



F-570X

ENGLISH

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.

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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

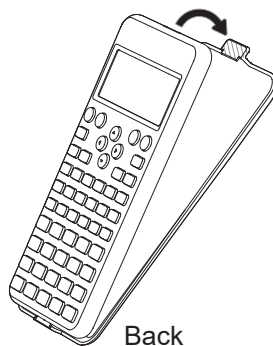
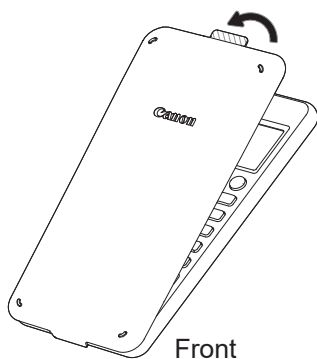
- This calculator contains precision components such as LSI chips and should not be used in places subject to rapid variations in temperature, excessive humidity, dirt or dust, or exposed to direct sunlight.
- The liquid crystal display panel is made of glass and should not be subjected to excessive 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.

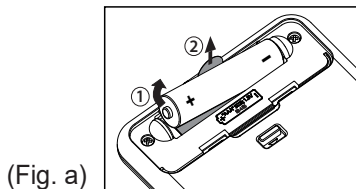


Getting Started

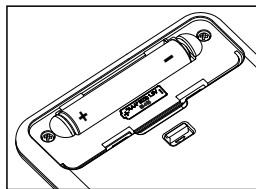
Power On, Off

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.



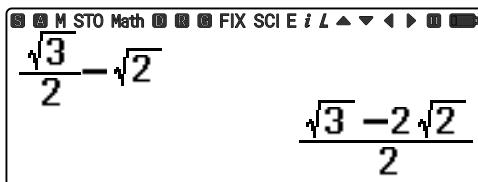
Press **(▶)** to darken the display contrast.

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



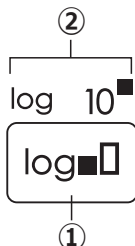
<Status Indicators>

- 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.

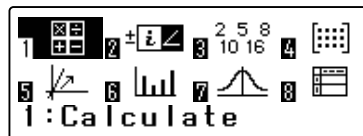
- ① Keycap function
- ② Alternate function



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	2 5 8 10 16
4	Matrix calculations	
5	Vector calculations	
6	Statistical and Regression calculations	
7	Distribution calculations	
8	Function table generation	
9	Equation solution	$\underline{x+y=0}$
A	Inequality solution	$\underline{x+y>0}$
B	Verify calculation or statement	T F
C	Ratio calculations	A : B

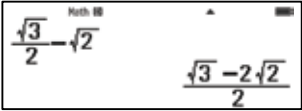
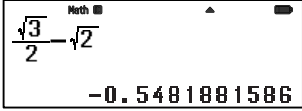
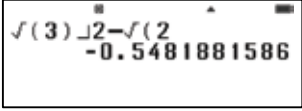
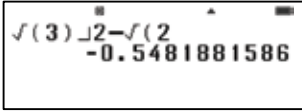
Calculator Set-up Menu

■ Press   to enter the **Calculator Set-up Menu**; press  /  for next / previous page.

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

Input and Output Formats

Before starting a calculation on the calculator, you should first use the operations in the table below to specify 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, $\sqrt{\quad}$, 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

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

Number Format

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

$$\begin{aligned}\text{Example: } 220 \div 7 &= 31.4286 \text{ (FIX 4)} \\ &= 31.43 \text{ (FIX 2)}\end{aligned}$$

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

$$\begin{aligned}\text{Example: } 220 \div 7 &= 3.1429 \times 10^1 \text{ (SCI 5)} \\ &= 3.143 \times 10^1 \text{ (SCI 4)}\end{aligned}$$

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.

$$\begin{aligned}\text{Example: } 1 \div 1000 &= 1 \times 10^{-3} \text{ (Norm 1)} \\ &= 0.001 \text{ (Norm 2)}\end{aligned}$$

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 $a+bi$ **2** $r\angle\theta$

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.

■ 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 $\text{Shift} \text{ Insert}$ 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 \leftarrow 7 times	1234567I+889900
	DEL 0	1234560I+889900
Method 2: Line mode – Overwrite mode	Shift Setup 1 3 1234567 + 889900 Shift Insert	1234567+889900_
	\leftarrow 8 times	123456 <u>7</u> +889900
	0	1234560 <u>+</u> 889900

(2) Deletion (1234567 → 134567)

Mode Setting	Key In Operation	Display (input Line only)
Method 1: Line/Maths mode – Insert mode	12 times	12 34567+889900
		1 34567+889900
Method 2: Line mode – Overwrite mode		1234567+889900_
	13 times	1 <u>2</u> 34567+889900
		1 <u>3</u> 4567+889900

(3) Insertion (889900 → 2889900)

Mode Setting	Key In operation	Display (input Line only)
Line/Maths mode – Insert mode	6 times	1234567+ 889900
		1234567+2 889900

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^\square , $\sqrt{\square}$, $\sqrt[3]{\square}$, $\sqrt[\square]{\square}$, x^{-1} , 10^\square , e^\square , Abs) is shown in Handwriting/Mathematics format.

MATHI / MATHO MODE:

Example	Key in operation	Display
$\left \sqrt{3} - \frac{2}{\sqrt{2}} \right $	 	$\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^{\wedge} (, 10^{\wedge} (, $\sqrt{\quad}$ (, $\sqrt[3]{\quad}$ (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, \wedge (, $\sqrt{\quad}$ (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(\angle).
10th	Dot: •
11th	Multiplication and division: \times , \div
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 \angle 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 \div 2 (Shift) π $=$ $1 \div 2\pi = 0.1591549431$

Example 2:

2 STO $(-)$ $2 \rightarrow A$

1 \div 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 (∇) / (\blacktriangle) for next / previous pages.

Basic Calculations

- 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)** **(abc→dc)** 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, $\sqrt{\quad}$ 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 $\sqrt{\quad}$ calculation will display the decimal value only.




















LINE1 / 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_ 3+2
	2 =	8_ 3
	F↔D	2_ 3+2 2.666666667

Fraction ↔ Decimal point conversion

MATH1 / MATHO MODE: **Shift** **Setup** **1** **1**

Example	Key in operation	Display
$1\frac{1}{2} + \frac{5}{6} = \frac{7}{3}$	1 Shift $\frac{\square}{\square}$ 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 $\frac{abc}{d/c}$	$1\frac{1}{2} + \frac{5}{6}$ $2\frac{1}{3}$





















Example	Key in operation	Display
$\frac{2}{3} + 2 = \frac{8}{3} = 2.666666667$	      	$\frac{2}{3} + 2$ $\frac{8}{3}$
		$\frac{2}{3} + 2$ 2.666666667
$\tan 30 = \frac{\sqrt{3}}{3}$ =0.5773502692	   	tan(30) $\frac{\sqrt{3}}{3}$
		tan(30) 0.5773502692
$\pi \div 8 = \frac{1}{8}\pi$ =0.3926990817	    	$\pi \div 8$ $\frac{1}{8}\pi$
		$\pi \div 8$ 0.3926990817

NOTE:

- In some Calculation results, pressing  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	        	820x25% 205
The percentage of 750 against 1250	          	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: Setup

Example	Key in operation	Display
$86^{\circ}37'34.2'' \div 0.7 =$ $123^{\circ}45'6''$	 	$86^{\circ}37'34.2'' \div 0.7$ $123^{\circ}45'6''$
$123^{\circ}45'6'' \rightarrow 123.7516667$		$86^{\circ}37'34.2'' \div 0.7$ 123.7516667
$2.3456 \rightarrow 2^{\circ}20'44.16''$	 	2.3456 $2^{\circ}20'44.16''$

Engineering Notation and Symbols

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

Example	Key in operation	Display
52700	 	52700 52.7×10^3
		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	$\boxed{5} \boxed{2} \boxed{7} \boxed{0} \boxed{0}$ $\boxed{=}$	52700 52.7k
	$\textcircled{\text{Shift}} \boxed{\text{Eng}}$	52700 0.0527M

Engineering Symbol can also been used for input by pressing $\boxed{\text{Apps}} \textcircled{\blacktriangle} \boxed{3}$. Total 11 metric prefix can be used.

