 Binomial PD	Binomial probability density
▼ 1 Binomial CD	Binomial cumulative distribution
▼ 2 Poisson PD	Poisson probability density
▼ 3 Poisson CD	Poisson cumulative distribution

- For Normal PD, Normal CD, or Inverse Normal, input the variable value directly.
- For Binomial PD, Binomial CD, Poisson PD or Poisson CD, you have two options for data input.
  a) Press 1 (List) to input a set of data values
  b) Press 2 (Variable) to input the variable value.
- After inputting all data, then press =, the screen will display the calculation result.
- Pressing = again while the calculation result is displayed will return to the data input screen.

Required Variables for Distribution Calculations

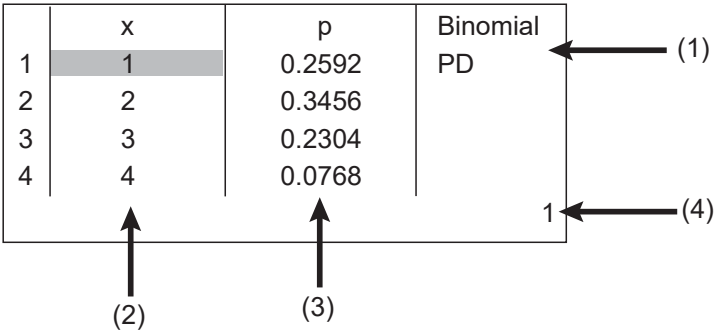
This table details the necessary input variables for each distribution type:

Distribution Type	Required Variables
Normal PD	x,σ,μ
Normal CD	Lower, Upper, σ,μ
Inverse Normal	Area, σ,μ
Binomial PD	x,N,p
Binomial CD	
Poisson PD	x,λ
Poisson CD	

- x: data, σ: standard deviation ($\sigma > 0$), μ: mean
- λ: mean number of events ($\lambda > 0$)
- Lower: lower boundary, Upper: upper boundary
- Area: probability value ($0 \leq \text{Area} \leq 1$)
- N: number of trails (a positive integer)
- p: success probability ($0 \leq p \leq 1$)

List Screen

A maximum of 45 data samples can be input for each variable, and the calculation results will be displayed directly on the List Screen.



(1) Distribution calculation type

(2) Data (x)

(3) Calculation results (P)

(4) Value at current cursor position

Editing sample data

- To replace the data in a cell
  (1) In the List screen, use the cursor key to highlight the cell you want to edit.
  (2) Input the new data value or expression, and press [=] to save the edit.
- To delete a data
  (1) In the List screen, use the cursor key to highlight the cell you want to delete.
  (2) Press [DEL].
- To insert a data line
  (1) In the statistical data input screen, use the cursor key to highlight the line you want to insert the new line above.
  (2) Press [Apps] [2] [1] (Insert row).
- To delete all statistical data input
  (1) Press [Apps] [2] [2] (Delete All).

Distribution Calculation Example

Example: Calculate the normal probability density when x=15, σ=5, μ=5

Key in operation	Display
[Mode] [7] [1]	Normal PD X : 0 σ : 1 *μ* : 0
[1] [5] [=] [5] [=] [5] [=]	Normal PD x : 15 σ : 5 *μ* : 5
[=]	P= 0.0107981933

Example: Calculate the binomial probability for the data {2,4,6,8} when N=9 and *p*=0.6

Key in operation	Display
Apps 1 4 (Binomial PD) 1 (List)	x / p / Binomial PD 1 2 3 4
2 = 4 = 6 = 8 =	x / p / Binomial PD 2 4 3 6 4 8 5
=	Binomial PD N : 0 P : 0
9 = 0 • 6 =	Binomial PD N : 9 P : 0.6
=	x / p / Binomial PD 1 2 0.0212 2 4 0.1672 3 6 0.2508 4 8 0.0604 2

- "ERROR" will appear in the P column of the result screen if the input value for the corresponding data is outside the allowable range.
- "Argument ERROR" will appear after pressing = when the input value is out of the allowable range.

