fx-82AU PLUS II

(2nd edition / NATURAL-V.P.A.M.)

User's Guide

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CASIO®

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About this Manual

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- Unless specifically stated, all sample operations in this manual assume that the calculator is in its initial default setup. Use the procedure under "Initializing the Calculator" to return the calculator to its initial default setup.
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Initializing the Calculator

Perform the following procedure when you want to initialize the calculator and return the calculation mode and setup to their initial default settings. Note that this operation also clears all data currently in calculator memory.
[SHIFT] [9] (CLR) [3] (All) [=] (Yes)

Precautions

Be sure to read the following safety precautions before using the calculator.

Safety Precautions

> ⚠ **Battery**
> - Keep batteries out of the reach of small children.

- Use only the type of battery specified for this calculator in this manual.

Handling Precautions

- Even if the calculator is operating normally, replace the battery according to the schedule shown below. Continued use after the specified number of years may result in abnormal operation. Replace the battery immediately after display figures become dim.
  - fx-82AU PLUS II: Every 2 years
- A dead battery can leak, causing damage to and malfunction of the calculator. Never leave a dead battery in the calculator.
- **The battery that comes with the calculator is for factory testing, and it discharges slightly during shipment and storage. Because of these reasons, its battery life may be shorter than normal.**
- Do not use a nickel-based primary battery with this product. Incompatibility between such batteries and product specifications can result in shorter battery life and product malfunction.
- Avoid use and storage of the calculator in areas subjected to temperature extremes, and large amounts of humidity and dust.
- Do not subject the calculator to excessive impact, pressure, or bending.
- Never try to take the calculator apart.
- Use a soft, dry cloth to clean the exterior of the calculator.
- Whenever discarding the calculator or batteries, be sure to do so in accordance with the laws and regulations in your particular area.

Getting Started

Removing the Hard Case

Before using the calculator, slide its hard case downwards to remove it, and then affix the hard case to the back of the calculator as shown in the illustration below.
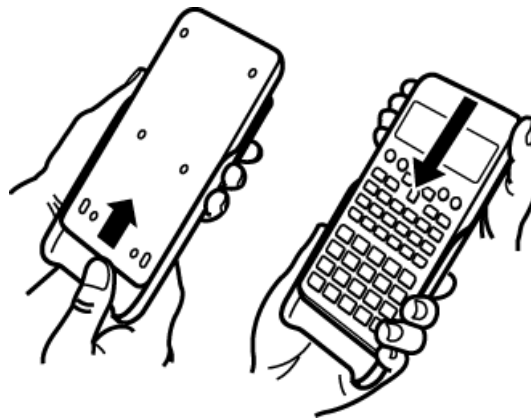
Turning Power On and Off

- Press ⒪ⓝ to turn on the calculator.
- Press ⓢⓗⓘⓕⓣ Ⓐⓒ (OFF) to turn off the calculator.

> **Note**
>
> - The calculator also will turn off automatically after approximately 10 minutes of non-use. Press the ⒪ⓝ key to turn the calculator back on.

Adjusting Display Contrast

1. Press ⓢⓗⓘⓕⓣ ⓜⓞⓓⓔ (SETUP)⊙ ⑤ (◀CONT▶).

```
CONTRAST

LIGHT              DARK
 [◀]                [▶]
```

2. Use ◀ and ▶ to adjust display contrast.
3. After the setting is the way you want, press Ⓐⓒ.

> **Important!**
>
> - If adjusting display contrast does not improve display readability, it probably means that battery power is low. Replace the battery.

Key Markings

Pressing the ⓢⓗⓘⓕⓣ or ⓐⓛⓟⓗⓐ 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.

$$\overset{(2)}{\overbrace{sin^{-1} \quad D}}$$

$$\underset{(1)}{\underbrace{\boxed{\textbf{sin}}}}$$

(1) Keycap function (2) Alternate function

- The following shows an example of how an alternate function operation is represented in this manual.