1:m	2: μ	3:n
4:p	5:f	6:k
7:M	8:G	9:T
A:P	B:E	

Example	Key in operation	Display
600000 + 500000	$\boxed{6} \boxed{0} \boxed{0} \boxed{\text{Apps}} \textcircled{\blacktriangle} \boxed{3}$ $\boxed{6} \boxed{+} \boxed{5} \boxed{0} \boxed{0}$ $\boxed{\text{Apps}} \textcircled{\blacktriangle} \boxed{3} \boxed{6} \boxed{=}$	600k + 500k 1.1M
	$\boxed{\text{Eng}}$	600k + 500k 1100k

Absolute Value Calculation

MATHI / MATHO MODE: $\textcircled{\text{Shift}} \textcircled{\circ} \text{Setup} \boxed{1} \boxed{1}$

Example	Key in operation	Display
$ \sin(60 - 5) \times (-\pi) $	$\boxed{\text{Abs}} \boxed{\sin} \boxed{6} \boxed{0} \boxed{-}$ $\boxed{5} \boxed{)} \boxed{\times} \boxed{(} \boxed{(-)}$ $\textcircled{\text{Shift}} \boxed{\pi} \boxed{)} \boxed{=}$	$ \sin(60 - 5) \times (-\pi) $ 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 \blacktriangledown (or \blacktriangle) can replay the performed calculation input and result history.
- After obtaining the calculation result on the display, press \blacktriangleleft or \blacktriangleright to edit the input expression of that result.
- If the \blacktriangleright Indicator is on the right side of a calculation result display, you need to press $\boxed{\text{CA}}$ and then \blacktriangleleft or \blacktriangleright to scroll through the calculation.
- Replay memory is cleared when you:
 1. Initialize calculator setting by Shift $\boxed{\text{Clear}}$ $\boxed{3}$ $\boxed{=}$ $\boxed{\text{CA}}$
 2. Change from one calculation mode or display mode to another.
 3. Press ON key.
 4. Press Shift $\boxed{\text{OFF}}$ to power off the machine.

■ Multi-statements Function

- Use a colon $\boxed{\text{:}}$ 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 $\boxed{1}$ $\boxed{1}$

Example	Key in operation	Display
$1 \times 12 = 12$ $2 + 25 = 27$ using a multi-statement	$\boxed{1}$ $\boxed{\times}$ $\boxed{1}$ $\boxed{2}$ Alpha $\boxed{\text{:}}$ $\boxed{2}$ $\boxed{+}$ $\boxed{2}$ $\boxed{5}$	$1 \times 12 : 2 + 25 $
	$\boxed{=}$	1×12 \blacktriangle II 12
	$\boxed{=}$	$2 + 25$ \blacktriangle 27
Replay the previous calculation history ($1 \times 12 = 12$)	\blacktriangle	1×12 \blacktriangledown 12

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 \square STO \square + Memory variable.
- Recall memory values by pressing \square Shift \square Recall \square .
- Memory content can be cleared by pressing \square 0 \square STO \square + Memory

Example: $23 + 7 \rightarrow A$ (30 store into A), calculate $2 \sin A$ and clear memory A.

MATHI / MATHO MODE: \square Shift \square Setup \square 1 \square 1

Example	Key in operation	Display
$23 + 7 \rightarrow A$	\square 2 \square 3 \square + \square 7 \square STO \square rA1 \square	$23+7 \rightarrow A$ 30
$2 \times \sin A = 1$	\square 2 \square sin \square Alpha \square rA1 \square = \square	$2\sin(A)$ 1
Clear memory	\square 0 \square STO \square rA1 \square	$0 \rightarrow A$ 0

Independent Memory

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

Memory List Recall

- All memory can be recalled in a list by pressing \square Shift \square Recall \square and toggle between (A-F, M, X, Y, Z and 0-9) by pressing \square \blacktriangle \square \blacktriangledown .

A=0	B=0 \blacktriangle
C=0	D=0
E=0	F=0
M=0	X=0
Y=0	Z=0

0=0	1=0 \blacktriangle
2=0	3=0
4=0	5=0
6=0	7=0
8=0	9=0

Answer Memory

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

Example	Key in operation	Display
123 + 456 → M+, Ans ² = 335,241	$\boxed{1} \boxed{2} \boxed{3} \boxed{+} \boxed{4}$ $\boxed{5} \boxed{6} \boxed{M+} \boxed{x^2} \boxed{=}$	Ans ² 335241
789900 – Ans = 454,659	$\boxed{7} \boxed{8} \boxed{9} \boxed{9} \boxed{0}$ $\boxed{0} \boxed{-} \boxed{\text{Ans}} \boxed{=}$	789900–Ans 454659

Previous Answer Memory

- Previous Answer Memory is only available in Calculate Mode.

Example	Key in operation	Display
123 + 456 → M+, Ans ² = 335,241	$\boxed{1} \boxed{2} \boxed{3} \boxed{+} \boxed{4}$ $\boxed{5} \boxed{6} \boxed{M+} \boxed{x^2} \boxed{=}$	Ans ² 335241
789900 – Ans = 454,659	$\boxed{7} \boxed{8} \boxed{9} \boxed{9} \boxed{0}$ $\boxed{0} \boxed{-} \boxed{\text{Ans}} \boxed{=}$	789900–Ans 454659
Previous Answer	$\textcircled{\text{Alpha}} \boxed{\text{PreAns}} \boxed{=}$	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 $\boxed{F\leftrightarrow D}$. Recurring decimal input is possible only when the input mode is selected to either MathI/ MathO or MathI/DecimalO.

MATHI / MATHO MODE: Shift Setup $\boxed{1}$ $\boxed{1}$

Example	Key in operation	Display
To input $0.33333\dots$ ($0.\dot{3}$)	$\boxed{0}$ \cdot	$0.\dot{1}$ <small>Math I</small>
	Alpha $\frac{\cdot}{\square}$	$0.\dot{1}\square$ <small>Math I</small>
	$\boxed{3}$	$0.\dot{3}\dot{1}$ <small>Math I</small>
To input $1.428571428571\dots$ $1.\dot{4}2857\dot{1}$	$\boxed{1}$ \cdot Alpha $\frac{\cdot}{\square}$	$1.\dot{1}\square$ <small>Math I</small>
	$\boxed{4}$ $\boxed{2}$ $\boxed{8}$ $\boxed{5}$	$1.\dot{4}2857\dot{1}\square$ <small>Math I</small>
	$\boxed{7}$ $\boxed{1}$	$1.\dot{4}2857\dot{1}\square$ <small>Math I</small>
To calculate $1.\dot{0}2\dot{1} + 2.\dot{3}1\dot{2}$	$\boxed{1}$ \cdot Alpha $\frac{\cdot}{\square}$ $\boxed{0}$	$1.\dot{0}2\dot{1} + 2.\dot{3}1\dot{2}$ $\frac{10}{3}$
	$\boxed{2}$ $\boxed{1}$ \blacktriangleright $+$ $\boxed{2}$	
	\cdot Alpha $\frac{\cdot}{\square}$ $\boxed{3}$ $\boxed{1}$	
	$\boxed{2}$ $=$	
Calculation result displayed as recurring decimal value:	$\boxed{F\leftrightarrow D}$	$1.\dot{0}2\dot{1} + 2.\dot{3}1\dot{2}$ $3.\dot{3}$ <small>Math I</small>