Function Table Generation

- This feature generates a table of values for a specific function within a defined range.
- Steps to Generate a Number Table
  1. Press (Mode) [8] to enter the Table function calculation.
  2. Input the Function
     - Enter the desired function using the variable X. To input the variable X, press [x].
     - Press [=] to proceed.
     - Variables other than X (A to F, Y, Z, 0 to 9) and Independent Memory (M) are treated as the stored numeric values within the function.
     - Pol, Rec, Q...r functions cannot be used within the Function Input screen.
     - Using this feature will overwrite the current value stored in the calculator's memory for variable X.
  3. Define the X-value range (Start, End, Step)
     - Enter a value for each setting, and press [=] to confirm.

Display screen	Input value	Default Value
Start	Input the lower limit of X-range	1
End	Input the upper limit of X-range	5
Step	Input the increment step between X-values	1

     - The maximum number of rows in the generated number table depends on the setup menu table setting. Maximum 45 rows are supported for the f(x) setting, while maximum 30 rows are supported for the "f(x),g(x)" setting.
       Executing a number generation table using a Start, End, and Step value combination that exceeds the above requirements will causes an error, [Range ERROR] will be shown.
- In the Function Table Result screen, you can edit the value in column "x" to update the results of column f(x) and g(x), but cannot directly modify the results in column f(x) and g(x).
  Press [CA] to return to the Function input screen.

Example: Generate a function table for $f(x) = x^3 + 3x^2 - 2x$ within range $1 \le x \le 5$, using increment step of 1.

Key in operation	Display
Mode 8	f(x)=
x Shift x^3 + 3 x x^2 − 2 x	$f(x) = x^3 + 3x^2 - 2x$
=	g(x) =
=	Table Range Start : 1 End : 5 Step : 1
=	x f(x) 1 1 2 2 2 16 3 3 48 4 4 104

Example: Generate a function table for $f(x) = x^3 - 2x$, $g(x) = x - 5$ within range $5 \leq x \leq 10$, using increment step of 1.

Key in operation	Display
Mode 8	f(x)=
X Shift x^3 — 2 X	$f(x) = x^3 - 2x$
=	g(x) =
X — 5	g(x) = x – 5
=	Table Range Start : 1 End : 5 Step : 1
5 = 1 0 =	Table Range Start : 5 End : 10 Step : 1
=	x / f(x) / g(x) 1: 5 / 115 / 0 2: 6 / 204 / 1 3: 7 / 329 / 2 4: 8 / 496 / 3 5

Equation Solution

■ Press (Mode) 9 to enter Equation Solution mode.

■ Select the type of calculation

Type of calculation	Keys in operation
Simultaneous linear equations with 2, 3, or 4 unknowns	Press 1 (Simul Equation), then input a key from 2 to 4 to specify the number of unknowns
Quadratic (degree 2), Cubic (degree 3) or Quartic (degree 4) equation	Press 2 (Polynomial), then input a key from 2 to 4 to specify the polynomial degree.

Changing equation Type

■ Press Apps 1 .

■ Follow the prompts displayed on the screen to re-select a new equation type (1 simultaneous equations, 2 polynomial).

■ Input a key from 2 to 4 to specify the number of unknowns or the polynomial degree.

Simultaneous Linear Equations

Example: Solve the simultaneous equation with three unknowns:
$2x + 4y - 4z = 20$, $2x - 2y + 4z = 8$, $5x - 2y - 2z = 20$

MATHI / MATHO MODE: (Shift) Setup 1 1

Key in operation	Display
(Mode) 9 1 3	0x + 0y + 0z 0x + 0y + 0z 0x + 0y + 0z 0
2 = 4 = (−) 4 = 2 0 = 2 = (−) 2 = 4 = 8 = 5 = (−) 2 = (−) 2 = 2 0 =	+ 4y − 4z = 20 − 2y + 4z = 8 − 2y − 2z = 20 20
=	x= $\frac{11}{2}$
=	y= 3
=	z= $\frac{3}{4}$