    Example: ⓢⓗⓘⓕⓣ ⓢⓘⓝ (sin⁻¹)* 1 ▤

    * Indicates the function that is accessed by the key operation (ⓢⓗⓘⓕⓣ ⓢⓘⓝ) before it. Note that this is not part of the actual key operation you perform.

- The following shows an example of how a key operation to select an on-screen menu item is represented in this manual.

    Example: $\boxed{1}$(COMP)*

    * Indicates the menu item that is selected by the number key operation ($\boxed{1}$) before it. Note that this is not part of the actual key operation you perform.
- The cursor key is marked with four arrows, indicating direction, as shown in the illustration nearby. In this manual, cursor key operation is indicated as Ⓐ, Ⓥ, Ⓐ, and Ⓑ.

Reading the Display

The two-line display makes it possible to view both the input expression and its result at the same time.

(1) -- | Pol(√2,√2) | Pol(1.414213562▷ | --- (3)
(2) -- | r=2,θ=45 | r=2,θ=0.7853981▶ |
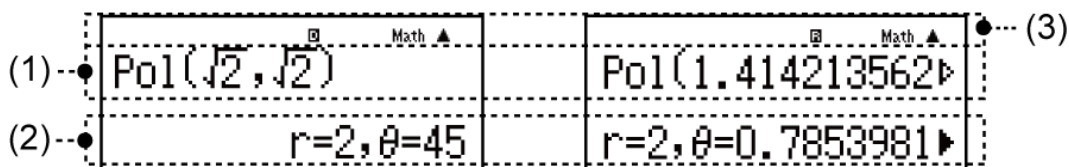
(1) Input expression
(2) Calculation result
(3) Indicators

- If a ▶ indicator appears on the right side of the calculation result, it means the displayed calculation result continues to the right. Use Ⓑ and Ⓐ to scroll the calculation result display.
- If a ▷ indicator appears on the right side of the input expression, it means the displayed calculation continues to the right. Use Ⓑ and Ⓐ to scroll the input expression display. Note that if you want to scroll the input expression while both the ▶ and ▷ indicators are displayed, you will need to press $\boxed{AC}$ first and then use Ⓑ and Ⓐ to scroll.

Display indicators

This indicator:	Means this:
S	The keypad has been shifted by pressing the $\boxed{SHIFT}$ key. The keypad will unshift and this indicator will disappear when you press a key.

A	The alpha input mode has been entered by pressing the [ALPHA] key. The alpha input mode will be exited and this indicator will disappear when you press a key.
M	There is a value stored in independent memory.
STO	The calculator is standing by for input of a variable name to assign a value to the variable. This indicator appears after you press [SHIFT] [RCL] (STO).
RCL	The calculator is standing by for input of a variable name to recall the variable's value. This indicator appears after you press [RCL].
STAT	The calculator is in the STAT Mode.
D	The default angle unit is degrees.
R	The default angle unit is radians.
G	The default angle unit is grads.
FIX	A fixed number of decimal places is in effect.
SCI	A fixed number of significant digits is in effect.
Math	Natural Display is selected as the display format.
▼ ▲	Calculation history memory data is available and can be replayed, or there is more data above/below the current screen.
Disp	The display currently shows an intermediate result of a multi-statement calculation.

Important!

- For some type of calculation that takes a long time to execute, the display may show only the above indicators (without any value) while it performs the calculation internally.

Using Menus

Some of the calculator's operations are performed using menus. Pressing ▣MODE or ▣hyp, for example, will display a menu of applicable functions. The following are the operations you should use to navigate between menus.

- You can select a menu item by pressing the number key that corresponds to the number to its left on the menu screen.
- The ▼ indicator in the upper right corner of a menu means there is another menu below the current one. The ▲ indicator means another menu above. Use ▼ and ▲ to switch between menus.
- To close a menu without selecting anything, press ▣AC.

Calculation Modes and Calculator Setup

Calculation Mode

Before starting a calculation, you must first enter the correct mode as indicated in the table below.