Conditions for Displaying a Calculation as a Recurring Decimal

If a calculation result satisfies the following conditions, pressing $\boxed{F\leftrightarrow D}$ 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.
- $\pi = 3.1415926535897932385$
- $e = 2.7182818284590452353$

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

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

Example	Key in operation	Display
$(\sqrt[3]{2^2 + 5^3})^{-1} \times \pi$ = 0.6217559776	$($ (Shift) $\sqrt[3]{\quad}$ 2 (x²) $+$ 5 (Shift) x^{\square} (▶) $)$ (x⁻¹) (x) (Shift) π $=$	$(\sqrt[3]{2^2 + 5^3})^{-1} \times \pi$ 0.6217559776
$\sqrt[3]{2^6} + \sqrt[5]{243}$ = 7	(Shift) $\sqrt[3]{\quad}$ 2 (xⁿ) 6 (▶) (▶) $+$ $\sqrt[n]{\quad}$ 5 (▶) 2 4 3 $=$	$\sqrt[3]{2^6} + \sqrt[5]{243}$ 7

Logarithm, Natural Logarithm, Antilogarithm and Log_ab

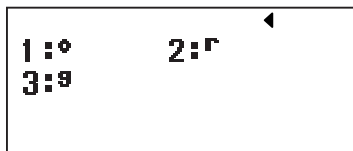
MATHI / MATHO MODE: **(Shift)** **(Setup)** **1** **1**

Example	Key in operation	Display
$e^{-3} + 10^{1.2} + \ln 3 =$ 16.99733128	(Shift) e^{\square} (-) 3 (▶) $+$ (Alpha) 10^{\square} 1 (.) 2 (▶) $+$ ln 3 $=$	$e^{-3} + 10^{1.2} + \ln(3)$ 16.99733128
$\log_3 81 - \log 1 = 4$	\log_{\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
$\sin\left(\frac{\pi}{2}r\right)$	sin Shift π □ 2 ▶ Apps ▲ 2 2) =	Math ▣ $\sin\left(\frac{\pi}{2}r\right)$ 1
	sin 1 0 0 Apps ▲ 2 3) =	Math ▣ $\sin(100^g)$ 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	15°
Radian	$\frac{1}{12}\pi$ Radians
Gradian	$\frac{50}{3}$ Gradians

- $90^\circ = \frac{\pi}{2}$ Radians = 100 Gradians.




MATHI / MATHO MODE:   **1** **1**

Example	Key in operation	Display
Degree Mode	  2 1	D
$\sin 60 = \frac{\sqrt{3}}{2}$	sin 6 0 =	sin(60) $\frac{\sqrt{3}}{2}$
$\frac{1}{\sin 45^\circ} = \operatorname{cosec} 45^\circ = \sqrt{2}$	sin 4 5) x⁻¹ =	sin(45) ⁻¹ $\sqrt{2}$

Hyperbolic (sinh/ cosh/ tanh), Inverse Hyperbolic (sinh⁻¹/cosh⁻¹/tanh⁻¹) functions.

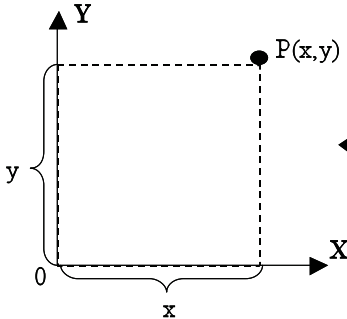
■ Press **Apps**  **1** .

1: sinh	2: cosh
3: tanh	4: sinh ⁻¹
5: cosh ⁻¹	6: tanh ⁻¹

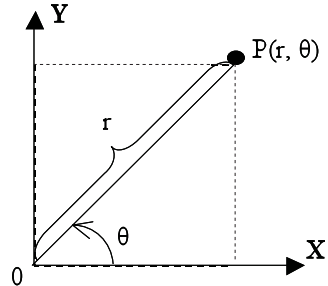
Example	Key in operation	Display
$\sinh 2.5 - \cosh 2.5 = -0.08208499882$	Apps  1 1 2 . 5) - Apps  1 2 2 . 5) =	sinh(2.5)-cosh(2.▷ - 0.08208499862
$\cosh^{-1} 45 = 4.499686191$	Apps  1 5 4 5) =	cosh ⁻¹ (45) 4.499686191

Coordinate Conversion

- With polar coordinates, you can calculate and display θ within the range of $-180^\circ < \theta \leq 180^\circ$. (Same as Radian and Gradient)
- In MathI / MathO mode, press \leftarrow or \rightarrow 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 $(x=1, y=\sqrt{3})$. Find Polar coordinate (r, θ) at degree mode	Shift Pol 1 Shift ' $\sqrt{\square}$ 3 =	Pol(1, $\sqrt{3}$ $r=2, \theta=60$
	Shift Recall	A=0 B=0 C=0 D=0 E=0 F=0 M=0 $x=2$ $y=60$ $x=0$

(Shift) **Rec1** : Convert polar coordinates (r, θ) to rectangular coordinates (x, y);
 press **(Shift)** **Recall** for x and y.

LINE1 / LINE0 MODE: **(Shift)** **Setup** **1** **3**

Example	Key in operation	Display
With Polar coordinate (r=2, θ=60°). Find Rectangular coordinate (x, y) at degree mode	(Shift) Rec1 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 : $x! = x(x-1)(x-2)\dots(2)(1)$

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 =	${}_5C_2$ 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**

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

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

Product (\prod) Calculation

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

Math mode: $\prod_{x=a}^b (C)$

Line mode: $\prod (c, a, b)$

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

MATHI / MATHO MODE: **Shift** **Setup**

Key in operation	Display
Alpha $\text{I}=\text{O}$ <input type="text"/> x + 1 ▲ 5 ▼ 0 =	$\prod_{x=0}^5 (x + 1)$ 720

Summation (Σ) Calculation

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

Math mode: $\sum_{x=a}^b (C)$

Line mode: $\Sigma(c, a, b)$

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

LINEI / LINEO MODE: Shift Setup **1** **3**

Key in operation	Display
Shift Σ $\text{}$ x $+$ 1 Shift	$\Sigma(x+1, 1,5$
' 1 Shift ' 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 $\frac{1}{5}X^2 = 30$

MATH1 / MATHO MODE: (Shift) Setup **1** **1**

Key in Operation	Display
$\frac{1}{5}$ $\frac{\square}{\square}$ 5 \blacktriangleright x x^2 (Alpha) $\frac{1}{5}X^2 = 30$ $=$ 3 0	$\frac{1}{5}X^2 = 30$
(Shift) Solve \square	$\frac{1}{5}X^2 = 30$ $x = 0$
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 $x = 7$.

LINE1 / LINEO MODE: Shift Setup 1 3

Key in operation	Display
Mode 1	
Alpha y' Alpha = 5 x x² - 2 Alpha x + 1	$y=5x^2-2x+1$
Calc 5 = =	$y=5x^2-2x+1$ <div style="text-align: right;">116</div>
Calc 7 = =	$y=5x^2-2x+1$ <div style="text-align: right;">232</div>

! 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:

$$\text{(Shift)} \left[\frac{d}{dx} \right] \text{f(x)} \text{' } \text{a} \text{' } \Delta x \text{ ()}$$

- $f(x)$: 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 approximating 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: $\text{(Shift)} \text{Setup}$ 1 3

Key in operation	Display
(Mode) 1	
$\text{(Shift)} \left[\frac{d}{dx} \right] \text{sin} \text{3} \text{X} \text{+} \text{3}$ $\text{0} \text{)} \text{(Shift)} \text{' } \text{1} \text{0} \text{(Shift)}$ $\text{' } \text{1} \text{x10}^{\text{x}} \text{(-)} \text{8} \text{)} \text{=}$	$d/dx(\sin(3x+30), 1$ $0, 1 \times 10^{-8})$ <div style="text-align: right;">0.02617993878</div>

- ! 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.
- ! $i\sim$ Rand(, Rec(, Pol(, \int (, d/dx (, Σ (, and Π (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:

$$\int_a^b f(x) dx \quad \text{with tolerance } n$$

- $f(x)$: 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_a^b 5 X x^{\square} 4) + 3 X x^2 + 2 X + 1 Shift ' 2 Shift ' 3 Shift ' 4) =	$\int (5x^4 + 3x^2 + 2x + 1) dx$ <div style="text-align: right; font-weight: bold; font-size: 1.2em;">236</div>

- ! 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 remainder that cannot be factored will be enclosed in parentheses on the display.