Quadratic, Cubic and Quart Equations

Example: Solve the Cubic equation $5x^3 + 2x^2 - 2x + 1 = 0$

MATHI / MATHO MODE: (Shift) Setup ○ 1 1

Key in operation	Display
Apps 2 3	$ax^3 + bx^2 + cx + d$ $0x^3 + 0x^2 + 0x$ $+ 0$ 0
5 = 2 = (−) 2 = 1 =	$ax^3 + bx^2 + cx + d$ $5x^3 + 2x^2 - 2x$ $+ 1$ 1
=	$ax^3 + bx^2 + cx + d = 0$ $x_1 =$ −1
=	$ax^3 + bx^2 + cx + d = 0$ $x_2 =$ $\frac{3}{10} + 0.331662479i$
=	$ax^3 + bx^2 + cx + d = 0$ $x_3 =$ $\frac{3}{10} - 0.331662479i$
=	Local Max of $y = ax^3 + bx^2 + cx + d$ $x =$ $\frac{-2-\sqrt{34}}{15}$
=	Local Max of $y = ax^3 + bx^2 + cx + d$ $y =$ 1.877784783
=	Local Min of $y = ax^3 + bx^2 + cx + d$ $x =$ $\frac{-2+\sqrt{34}}{15}$
=	Local Min of $y = ax^3 + bx^2 + cx + d$ $y =$ 0.7029559573

- For Quadratic, Cubic and Quart equations, the solution is displayed using variable name starting with "x_1".
- The x- and y-coordinates of the local minimum or local maximum of the function are also displayed for a quadratic equation.
- The x- and y-coordinates of the local minimum and local maximum of the function are also displayed for a cubic equation.

Inequality Solution

- Press Mode rA1 to enter Inequality Solution mode.
- Press a key from 2 to 4 to specify the polynomial degree (2 for quadratic, 3 for cubic, or 4 for quartic)
- Press a key from 1 to 4 to select the inequality symbol type and orientation.

Changing Polynomial degree or Inequality Type

- Press Apps 1 .
- Then, follow the prompts on the screen to re-select the polynomial degree and the inequality symbol type.

Inequality equations calculation

Example: Solve the Inequality $x^2 + 3x - 10 < 0$

MATHI / MATHO MODE: Shift Setup 1 1

Key in operation	Display
Mode rA1 2 2	$ax^2+bx+c<0$ $0x^2 +$ $0x +$ $0 < 0$ 0
1 = 3 = (−) 1 0 =	$ax^2 + bx + c < 0$ $1x^2 +$ $3x -$ $10 < 0$ -10
=	$a<x<b$ $-5<x<2$

- "All Real Numbers" appears on the solution screen when the inequality is true for all possible numbers (the solution set is infinite).
- "No Solution" appears on the solution screen when the inequality has no valid solution (the solution set is empty).

Verify Calculation or Statement

- Press Mode rB1 to enter Verify calculation or statement mode.
- Verify calculation or statement mode checks if an input equation or inequality is mathematically true or false.
- The calculator performs a mathematical evaluation of the expression and then displays "TRUE" or "FALSE". The verification result is stored in the "Ans" memory: Ans = 1 for TRUE, and Ans = 0 for FALSE.
- If the right-hand side of the equation is empty, pressing the = key will automatically append "=0" to the expression.

Input Precautions

- The specific numerical result of the calculation or any calculation errors may not display in this mode if the expression approaches a mathematical singularity (e.g. division by zero) or contains complex nested operations.
- The following examples of expressions cause a "Syntax ERROR" and cannot be verified.