When you want to perform this type of operation:	Perform this key operation:
General calculations	[MODE] [1](COMP)
Statistical and regression calculations	[MODE] [2](STAT)
Verify a calculation	[MODE] [3](VERIF)

> **Note**
>
> • The initial default calculation mode is the COMP Mode.

Configuring the Calculator Setup

Pressing [SHIFT] [MODE](SETUP) displays the setup menu, which you can use to control how the calculations are executed and displayed. The setup menu has two screens, which you can jump between using ⊙ and ⊛.

```
1:MthIO  2:LineIO        1:ab/c   2:d/c
3:Deg    4:Rad           3:STAT   4:Disp
5:Gra    6:Fix           5:◀CONT▶
7:Sci    8:Norm
```
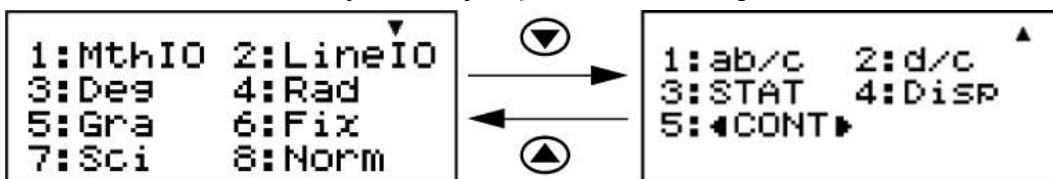
Underlined (___) settings are initial defaults.

Specifying the Display Format

To specify this display format:	Perform this key operation:
Natural Display (MthIO-MathO)	[SHIFT] [MODE](SETUP)[1](MthIO)[1](MathO)

Natural Display (MthIO-LineO)	[SHIFT] [MODE] (SETUP) [1] (MthIO) [2] (LineO)
Linear Display (LineIO)	[SHIFT] [MODE] (SETUP) [2] (LineIO)

Natural Display (MthIO-MathO, MthIO-LineO) causes fractions, irrational numbers, and other expressions to be displayed as they are written on paper.

MthIO-MathO displays input and calculation results using the same format as they are written on paper.

MthIO-LineO displays input the same way as MthIO-MathO, but calculation results are displayed in linear format.

Linear Display (LineIO) causes fractions and other expressions to be displayed in a single line.

Examples:
MthIO-MathO

```
1÷200

           1
          ───
          200
```

MthIO-LineO
(Number Format: Norm 1)

```
1÷200

        5×10⁻³
```

MthIO-LineO
(Number Format: Norm 2)

```
1÷200

        0.005
```

LineIO
(Number Format: Norm 1)

```
1÷200

        5×10⁻³
```

Note

- The calculator switches to Linear Display automatically whenever you enter the STAT Mode.

Specifying the Default Angle Unit

To specify this as the default angle unit:	Perform this key operation:
Degrees	SHIFT MODE (SETUP) 3 (Deg)
Radians	SHIFT MODE (SETUP) 4 (Rad)
Grads	SHIFT MODE (SETUP) 5 (Gra)

90°= π/2 radians = 100 grads

Specifying the Number Format

Specifies the number of digits for display of a calculation result.

To specify this:	Perform this key operation:
Number of Decimal Places	SHIFT MODE (SETUP) 6 (Fix) 0 - 9
Number of Significant Digits	SHIFT MODE (SETUP) 7 (Sci) 0 - 9
Exponential Display Range	SHIFT MODE (SETUP) 8 (Norm) 1 (Norm 1) or 2 (Norm 2)

Fix: The value you specify (from 0 to 9) controls the number of decimal places for displayed calculation results. Calculation results are rounded off to the specified digit before being displayed.
Example: (LineIO) 100 ÷ 7 = 14.286 (Fix 3)
14.29 (Fix 2)
Sci: The value you specify (from 0 to 9) controls the number of significant digits for displayed calculation results. Calculation results are rounded off to the specified digit before being displayed.
Example: (LineIO) 1 ÷ 7 = 1.4286×10^{-1} (Sci 5)
1.429×10^{-1} (Sci 4)
$1.428571429 \times 10^{-1}$ (Sci 0)
Norm: Selecting one of the two available settings (Norm 1, Norm 2) determines the range in which results will be displayed in exponential

format. Outside the specified range, results are displayed using non-exponential format.