Example: $99999\ 99999 = 3^2 \times 11 \times 41 \times 271 \times (9091)$

MATHI / MATHO MODE:    

Key in Operation	Display
            	Math  PFact(9999999999 $3^2 \times 11 \times 41 \times 271 \times (909 \blacktriangleright)$
      	Math  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 \leftarrow or \rightarrow 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 $\boxed{1}$ $\boxed{3}$

Example	Key in operation	Display
$35 \div 10 = 3 \times 10 + 5$ Q=3 R=5	Apps $\boxed{1}$ $\boxed{3}$ $\boxed{5}$ Shift ' $\boxed{1}$ $\boxed{0}$ $\boxed{=}$	Q...R(35, 10 Q= 3 R= 5
Quotient value (Q) + 3 = 6	$\boxed{+}$ $\boxed{3}$ $\boxed{=}$	Ans+3 6

HCF and LCM

- Highest Common Factor and Least Common Multiple functions.

MATHI / MATHO MODE: Shift Setup $\boxed{1}$ $\boxed{1}$

Example	Key in operation	Display
HCF(35 , 125)	Apps $\boxed{3}$ $\boxed{3}$ $\boxed{5}$ Shift ' $\boxed{1}$ $\boxed{2}$ $\boxed{5}$ $\boxed{)}$ $\boxed{=}$	HCF(35 , 125) 5
LCM(20 , 36)	Apps $\boxed{2}$ $\boxed{2}$ $\boxed{0}$ Shift ' $\boxed{3}$ $\boxed{6}$ $\boxed{)}$ $\boxed{=}$	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 existence 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".

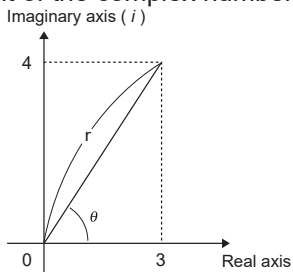
Example: $\lim_{x \rightarrow 3} \left(\frac{\frac{1}{x} - \frac{1}{3}}{x - 3} \right)$

MATHI / MATHO MODE: Shift Setup 1 1

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

Complex Number Calculations

Complex numbers can be expressed in rectangular form ($z = a + bi$) or polar form ($r \angle \theta$). 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:

1 : Argument
 2 : Conjugate
 3 : Real Part
 4 : Imaginary Part

1 : $r \angle \theta$
 2 : $a + bi$

- Check the current angle unit setting (Degree, Radian, Gradian).
- $[i]$ indicates the display result is the imaginary number;
 $[\angle]$ 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 =	$3+4i \blacktriangleright r \angle \theta$ $5 \angle 53.13010235$
Find the Rectangular Form of $\sqrt{2} \angle 45$	$\sqrt{\square}$ 2 \blacktriangleright Shift $r \angle$ \leftarrow 4 5 Apps ∇ 2 =	$\sqrt{2} \angle 45 \blacktriangleright a + bi$ $1+i$

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.

LINE1 / 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 $z = a - bi$.

LINE1 / LINEO MODE: **Shift** **Setup** **1** **3**

Example	Key in operation	Display
Find the conjugate value of $3+4i$	Apps 2 3 + 4 $\leftarrow i$) =	Conj($3+4i$) 3 $-4i$

Determine the Real/Imaginary Values of a Complex Number

MATH1 / MATHO MODE: **Shift** **Setup** **1** **1**

Example	Key in operation	Display
Find the Real and Imaginary values and a complex number $23 \angle 54$	Apps 3 2 3 Shift r/L1 5 4) =	Real($23 \angle 54$) 13.5190608
	▶ DEL Apps 4 =	Imag($23 \angle 54$) 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 $10101011+1100-1001 \times 101 \div 10 = 10100001$	$\overset{\text{BIN}}{\text{BIN}}$ <input type="text"/> 1 <input type="text"/> 0 <input type="text"/> 1 <input type="text"/> 0 <input type="text"/> 1 <input type="text"/> 0 <input type="text"/> <input type="text"/> 1 <input type="text"/> 1 <input type="text"/> + <input type="text"/> 1 <input type="text"/> 1 <input type="text"/> 0 <input type="text"/> 0 <input type="text"/> <input type="text"/> - <input type="text"/> 1 <input type="text"/> 0 <input type="text"/> 0 <input type="text"/> 1 <input type="text"/> x <input type="text"/> 1 <input type="text"/> <input type="text"/> 0 <input type="text"/> 1 <input type="text"/> ÷ <input type="text"/> 1 <input type="text"/> 0 <input type="text"/> = <input type="text"/>	[Bin] $1 \times 101 \div 10$ 0000 0000 0000 0000 0000 0000 1010 0001
In Hexadecimal Mode $(77A6C+D9) \times B \div F = 57C87$	$\overset{\text{HEX}}{\text{HEX}}$ <input type="text"/> (<input type="text"/> 7 <input type="text"/> 7 <input type="text"/> $\overset{\text{rA1}}{\text{rA1}}$ <input type="text"/> 6 <input type="text"/> $\overset{\text{rC1}}{\text{rC1}}$ <input type="text"/> + <input type="text"/> $\overset{\text{rD1}}{\text{rD1}}$ <input type="text"/> 9 <input type="text"/>) <input type="text"/> x <input type="text"/> $\overset{\text{rB1}}{\text{rB1}}$ <input type="text"/> ÷ <input type="text"/> $\overset{\text{rF1}}{\text{rF1}}$ <input type="text"/> = <input type="text"/>	[Hex] $(77A6C+D9) \times B \div F$ 00057C87

Base-n Transformation

Example	Key in operation	Display
Find 12345+101 in Decimal mode, and then convert the result to Hexadecimal	DEC <input type="text"/> <input type="text"/> 1 <input type="text"/> 2 <input type="text"/> 3 <input type="text"/> 4 <input type="text"/> 5 <input type="text"/> + <input type="text"/> 1 <input type="text"/> 0 <input type="text"/> 1 <input type="text"/> =	[Dec] 12345+101 12446
	HEX <input type="text"/>	[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 <input type="text"/> 7 <input type="text"/> 8 <input type="text"/> 9 <input type="text"/> rA1 <input type="text"/> rB1 <input type="text"/> <input type="text"/> rC1 <input type="text"/> Apps <input type="text"/> 4 <input type="text"/> 1 <input type="text"/> 4 <input type="text"/> 7 <input type="text"/> 2 <input type="text"/> 5 <input type="text"/> 8 <input type="text"/> =	[Hex] 789ABCxnor147258 FF93171B
In Hexadecimal Mode, find the logical OR of calculation result and 789ABC (FF93171B ₁₆ OR 789ABC ₁₆)	Ans <input type="text"/> Apps <input type="text"/> 2 <input type="text"/> 7 <input type="text"/> 8 <input type="text"/> 9 <input type="text"/> rA1 <input type="text"/> rB1 <input type="text"/> rC1 <input type="text"/> =	[Hex] FF93171B Ansor789ABC FFFB9FBF
In Hexadecimal Mode, find the negative vale of 789ABC ₁₆	HEX <input type="text"/> Apps <input type="text"/> 6 <input type="text"/> 7 <input type="text"/> 8 <input type="text"/> 9 <input type="text"/> rA1 <input type="text"/> rB1 <input type="text"/> rC1 <input type="text"/> =	[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 $\boxed{4}$ to enter Matrix Calculations mode.
- Press CA Apps to use the Matrix Application, and press \blacktriangle or \blacktriangledown for the next or previous pages.