Expression example	Display
Expression starts with a relational operator (The left-hand side of the equation is empty)	=7
Relational operator inside parentheses (nested logic)	(3 > 2) > 1
Multiple relational operators with not oriented in the same direction	3 ≥ 2 ≤ 1
Combining the ≠ operator with any other inequality operator (>, <, ≥, ≤)	3 ≥ 2 ≠ 1
Consecutive relational operators	3 ≥ = 2
Relational operator inside a function	sin(5=8)
Relational operator inside a fraction	$\frac{5>1}{15}$

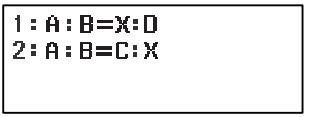
Verify calculation Example

MATHI / MATHO MODE: Shift Setup 1 1

Example	Key in operation	Display
Verify 2 > 3 > 4	Mode rB1 2 Apps 3 3 Apps 3 4 =	2 > 3 > 4 FALSE
Verify $3^2 = 9 = \sqrt{81}$	3 x^2 Apps 1 9 Apps 1 $\sqrt{\square}$ 8 1 =	$3^2 = 9 = \sqrt{81}$ TRUE
Verify $(\frac{5}{9})^2 - \frac{5}{9} < 1$	($\frac{\square}{\square}$ 5 ▼ 9 ▶) x^2 − $\frac{\square}{\square}$ 5 ▼ 9 ▶ Apps 4 1 =	$(\frac{5}{9})^2 - \frac{5}{9} < 1$ TRUE

Ratio Calculation

- Press Mode rCl to enter Ratio mode.
- Press 1 or 2 to select the ratio type.



Example: Calculate the ratio 2:3 = 5:X

MATHI / MATHO MODE: Shift Setup 1 1

Key in operation	Display
Mode rCl 2	1: 1 = 1: x 1
2 = 3 = 5 =	2: 3 = 5: x 5
=	X= $\frac{15}{2}$

- The following operations are not support by Coefficient Editor. M+ , Shift M- , Pol(, Rec(and : .
- "Math ERROR" will appear if any coefficient is entered as 0.

Metric Conversations

The calculator features 210 conversion pairs for converting numbers between specified metric units.

- Press Shift Convt to enter the conversion menu.
- Use the ▲ and ▼ keys to navigate the 9 category pages: Distance, Area, Volume, Mass, Velocity, Pressure, Energy, Power, and Temperature.