Norm 1: $10^{-2} > |x|$, $|x| \geqq 10^{10}$

Norm 2: $10^{-9} > |x|$, $|x| \geqq 10^{10}$

Example: (LineIO) $1 \div 200 = 5 \times 10^{-3}$ (Norm 1)

$\qquad\qquad\qquad\qquad$ 0.005 (Norm 2)

Specifying the Fraction Display Format

To specify this fraction display format:	Perform this key operation:
Mixed	[SHIFT] [MODE] (SETUP)⊙ [1](ab/c)
Improper	[SHIFT] [MODE] (SETUP)⊙ [2](d/c)

Specifying the Stat Format

Specifies whether or not to display a FREQ (frequency) column in the STAT Mode Statistics Editor.

To specify this:	Perform this key operation:
Show FREQ Column	[SHIFT] [MODE] (SETUP)⊙ [3](STAT)[1](ON)
Hide FREQ Column	[SHIFT] [MODE] (SETUP)⊙ [3](STAT)[2](OFF)

Specifying the Decimal Point Display Format

Specifies whether to display a dot or a comma for the calculation result decimal point. A dot is always displayed during input.

To specify this decimal point display format:	Perform this key operation:
Dot (.)	[SHIFT] [MODE] (SETUP)⊙ [4](Disp)[1](Dot)
Comma (,)	[SHIFT] [MODE] (SETUP)⊙ [4](Disp)[2](Comma)

Note

• When dot is selected as the decimal point, the separator for multiple results is a comma (,). When comma is selected, the separator is a semicolon (;).

Adjusting Display Contrast

⌜SHIFT⌝ ⌜MODE⌝ (SETUP)⊙ ⑤(◀CONT▶)
See "Getting Started" for details.

▌Initializing Calculator Settings

Perform the following procedure to initialize the calculator, which returns
the calculation mode to COMP and returns all other settings, including
setup menu settings, to their initial defaults.

⌜SHIFT⌝ ⑨(CLR)①(Setup)⌜=⌝(Yes)

This setting:	Is initialized to this:
Calculation Mode	COMP
Display Format	MthIO-LineO
Angle Unit	Deg
Number Format	Norm 2
Fraction Display Format	d/c
Stat Format	OFF
Decimal Point	Dot

Inputting Expressions and Values

Basic Input Rules

Calculations can be input in the same form as they are written. When you press ☰ the priority sequence of the input calculation will be evaluated automatically and the result will appear on the display.

Example 1: 4 × sin30 × (30 + 10 × 3) = 120

4 ☒ sin 30 ⦆ ☒ ⦅ 30 ⊞ 10 ☒ 3 ⦆ ☰

*1
*2
*3

```
                    B        Math ▲
4×sin(30)×(30+1▷

                          120
```

*1 Input of the closing parenthesis is required for sin, sinh, and other functions that include parentheses.
*2 These multiplication symbols (×) can be omitted. A multiplication symbol can be omitted when it occurs immediately before an opening parenthesis, immediately before sin or other function that includes parentheses, immediately before the Ran# (random number) function, or immediately before a variable (A, B, C, D, E, F, M, X, Y), scientific constants, π or e.
*3 The closing parenthesis immediately before the ☰ operation can be omitted.

Example 2: Input example omitting ☒*2 and ⦆*3 operations in the above example.

4 sin 30 ⦆ ⦅ 30 ⊞ 10 ☒ 3 ☰

```
                    B        Math ▲
4sin(30)(30+10×3

                          120
```

> **Important!**
>
> • If you execute a calculation that includes both division and multiplication operations in which a multiplication sign has been omitted, parentheses will be inserted automatically as shown in the examples below.
> - When a multiplication sign is omitted immediately before an open parenthesis or after a closed parenthesis.