1: Define Matrix	
2: Edit Matrix	
3: MatA	4: MatB
5: MatC	6: MatD

1: MatAns	2: Det
3: Trn	4: Ide
5: Adj	6: Inv

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 $\boxed{4}$ to enter Matrix Calculations mode.
- Press $\boxed{1}$ (MatA), $\boxed{2}$ (2rows), $\boxed{2}$ (2coulmns)
- Input the elements of MatA: $\boxed{1} = \boxed{2} = \boxed{3} = \boxed{4} =$
- 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: $MatA = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$, $MatB = \begin{pmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{pmatrix}$, calculate $MatA \times MatB = ?$

Example	Key in operation	Display
Create MatA	Mode 4 1 3 3	MatA = $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$ 0
Input element value of MatA	1 = 2 = 3 = 4 = 5 = 6 = 7 = 8 = 9 =	MatA = $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$ 9
Create MatB	CA Apps 1 2 3 3	MatB = $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$ 0
Input element value of MatB	9 = 8 = 7 = 6 = 5 = 4 = 3 = 2 = 1 =	MatB = $\begin{pmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{pmatrix}$ 1
Calculate MatA x MatB	CA Apps 3 X Apps 4 =	MatAns = $\begin{pmatrix} 30 & 24 & 18 \\ 84 & 69 & 54 \\ 138 & 114 & 90 \end{pmatrix}$ 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 x² =	MatAns= $\begin{bmatrix} 120 & -95 \\ -76 & 101 \end{bmatrix}$ 120
Calculate the cube of MatC	Apps 5 Shift x³ =	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.

1:Define Vector
 2>Edit Vector
 3:VctA 4:VctB
 5:VctC 6:VctD

1:VctAns
 2:Dot Product
 3:Angle
 4:Unit Vector

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.



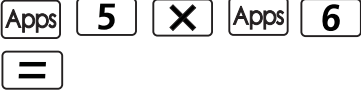
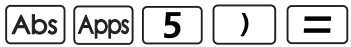
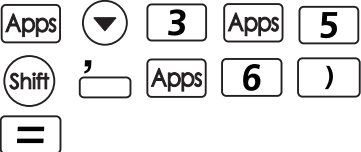
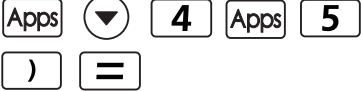
Vector Calculation

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-dimensional vector and a 3-dimensional vector.

Example: $\text{VctC} = (4, 5, -6)$, $\text{VctD} = (-7, 8, 9)$

Example	Key in operation	Display
Calculate the scalar product of VctC (VctC \times 5)		VctAns = $\begin{pmatrix} 20 \\ 25 \\ -30 \end{pmatrix}$ 20
Calculate the inner product of VctC and VctD (VctC \cdot VctD)		VctC \cdot VctD -42
Calculate the outer product of VctC and VctD (VctC \times VctD)		VctAns = $\begin{pmatrix} 93 \\ 6 \\ 67 \end{pmatrix}$ 93
Calculate the absolute value of VctC		Abs(VctC) 8.774964387
Calculate angle of VctC and VctD		Angle(VctC, VctD) 110.0987671
Calculate the unit vector of VctC		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 $\boxed{6}$ to enter Statistical Calculation mode.
- Press Apps $\boxed{1}$ (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.

1: 1-Variable
 2: $y = a + bx$
 3: $y = a + bx + cx^2$
 4: $y = a + b \cdot \ln(x)$

1: $y = a \cdot e^{(bx)}$
 2: $y = a \cdot b^x$
 3: $y = a \cdot x^b$
 4: $y = a + b/x$

Key in operation	Type of statistical calculation
$\boxed{1}$ 1-Variable	One-variable statistics (x)
$\boxed{2}$ $y = a + bx$	Two-variable, Linear regression
$\boxed{3}$ $y = a + bx + cx^2$	Two-variable, Quadratic regression
$\boxed{4}$ $y = a + b \cdot \ln(x)$	Two-variable, Logarithmic regression
\blacktriangledown $\boxed{1}$ $y = a \cdot e^{(bx)}$	Two-variable, e Exponential regression
\blacktriangledown $\boxed{2}$ $y = a \cdot b^x$	Two-variable, ab Exponential regression
\blacktriangledown $\boxed{3}$ $y = a \cdot x^b$	Two-variable, Power regression
\blacktriangledown $\boxed{4}$ $y = a + b/x$	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 $\boxed{3}$ to edit the data.
 - For 2-Variables type, press Apps $\boxed{4}$ 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 \blacktriangledown $\boxed{3}$ $\boxed{1}$.

- 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 $\boxed{=}$ 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 $\boxed{=}$ 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 $\boxed{\text{DEL}}$
- 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 $\boxed{\text{Apps}}$ $\boxed{2}$ $\boxed{1}$
- To delete all statistical data input
 - (1) Press $\boxed{\text{Apps}}$ $\boxed{2}$ $\boxed{2}$

Statistical Calculation Screen

- After inputting the data, press $\boxed{\text{CA}}$ to enter the statistical calculation screen.
- Statistical Calculation screen is in Linel / LineO Mode.
- Use the Statistical Menu to calculate the Statistical result.

Statistical Menu

1: Select Type
2: 2-Variable Calc
3: Regression Calc
4: Data

1: Summation
2: Variable
3: Min/Max
4: Regression

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 \downarrow 1 1
		Summation of all x ² value	$\sum x^2$	Apps \downarrow 1 2
	2 variable STAT	Summation of all x ³ value	$\sum x^3$	Apps \downarrow 1 3
		Summation of all x ⁴ value	$\sum x^4$	Apps \downarrow 1 4
		Summation of all y value	$\sum y$	Apps \downarrow 1 5
		Summation of all y ² value	$\sum y^2$	Apps \downarrow 1 6
		Summation of all xy pairs	$\sum xy$	Apps \downarrow 1 7
		Summation of all x ² y pairs	$\sum x^2y$	Apps \downarrow 1 8
Variable	1 & 2 variable STAT	Number of data sample	n	Apps \downarrow 2 1
		Mean of the x values	\bar{x}	Apps \downarrow 2 2
		Population standard deviation of x	σx	Apps \downarrow 2 3
		Sample standard deviation of x	s _x	Apps \downarrow 2 4
		Population Variance of x	σ^2x	Apps \downarrow 2 5
		Sample Variance of x	s ² _x	Apps \downarrow 2 6
	2 variable STAT	Mean of the y values	\bar{y}	Apps \downarrow 2 7
		Population standard deviation of y	σy	Apps \downarrow 2 8
		Sample standard deviation of y	s _y	Apps \downarrow 2 \downarrow 1
		Population Variance of y	σ^2y	Apps \downarrow 2 \downarrow 2
		Sample Variance of y	s ² _y	Apps \downarrow 2 \downarrow 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
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
6 1	1 x 2 3 4
7 5 = 8 5 = 9 0 = 7 7 = 7 9 =	3 x 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:

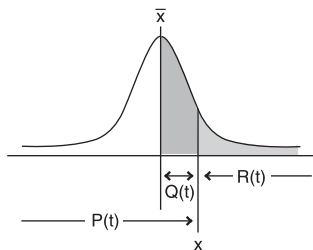
Advertisement expenses: X	18	35	40	21	19
Effectiveness: y (%)	38	54	59	40	38