Example: Convert 10 m to inches

LINEI / LINEO MODE: Shift Setup 1 3

Key in operation	Display
1 0 Shift Convt 1 3 4	10m►inch
=	10m►inch 393.7007874

■ Constant Table

Group	No.	Constant	Symbol	Value	Unit
1	1	Planck constant	h	6.62606957 x10^{-34}	J s
	2	h/2 π	ħ	1.054571726 x10^{-34}	J s
	3	Speed of light in vacuum	c_0	299792458	m s^{-1}
	4	Electric constant 1/$\mu_0 C^2$	ε_0	8.854187817 x10^{-12}	Fm^{-1}
	5	Magnetic constant	μ_0	1.256637061x10^{-6}	N A^{-2}
	6	Characteristic impedance of vacuum $\sqrt{(\mu_0/\varepsilon_0)}= \mu_0 c$	Z_0	376.7303135	Ω
	7	Newtonian constant of gravitation	G	6.67384 x10^{-11}	m^3 kg^{-1} s^{-2}
	8	Planck length ħ /mPc=(ħ G/c^3)$^{1/2}$	l_P	1.616199x10^{-35}	m
	9	Planck time l_P/c=(ħ G/c^5)$^{1/2}$	t_P	5.39106 x10^{-44}	s
2	1	Nuclear magneton e ħ /2m_p	μ_N	5.05078353 x10^{-27}	J T^{-1}
	2	Bohr magneton eħ /2m_e	μ_B	927.400968 x10^{-26}	J T^{-1}
	3	Elementary charge	e	1.602176565x10^{-19}	C
	4	Magnetic flux quantum h/2e	Φ_0	2.067833758 x10^{-15}	Wb
	5	Conductance quantum 2e^2/h	G_0	7.748091735x10^{-5}	S
	6	Josephson constant 2e/h	K_J	4.8359787 x10^{14}	Hz V^{-1}
	7	von Klitzing constant h/e^2	R_K	25812.80744	Ω
3	1	Proton mass	m_p	1.672621777x10^{-27}	Kg
	2	Neutron mass	m_n	1.674927351 x10^{-27}	Kg
	3	Electron mass	m_e	9.10938291x10^{-31}	Kg
	4	Muon mass	m_μ	1.883531475x10^{-28}	Kg
	5	Bohr radius α/4πR∞	a_0	5.291772109x10^{-11}	m
	6	Fine-structure constant e^2/4 π ε $_0$ħ c	α	7.29735257x10^{-3}	
	7	Classical electron radius α$^2a_0$	r_e	2.817940327x10^{-15}	m
	8	Compton wavelength h/m_ec	λ c	2.426310239 x10^{-12}	m
	9	Proton gyromagnetic ratio 2 μ_p / ħ	γ p	267522200.5	s^{-1} T^{-1}
	A	Proton Compton wavelength h/ m_p c	λ c,p	1.321409856 x10^{-15}	m
	B	Neutron Compton wavelength h/ m_nc	λ c,n	1.319590907x10^{-15}	m
	C	Rydberg constant $\alpha^2 m_e c/2h$	R_∞	10973731.57	m^{-1}
	D	Proton magnetic moment	μ_p	1.410606743x10^{-26}	J T^{-1}
	E	Electron magnetic moment	μ_e	–9.2847643x10^{-24}	J T^{-1}
	F	Neutron magnetic moment	μ_n	–9.6623647 x10^{-27}	J T^{-1}
	M	Muon magnetic moment	μ_μ	–4.49044807 x10^{-26}	J T^{-1}
	x	Tau mass	m_τ	3.16747 x10^{-27}	kg

Group	No.	Constant	Symbol	Value	Unit
4	1	(Unified) atomic mass constant	u	1.660538921 x10^{-27}	kg
	2	Faraday constant NAe	F	96485.3365	C mol^{-1}
	3	Avogadro constant	N_A	6.02214129x10^{23}	mol^{-1}
	4	Boltzmann constant R/NA	k	1.3806488 x10^{-23}	J K^{-1}
	5	Molar volume of ideal gas RT/p T=273.15 K, p=101.325 kPa	Vm	22.710953 x10^{-3}	m^3 mol^{-1}
	6	Molar gas constant	R	8.3144621	J mol^{-1} K^{-1}
	7	First radiation constant $2\pi hc^2$	c_1	3.74177153x10^{-16}	W m^2
	8	Second radiation constant hc/k	c_2	0.01438777	m K
	9	Stefan-Boltzmann constant	σ	5.670373x10^{-8}	W m^{-2} K^{-4}
5	1	Standard acceleration of gravity	g	9.80665	ms^{-2}
	2	Standard atmosphere	atm	101325	Pa
	3	von Klitzing constant h/e^2	R_{K-90}	25812.807	Ω
	4	Josephson constant 2e/h	K_{J-90}	4.835979 x10^{14}	Hz V^{-1}
6	1	Celsius temperature	t	273.15	

■ Unit Conversion

Page	Group	Unit
Page 1	Distance	mm cm m km inch feet mile yard n mile Pc
	Area	m^2 km^2 $feet^2$ $mile^2$ $yard^2$ acres
	Volume	L gal (US) gal (UK) pint fl. oz
	Mass	oz lb kg g Tr. oz
Page 2	Velocity	m/s km/h mile/h
	Pressure	Atm Pa kPa mmHg Kgf/cm^2 lbf/in^2
	Energy	J cal Kgf.m
	Power	hp►kW kW►hp
Page 3	Temperature	°F °C K

Error Messages and Error Locator

The calculator is locked up when an error message is shown on the display indicating the cause of the error.

- Press [CA] to clear the error message, then return to the initial display of the latest mode.
- Press ◀ or ▶ to display the calculation with the cursor positioned under the error and you can correct it.
- Press ON to clear the error message, remove the replay memory and return to the initial display of the latest mode.

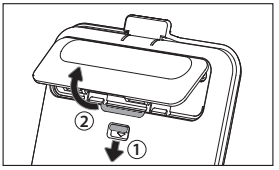
Error Message	Cause	Action
Math ERROR	• The intermediate or final result of the calculation you are perform ing exceeds the allowable calculation range. • Your input exceeds the allowable input range (particularly when using functions). • The calculation you are performing contains an illegal mathematical operation (such as division by zero).	• Check the input values, reduce the number of digits, and try again. • When using independent memory or a variable as the argument of a function, make sure that the memory or variable value is within the allowable range for the function. • Press ◀ or ▶ to display the calculation with the cursor located at the error and make required corrections.
Stack ERROR	• The calculation you are performing has caused the capacity of the numeric stack or the command stack to be exceeded.	• Simplify the calculation expression so it does not exceed the capacity of the stack. • Try splitting the calculation into two or more parts. • Press ◀ or ▶ to display the calculation with the cursor located at the error and make required corrections.
Syntax ERROR	• There is a problem with the format of the calculation you are performing.	• Make necessary corrections. • Press ◀ or ▶ to display the calculation with the cursor located at the error and make required corrections.
Range ERROR	• f(x) : There is not enough memory to perform your calculation in the table mode while the table has more than 45 X-value. • f(x), g(x): There is not enough memory to perform your calculation in the table mode while the table has more than 30 X-value.	• Narrow the table calculation range by changing the Start, End, and Step values, and try again. • Press ◀ or ▶ to display the calculation with the cursor located at the error and make required corrections in the function input.

Error Message	Cause	Action
Dimension ERROR (only in Matrix or Vector modes)	• The matrix or vector you are trying to use in a calculation was input without specifying its dimension. • You are trying to perform a calculation with matrices or vectors whose dimensions do not allow that type of calculation.	• Specify the dimension of the matrix or vector and then perform the calculation again. • Check the dimensions specified for the matrices or vectors to see if they are compatible with the calculation.
Variable ERROR (only in SOLVE feature)	• You did not specify a solution variable, and there is no X variable in the equation you input. • The solution variable that you specified is not included in the equation you input.	• The equation you input must include an X variable when you do not specify the solution variable. • Specify a variable that is included in the equation you input as the solution variable.
Can't Solve ERROR (only in SOLVE feature)	• The calculator could not obtain a solution.	• Check for errors in the equation that you input. • Input a value for the solution variable that is close to the expected solution and try again.
Time Out ERROR	• The current differential or integration calculation ends without the ending condition being fulfilled.	• Try increasing the tol value. Note that this also decreases solution precision.
Argument ERROR	• There is a problem with the argument of the calculation you are performing.	• Make necessary corrections.

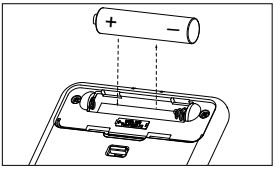
Battery Replacement

When the display characters are dim, turn it off, replace the battery immediately.

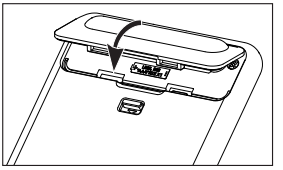
1. Press (Shift) OFF to power off the calculator.
2. Remove the battery cover on the back of the main unit. (Fig. 1)
3. Insert the AAA battery with the correct polarity (+, –) (Fig. 2).
4. Place the battery cover to its original position (Fig. 3). And press ON, (Shift) Clear 3 = CA to initialize the calculator.



(Fig. 1)



(Fig. 2)


(Fig. 3)

■ Electromagnetic interference or electrostatic discharge may cause the display to malfunction or the contents of the memory to be lost or altered. Should this occur, press ON, (Shift) Clear 3 = CA to restart the calculator.

* Replace the battery immediately when the display characters are dim even with a darker LCD display contrast **OR** when the battery level indication show as " " or " ".