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	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20px;"></td> <td style="width: 30%; text-align: center; border-bottom: 1px solid black;">x</td> <td style="width: 30%; text-align: center; border-bottom: 1px solid black;">y</td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">1</td> <td style="border-bottom: 1px solid black;"></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">2</td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">3</td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">4</td> <td></td> <td></td> <td></td> </tr> </table>		x	y		1				2				3				4			
	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 =	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20px;"></td> <td style="width: 30%; text-align: center; border-right: 1px solid black;">x</td> <td style="width: 30%; text-align: center; border-right: 1px solid black;">y</td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center;">3</td> <td style="border-right: 1px solid black;"></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">4</td> <td style="border-right: 1px solid black; text-align: center;">40</td> <td style="text-align: center;">59</td> <td></td> </tr> <tr> <td style="text-align: center;">5</td> <td style="border-right: 1px solid black; text-align: center;">21</td> <td style="text-align: center;">40</td> <td></td> </tr> <tr> <td style="text-align: center;">6</td> <td style="border-right: 1px solid black; text-align: center;">19</td> <td style="text-align: center;">38</td> <td></td> </tr> </table>		x	y		3				4	40	59		5	21	40		6	19	38	
	x	y																			
3																					
4	40	59																			
5	21	40																			
6	19	38																			
CA 3 0 Apps ▼ 4 6 =	$30\hat{y}$ <div style="text-align: right; margin-top: 10px;">48.69615715</div>																				
5 0 Apps ▼ 4 4 =	$50\hat{x}_1$ <div style="text-align: right; margin-top: 10px;">31.30538226</div>																				
5 0 Apps ▼ 4 5 =	$50\hat{x}_2$ <div style="text-align: right; margin-top: 10px;">-167.1096731</div>																				

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.



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

x : Random variable

\bar{x} : Mean of sample

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

- 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 (σ) 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	<table border="1"> <tr><td>1</td><td>x</td><td></td></tr> <tr><td>2</td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td></tr> </table>	1	x		2			3			4		
1	x												
2													
3													
4													
2 0 = 4 3 = 2 6 = 4 6 = 2 0 = 4 3 =	<table border="1"> <tr><td>4</td><td>x</td><td>46</td></tr> <tr><td>5</td><td></td><td>20</td></tr> <tr><td>6</td><td></td><td>43</td></tr> <tr><td>7</td><td></td><td></td></tr> </table>	4	x	46	5		20	6		43	7		
4	x	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.

1: Normal PD
2: Normal CD
3: Inverse Normal
4: Binomial PD

1: Binomial CD
2: Poisson PD
3: Poisson CD

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.
 - Press **1** (List) to input a set of data values
 - 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 trials (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	x	p	Binomial	← (1)
1	1	0.2592	PD	
2	2	0.3456		
3	3	0.2304		
4	4	0.0768		
				1 ← (4)

↑ (2)
↑ (3)

- (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 $\boxed{=}$ 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 \boxed{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 $\boxed{\text{Apps}} \boxed{2} \boxed{1}$ (Insert row).
- To delete all statistical data input
 - (1) Press $\boxed{\text{Apps}} \boxed{2} \boxed{2}$ (Delete All).

Distribution Calculation Example

Example: Calculate the normal probability density when $x=15$, $\sigma=5$, $\mu=5$

Key in operation	Display
$\boxed{\text{Mode}} \boxed{7} \boxed{1}$	Normal PD $X : 0$ $\sigma : 1$ $\mu : 0$
$\boxed{1} \boxed{5} \boxed{=} \boxed{5} \boxed{=}$ $\boxed{5} \boxed{=}$	Normal PD $x : 15$ $\sigma : 5$ $\mu : 5$
$\boxed{=}$	P= <p style="text-align: right;">0.0107981933</p>

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)	<table border="1"> <thead> <tr> <th></th> <th>x</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		x			1				2				3				4				p	Binomial PD		
	x																								
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3																									
4																									
2 = 4 = 6 = 8 =	<table border="1"> <thead> <tr> <th></th> <th>x</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>2</td> <td></td> <td>4</td> <td></td> </tr> <tr> <td>3</td> <td></td> <td>6</td> <td></td> </tr> <tr> <td>4</td> <td></td> <td>8</td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		x			2		4		3		6		4		8		5				p	Binomial PD		
	x																								
2		4																							
3		6																							
4		8																							
5																									
=	Binomial PD N : 0 P : 0																								
9 = 0 · 6 =	Binomial PD N : 9 P : 0.6																								
=	<table border="1"> <thead> <tr> <th></th> <th>x</th> <th></th> <th>p</th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td>2</td> <td>0.0212</td> <td rowspan="4">Binomial PD</td> </tr> <tr> <td>2</td> <td></td> <td>4</td> <td>0.1672</td> </tr> <tr> <td>3</td> <td></td> <td>6</td> <td>0.2508</td> </tr> <tr> <td>4</td> <td></td> <td>8</td> <td>0.0604</td> </tr> </tbody> </table>		x		p		1		2	0.0212	Binomial PD	2		4	0.1672	3		6	0.2508	4		8	0.0604		
	x		p																						
1		2	0.0212	Binomial PD																					
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 $1 \leq x \leq 5$, using increment step of 1.

Key in operation	Display															
 	f(x)=															
         	$f(x) = x^3 + 3x^2 - 2x$															
	g(x) =															
	Table Range Start : 1 End : 5 Step : 1															
	<table border="1"> <thead> <tr> <th></th> <th>x</th> <th>f(x)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> <td>2</td> </tr> <tr> <td>2</td> <td>2</td> <td>16</td> </tr> <tr> <td>3</td> <td>3</td> <td>48</td> </tr> <tr> <td>4</td> <td>4</td> <td>104</td> </tr> </tbody> </table>		x	f(x)	1	1	2	2	2	16	3	3	48	4	4	104
	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																				
 	f(x)=																				
     	$f(x) = x^3 - 2x$																				
	$g(x) =$																				
  	$g(x) = x - 5$																				
	Table Range Start : 1 End : 5 Step : 1																				
    	Table Range Start : 5 End : 10 Step : 1																				
	<table border="1"> <thead> <tr> <th></th> <th>x</th> <th>f(x)</th> <th>g(x)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>5</td> <td>115</td> <td>0</td> </tr> <tr> <td>2</td> <td>6</td> <td>204</td> <td>1</td> </tr> <tr> <td>3</td> <td>7</td> <td>329</td> <td>2</td> </tr> <tr> <td>4</td> <td>8</td> <td>496</td> <td>3</td> </tr> </tbody> </table>		x	f(x)	g(x)	1	5	115	0	2	6	204	1	3	7	329	2	4	8	496	3
	x	f(x)	g(x)																		
1	5	115	0																		
2	6	204	1																		
3	7	329	2																		
4	8	496	3																		

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:
 $2x + 4y - 4z = 20$, $2x - 2y + 4z = 8$, $5x - 2y - 2z = 20$

MATH1 / MATHO MODE: **(Shift)** **(Setup)** **[1]** **[1]**

Key in operation	Display
(Mode) [9] [1] [3]	$\begin{matrix} 0x + & 0y + & 0z & & \\ 0x + & 0y + & 0z & & \\ 0x + & 0y + & 0z & & \end{matrix}$
[2] [=] [4] [=] (-) [4] [=] [2] [0] [=] [2] [=] (-) [2] [=] [4] [=] [8] [=] [5] [=] (-) [2] [=] (-) [2] [=] [2] [0] [=]	$\begin{matrix} + & 4y - & 4z = & 20 \\ - & 2y + & 4z = & 8 \\ - & 2y - & 2z = & 20 \end{matrix}$
[=]	$x = \frac{11}{2}$
[=]	$y = 3$
[=]	$z = \frac{3}{4}$