Specifications

Power Supply	:	AAA-size Alkaline battery x 1
Power Consumption	:	DC 1.5V / 3.15 mW
Battery Life	:	Approximately 1.5 years (Based on 1 hour of operation per day)
Auto power off	:	Approx. 7 minutes
Operation Temperature	:	0° ~ 40°C
Size	:	161.5 (L) × 78.5 (W) × 19 (H) mm (with cover) / 158 (L) × 76 (W) × 14 (H) mm (without cover)
Weight	:	119 g (with cover) / 96 g (without cover)

* Specifications are subject to change without notice.

■ Function Calculation Input Ranges

Functions	Input Range	
sinx	DEG	$0 \leqq \|x\| < 9\times10^{9}$
	RAD	$0 \leqq \|x\| < 157\ 079\ 632.7$
	GRA	$0 \leqq \|x\| < 1\times10^{10}$
cosx	DEG	$0 \leqq \|x\| < 9\times10^{9}$
	RAD	$0 \leqq \|x\| < 157\ 079\ 632.7$
	GRA	$0 \leqq \|x\| < 1\times10^{10}$
tanx	DEG	Same as sinx, except when $\|x\| = (2n-1)\times90$
	RAD	Same as sinx, except when $\|x\| = (2n-1)\times \pi/2$
	GRA	Same as sinx, except when $\|x\| = (2n-1)\times100$
$\sin^{-1}x$	$0 \leqq \|x\| \leqq 1$	
$\cos^{-1}x$		
$\tan^{-1}x$	$0 \leqq \|x\| \leqq 9.999\ 999\ 999\times10^{99}$	
sinhx	$0 \leqq \|x\| \leqq 230\ 258\ 509\ 2$	
coshx		
$\sinh^{-1}x$	$0 \leqq \|x\| \leqq 4.999\ 999\ 999\times10^{99}$	
$\cosh^{-1}x$	$1 \leqq x \leqq 4.999\ 999\ 999\times10^{99}$	
tanhx	$0 \leqq \|x\| \leqq 9.999\ 999\ 999\times10^{99}$	
$\tanh^{-1}x$	$0 \leqq \|x\| \leqq 9.999\ 999\ 999\times10^{-1}$	
logx/lnx	$0 < x \leqq 9.999\ 999\ 999\times10^{99}$	
10^{x}	$-9.999\ 999\ 999 \times 10^{99} \leqq x \leqq 99.999\ 999\ 99$	
e^{x}	$-9.999\ 999\ 999 \times 10^{99} \leqq x \leqq 230.258\ 509\ 2$	
$\sqrt{x}$	$0 \leqq x < 1\times10^{100}$	
x^2	$\|x\| < 1\times10^{50}$	
x^3	$\|x\| \leqq 2.154\ 434\ 69\times10^{33}$	
x^{-1}	$\|x\| < 1\times10^{100}$, $x \neq 0$	
$\sqrt[3]{x}$	$\|x\| < 1\times10^{100}$	
x!	$0 \leqq x \leqq 69$ (x is an integer)	
nPr	$0 \leqq n < 1\times10^{10}$, $0 \leqq r \leqq n$ (n,r are integers)	
	$1 \leqq \{n!/((n-r)!\} < 1\times10^{100}$	
nCr	$0 \leqq n < 1\times10^{10}$, $0 \leqq r \leqq n$ (n,r are integers)	
	$1 \leqq n!/r! < 1\times10^{100}$ or $1 \leqq n!/(n-r)! < 1\times10^{100}$	

Functions	Input Range
Pol(x,y)	$\|x\|, \|y\| \leqq 9.999\ 999\ 999 \times 10^{99}$ $\sqrt{x^2+y^2} \leqq 9.999\ 999\ 999 \times 10^{99}$
Rec(r, θ)	$0 \leqq r \leqq 9.999\ 999\ 999 \times 10^{99}$ θ : Same as sinx
°′ ″	$\|a\|,b,c < 1 \times 10^{100}$ $0 \leqq b,c$ The display seconds value is subject to an error of +/–1 at the second decimal place
◀ °′ ″	$\|x\| < 1 \times 10^{100}$ Deciaml ⟷ Sexagesimal Conversions $0°0'0'' \leqq \|x\| \leqq 9999999°59'59''$
^(x^y)	x>0: $-1 \times 10^{100} <$ ylog x < 100 x=0: y>0 x<0: y=n,m/(2n+1) (m,n are integers) However: $-1 \times 10^{100} <$ ylog|x|<100
$\sqrt[x]{y}$	y>0: x≠0, $-1 \times 10^{100} <$ 1/x logy<100 y=0:x>0 y<0:x=2n+1,(2n+1)/m (m≠0;m,n are integers) However: $-1 \times 10^{100} <$ 1/x log|y|<100
a b/c	Total of integer, numerator, and denominator must be 10 digits or less (including division marks).
i~Rand(a,b)	$0 \leqq a < 1 \times 10^{10}$, $0 \leqq b < 1 \times 10^{10}$ (a,b should be positive integers or 0)
Rand	Result generates a 3 digits pseudo random number (0.000~0.999)
LCM(x,y,z)	$0 < x, y, z \leqq 9.999\ 999\ 999 \times 10^{12}$ (positive integers) Default result when x, y, z=0
HCF(x,y,z)	$0 < x, y, z \leqq 9.999\ 999\ 999 \times 10^{12}$ (positive integers) Default result when x, y, z=0
Q…r(x,y)	$0 < x,y \leqq 9.999\ 999\ 999 \times 10^{12}$ (positive integers) $0 \leqq Q \leqq 999\ 999\ 9999$, $0 \leqq r \leqq 999\ 999\ 9999$ (Q,r are integers) Default result when x=0

Functions	Input Range
Int(x), Intg(x)	$\|x\|<1\times10^{100}$
Single-variable	$\|x\|<1\times10^{100}$ $\|FREQ\|<1\times10^{100}$
Paired-variable	$\|x\|<1\times10^{100}$ $\|y\|<1\times10^{100}$ $\|FREQ\|<1\times10^{100}$
Abs	$\|x\|<1\times10^{100}$
Pfact	$x \leqq 9999999999$ (positive integers)
BIN	Positive : 0~0111 1111 1111 1111 1111 1111 1111 1111 Negative : 1000 0000 0000 0000 0000 0000 0000 0000~ 1111 1111 1111 1111 1111 1111 1111 1111
DEC	Positive : 0~2147483647 Negative : –2147483648~–1
OCT	Positive : 0~177 7777 7777 Negative : 200 0000 0000~377 7777 7777
HEX	Positive : 0~7FFF FFFF Negative : 8000 0000 ~ FFFF FFFF
PEN	Positive : 0~13344223434042 Negative : 13344223434043~32244002423140
$\sum$ *(f(x),a, b)*	*a* and *b* are integers in the range of –1 • 10^10 < $a \leqq b$ <1 • 10^10.
$\prod$ *(f(x),a, b)*	*a* and *b* are integers in the range of –1 • 10^10 < $a \leqq b$ <1 • 10^10.

- Errors are cumulative in the case of consecutive calculations, this is also true as internal consecutive calculation are performed in the case of ^(xy), $x\sqrt{y}$, $\sqrt[3]{}$, x!, nPr, nCr , etc. and may become large.

■ Display of results using $\sqrt{}$

Calculation results may be displayed using $\sqrt{}$ in all of the following cases:

1. When intermediate and final calculation results are displayed in the following form:

$$\pm\frac{a\sqrt{b}}{c}\pm\frac{d\sqrt{e}}{f}$$

$0 \leq a < 100,\ 1 \leq d < 100$
$0 \leq b < 1000,\ 1 \leq e < 1000$
$1 \leq c < 100,\ 1 \leq f < 100$

2. When the number of terms in the intermediate and final calculation result involving $\sqrt{}$ is one or two.