Quadratic, Cubic and Quart Equations

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

MATH1 / MATHO MODE: Shift O **Setup** $\boxed{1}$ $\boxed{1}$

Key in operation	Display
Apps $\boxed{2}$ $\boxed{3}$	$ax^3 + bx^2 + cx + d$ + $0x^3 + 0x^2 + 0x$ 0
$\boxed{5}$ $\boxed{=}$ $\boxed{2}$ $\boxed{=}$ $\boxed{(-)}$ $\boxed{2}$ $\boxed{=}$ $\boxed{1}$ $\boxed{=}$	$ax^3 + bx^2 + cx + d$ + $5x^3 + 2x^2 - 2x + 1$ 1
$\boxed{=}$	$ax^3 + bx^2 + cx + d = 0$ $x_1 =$ -1
$\boxed{=}$	$ax^3 + bx^2 + cx + d = 0$ $x_2 =$ $\frac{3}{10} + 0.331662479i$
$\boxed{=}$	$ax^3 + bx^2 + cx + d = 0$ $x_3 =$ $\frac{3}{10} - 0.331662479i$
$\boxed{=}$	Local Max of $y = ax^3 + bx^2 + cx + d$ $x =$ $\frac{-2 - \sqrt{34}}{15}$
$\boxed{=}$	Local Max of $y = ax^3 + bx^2 + cx + d$ $y =$ 1.877784783
$\boxed{=}$	Local Min of $y = ax^3 + bx^2 + cx + d$ $x =$ $\frac{-2 + \sqrt{34}}{15}$
$\boxed{=}$	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".
- 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 $\boxed{2}$ to $\boxed{4}$ to specify the polynomial degree (2 for quadratic, 3 for cubic, or 4 for quartic)
- Press a key from $\boxed{1}$ to $\boxed{4}$ to select the inequality symbol type and orientation.

Changing Polynomial degree or Inequality Type

- Press Apps $\boxed{1}$.
- 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 $x^2 + 3x - 10 < 0$

MATH1 / MATHO MODE: Shift Setup $\boxed{1}$ $\boxed{1}$

Key in operation	Display
Mode rA1 $\boxed{2}$ $\boxed{2}$	$ax^2+bx+c<0$ $0x^2 + 0x + 0 < 0$ 0
$\boxed{1}$ = $\boxed{3}$ = (-) $\boxed{1}$ $\boxed{0}$ =	$ax^2 + bx + c < 0$ $1x^2 + 3x - 10 < 0$ -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) [FB1] 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	$3 \geq 2 \leq 1$
Combining the \neq operator with any other inequality operator ($>$, $<$, \geq , \leq)	$3 \geq 2 \neq 1$
Consecutive relational operators	$3 \geq = 2$
Relational operator inside a function	$\sin(5=8)$
Relational operator inside a fraction	$\frac{5>1}{15}$

Verify calculation Example

MATHI / MATHO MODE:  Setup  

Example	Key in operation	Display
Verify $2 > 3 > 4$	         	$2 > 3 > 4$ FALSE
Verify $3^2 = 9 = \sqrt{81}$	          	$3^2 = 9 = \sqrt{81}$ TRUE
Verify $(\frac{5}{9})^2 - \frac{5}{9} < 1$	                 	$(\frac{5}{9})^2 - \frac{5}{9} < 1$ TRUE

Ratio Calculation

- Press Mode rC1 to enter Ratio mode.
- Press $\boxed{1}$ or $\boxed{2}$ to select the ratio type.

1 : A : B = X : D
2 : A : B = C : X

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

MATH1 / MATHO MODE: Shift Setup $\boxed{1}$ $\boxed{1}$

Key in operation	Display
Mode rC1 $\boxed{2}$	$1: \underline{\quad} 1 = \underline{\quad} 1:$ x 1
$\boxed{2}$ $=$ $\boxed{3}$ $=$ $\boxed{5}$ $=$	$\underline{\quad} 2: \underline{\quad} 3 = \underline{\quad} 5:$ x 5
$\boxed{=}$	X= $\frac{15}{2}$

- The following operations are not support by Coefficient Editor. M+ , Shift M- , Pol , Recl and $\text{}$.
- "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)** **Convrt** 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

LINE1 / LINE0 MODE: **(Shift)** **Setup** **1** **3**

Key in operation	Display
1 0 (Shift) Convrt 1 3 4	10m▶inch
=	10m▶inch 393.7007874

■ Constant Table

Group	No.	Constant	Symbol	Value	Unit
1	1	Planck constant	h	$6.62606957 \times 10^{-34}$	J s
	2	$h/2 \pi$	\hbar	$1.054571726 \times 10^{-34}$	J s
	3	Speed of light in vacuum	c_0	299792458	m s^{-1}
	4	Electric constant $1/\mu_0 c^2$	ϵ_0	$8.854187817 \times 10^{-12}$	Fm^{-1}
	5	Magnetic constant	μ_0	$1.256637061 \times 10^{-6}$	N A^{-2}
	6	Characteristic impedance of vacuum $\sqrt{(\mu_0/\epsilon_0)} = \mu_0 c$	Z_0	376.7303135	Ω
	7	Newtonian constant of gravitation	G	6.67384×10^{-11}	$\text{m}^3 \text{kg}^{-1} \text{s}^{-2}$
	8	Planck length $\hbar / m_P c = (\hbar G/c^3)^{1/2}$	l_P	1.616199×10^{-35}	m
	9	Planck time $l_P/c = (\hbar G/c^5)^{1/2}$	t_P	5.39106×10^{-44}	s
2	1	Nuclear magneton $e \hbar / 2m_p$	μ_N	$5.05078353 \times 10^{-27}$	J T^{-1}
	2	Bohr magneton $e \hbar / 2m_e$	μ_B	$927.400968 \times 10^{-26}$	J T^{-1}
	3	Elementary charge	e	$1.602176565 \times 10^{-19}$	C
	4	Magnetic flux quantum $h/2e$	Φ_0	$2.067833758 \times 10^{-15}$	Wb
	5	Conductance quantum $2e^2/h$	G_0	$7.748091735 \times 10^{-5}$	S
	6	Josephson constant $2e/h$	K_J	4.8359787×10^{14}	Hz V^{-1}
	7	von Klitzing constant h/e^2	R_K	25812.80744	Ω
3	1	Proton mass	m_p	$1.672621777 \times 10^{-27}$	Kg
	2	Neutron mass	m_n	$1.674927351 \times 10^{-27}$	Kg
	3	Electron mass	m_e	$9.10938291 \times 10^{-31}$	Kg
	4	Muon mass	m_μ	$1.883531475 \times 10^{-28}$	Kg
	5	Bohr radius $a/4\pi R_\infty$	a_0	$5.291772109 \times 10^{-11}$	m
	6	Fine-structure constant $e^2/4 \pi \epsilon_0 \hbar c$	α	$7.29735257 \times 10^{-3}$	
	7	Classical electron radius $\alpha^2 a_0$	r_e	$2.817940327 \times 10^{-15}$	m
	8	Compton wavelength $h/m_e c$	λ_c	$2.426310239 \times 10^{-12}$	m
	9	Proton gyromagnetic ratio $2 \mu_p / \hbar$	γ_p	267522200.5	$\text{s}^{-1} \text{T}^{-1}$
	A	Proton Compton wavelength $h/ m_p c$	$\lambda_{c,p}$	$1.321409856 \times 10^{-15}$	m
	B	Neutron Compton wavelength $h/ m_n c$	$\lambda_{c,n}$	$1.319590907 \times 10^{-15}$	m
	C	Rydberg constant $\alpha^2 m_e c/2h$	R_∞	10973731.57	m^{-1}
	D	Proton magnetic moment	μ_p	$1.410606743 \times 10^{-26}$	J T^{-1}
	E	Electron magnetic moment	μ_e	$-9.2847643 \times 10^{-24}$	J T^{-1}
	F	Neutron magnetic moment	μ_n	$-9.6623647 \times 10^{-27}$	J T^{-1}
	M	Muon magnetic moment	μ_μ	$-4.49044807 \times 10^{-26}$	J T^{-1}
	x	Tau mass	m_τ	3.16747×10^{-27}	kg

Group	No.	Constant	Symbol	Value	Unit
4	1	(Unified) atomic mass constant	u	$1.660538921 \times 10^{-27}$	kg
	2	Faraday constant NAe	F	96485.3365	C mol ⁻¹
	3	Avogadro constant	NA	$6.02214129 \times 10^{23}$	mol ⁻¹
	4	Boltzmann constant R/NA	k	$1.3806488 \times 10^{-23}$	J K ⁻¹
	5	Molar volume of ideal gas RT/p T=273.15 K, p=101.325 kPa	Vm	22.710953×10^{-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	$3.74177153 \times 10^{-16}$	W m ²
	8	Second radiation constant hc/k	c ₂	0.01438777	m K
	9	Stefan-Boltzmann constant	σ	5.670373×10^{-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}	4.835979×10^{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.

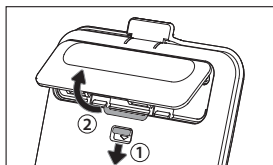
Error Message	Cause	Action
Math ERROR	<ul style="list-style-type: none"> • The intermediate or final result of the calculation you are performing exceeds the allowable calculation range. • Your input exceeds the allowable input range (particularly when using functions). • The calculation you are performing contains an illegal mathematical operation (such as division by zero). 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • The calculation you are performing has caused the capacity of the numeric stack or the command stack to be exceeded. 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • There is a problem with the format of the calculation you are performing. 	<ul style="list-style-type: none"> • Make necessary corrections. • Press ◀ or ▶ to display the calculation with the cursor located at the error and make required corrections.
Range ERROR	<ul style="list-style-type: none"> • $f(x)$: 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. 	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> The calculator could not obtain a solution. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> The current differential or integration calculation ends without the ending condition being fulfilled. 	<ul style="list-style-type: none"> Try increasing the tol value. Note that this also decreases solution precision.
Argument ERROR	<ul style="list-style-type: none"> There is a problem with the argument of the calculation you are performing. 	<ul style="list-style-type: none"> Make necessary corrections.

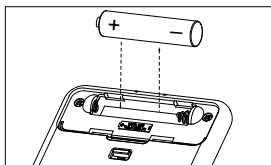
Battery Replacement

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

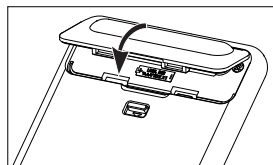
1. Press **(Shift)** **OFF** to power off the calculator.
2. Remove the battery cover on the back of the main unit. (Fig. 1)
3. Insert the AAA battery with the correct polarity (+, -) (Fig. 2).
4. Place the battery cover to its original position (Fig. 3). And press **ON**, **(Shift)** **Clear**
3 **=** **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	$0 \leq x < 9 \times 10^9$
	RAD	$0 \leq x < 157\,079\,632.7$
	GRA	$0 \leq x < 1 \times 10^{10}$
cosx	DEG	$0 \leq x < 9 \times 10^9$
	RAD	$0 \leq x < 157\,079\,632.7$
	GRA	$0 \leq x < 1 \times 10^{10}$
tanx	DEG	Same as sinx, except when $ x = (2n-1) \times 90$
	RAD	Same as sinx, except when $ x = (2n-1) \times \pi/2$
	GRA	Same as sinx, except when $ x = (2n-1) \times 100$
sin ⁻¹ x	$0 \leq x \leq 1$	
cos ⁻¹ x		
tan ⁻¹ x	$0 \leq x \leq 9.999\,999\,999 \times 10^{99}$	
sinhx	$0 \leq x \leq 230\,258\,509.2$	
coshx		
sinh ⁻¹ x	$0 \leq x \leq 4.999\,999\,999 \times 10^{99}$	
cosh ⁻¹ x	$1 \leq x \leq 4.999\,999\,999 \times 10^{99}$	
tanhx	$0 \leq x \leq 9.999\,999\,999 \times 10^{99}$	
tanh ⁻¹ x	$0 \leq x \leq 9.999\,999\,999 \times 10^{-1}$	
logx/lnx	$0 < x \leq 9.999\,999\,999 \times 10^{99}$	
10 ^x	$-9.999\,999\,999 \times 10^{99} \leq x \leq 99.999\,999\,99$	
e ^x	$-9.999\,999\,999 \times 10^{99} \leq x \leq 230.258\,509.2$	
√x	$0 \leq x < 1 \times 10^{100}$	
x ²	$ x < 1 \times 10^{50}$	
x ³	$ x \leq 2.154\,434\,69 \times 10^{33}$	
x ⁻¹	$ x < 1 \times 10^{100}, x \neq 0$	
³ √x	$ x < 1 \times 10^{100}$	
x!	$0 \leq x \leq 69$ (x is an integer)	
nPr	$0 \leq n < 1 \times 10^{10}, 0 \leq r \leq n$ (n,r are integers)	
	$1 \leq \{n!/((n-r)!\} < 1 \times 10^{100}$	
nCr	$0 \leq n < 1 \times 10^{10}, 0 \leq r \leq n$ (n,r are integers)	
	$1 \leq n!/r! < 1 \times 10^{100}$ or $1 \leq n!/((n-r)! < 1 \times 10^{100}$	

Functions	Input Range
Pol(x,y)	$ x , y \leq 9.999\ 999\ 999 \times 10^{99}$ $\sqrt{x^2+y^2} \leq 9.999\ 999\ 999 \times 10^{99}$
Rec(r, θ)	$0 \leq r \leq 9.999\ 999\ 999 \times 10^{99}$ θ : Same as sinx
o r "	$ a , b, c < 1 \times 10^{100}$ $0 \leq b, c$ The display seconds value is subject to an error of +/-1 at the second decimal place
◀ o r "	$ x < 1 \times 10^{100}$ Deciaml ↔ Sexagesimal Conversions $0^\circ 0' 0'' \leq x \leq 99999999^\circ 59' 59''$
$^{\wedge}(x^y)$	$x > 0$: $-1 \times 10^{100} < y \log x < 100$ $x = 0$: $y > 0$ $x < 0$: $y = n, m / (2n+1)$ (m, n are integers) However: $-1 \times 10^{100} < y \log x < 100$
$x \sqrt{y}$	$y > 0$: $x \neq 0, -1 \times 10^{100} < 1/x \log y < 100$ $y = 0$: $x > 0$ $y < 0$: $x = 2n+1, (2n+1)/m$ ($m \neq 0$; 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)	$0 \leq a < 1 \times 10^{10}, 0 \leq b < 1 \times 10^{10}$ (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)	$0 < x, y, z \leq 9.999\ 999\ 999 \times 10^{12}$ (positive integers) Default result when x, y, z=0
HCF(x,y,z)	$0 < x, y, z \leq 9.999\ 999\ 999 \times 10^{12}$ (positive integers) Default result when x, y, z=0
Q...r(x,y)	$0 < x, y \leq 9.999\ 999\ 999 \times 10^{12}$ (positive integers) $0 \leq Q \leq 999\ 999\ 9999, 0 \leq r \leq 999\ 999\ 9999$ (Q, r are integers) Default result when x=0

Functions	Input Range
Int(x), Intg(x)	$ x < 1 \times 10^{100}$
Single-variable	$ x < 1 \times 10^{100}$ $IFREQ < 1 \times 10^{100}$
Paired-variable	$ x < 1 \times 10^{100}$ $ y < 1 \times 10^{100}$ $IFREQ < 1 \times 10^{100}$
Abs	$ x < 1 \times 10^{100}$
Pfact	$x \leq 9999999999$ (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 $-1 \cdot 10^{\wedge}10 < a \leq b < 1 \cdot 10^{\wedge}10$.
$\prod (f(x), a, b)$	a and b are integers in the range of $-1 \cdot 10^{\wedge}10 < a \leq b < 1 \cdot 10^{\wedge}10$.

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

■ Display of results using $\sqrt{\quad}$

Calculation results may be displayed using $\sqrt{\quad}$ 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 $\sqrt{\quad}$ is one or two.