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Examples: 6 ÷ 2 (1 + 2) → 6 ÷ (2 (1 + 2))

6 ÷ A (1 + 2) → 6 ÷ (A (1 + 2))

1 ÷ (2 + 3) sin(30) → 1 ÷ ((2 + 3) sin(30))

- When a multiplication sign is omitted immediately before a variable, a constant, etc.

Examples: $6 ÷ 2\pi → 6 ÷ (2\pi)$

$2 ÷ 2\sqrt{2} → 2 ÷ (2\sqrt{2})$

$4\pi ÷ 2\pi → 4\pi ÷ (2\pi)$

- When inputting a function that uses commas (such as Pol, Rec, and RanInt#), be sure to input the closed parentheses required by the expression. If you do not input closed parentheses, parentheses may not be inserted automatically as described above.

• If you execute a calculation in which a multiplication sign has been omitted immediately before a fraction (including mixed fractions), parentheses will be inserted automatically as shown in the examples below.

$2 \times \dfrac{1}{3}$ (MthIO-LineO)

$\sin(30) \times \dfrac{4}{5}$ (MthIO-LineO)

Note

• If the calculation becomes longer than the screen width during input, the screen will scroll automatically to the right and the ◄ indicator will appear on the display. When this happens, you can scroll back to the left by using ◄ and ► to move the cursor.
• When Linear Display is selected, pressing ▲ will cause the cursor to jump to the beginning of the calculation, while ▼ will jump to the end.
• When Natural Display is selected, pressing ► while the cursor is at the end of the input calculation will cause it to jump to the beginning, while pressing ◄ while the cursor is at the beginning will cause it to jump to the end.
• You can input up to 99 bytes for a calculation. Each numeral, symbol, or function normally uses one byte. Some functions require three to 13 bytes.

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Inputting with Natural Display

Selecting Natural Display makes it possible to input and display fractions and certain functions (x^2, x^3, $x^{\blacksquare}$, $\sqrt{\blacksquare}$, $\sqrt[3]{\blacksquare}$, $\sqrt[\blacksquare]{\square}$, x^{-1}, $10^{\blacksquare}$, $e^{\blacksquare}$, Abs) just as they are written in your textbook.

Example: $\dfrac{2 + \sqrt{2}}{1 + \sqrt{2}}$ (MthIO-LineO)
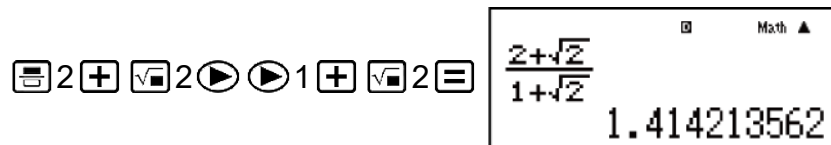
Important!

• Certain types of expressions can cause the height of an input expression to be greater than one display line. The maximum allowable height of an input expression is two display screens (31 dots × 2). Further input will become impossible if the height of the calculation you are inputting exceeds the allowable limit.
• Nesting of functions and parentheses is allowed. Further input will become impossible if you nest too many functions and/or parentheses. If this happens, divide the calculation into multiple parts and calculate each part separately.

Note

• When you press $=$ and obtain a calculation result using Natural Display, part of the expression you input may be cut off. If you need to view the entire input expression again, press [AC] and then use ◀ and ▶ to scroll the input expression.

Using Values and Expressions as Arguments (Natural Display only)

A value or an expression that you have already input can be used as the argument of a function. After you have input $\dfrac{7}{6}$, for example, you can make it the argument of $\sqrt{}$, resulting in $\sqrt{\dfrac{7}{6}}$.

Example: To input $1 + \dfrac{7}{6}$ and then change it to $1 + \sqrt{\dfrac{7}{6}}$ (MthIO-LineO)

$1 \boxed{+} 7 \boxed{\div} 6$ $1+\dfrac{7}{6}$ Math

$\boxed{\blacktriangleleft} \boxed{\blacktriangleleft} \boxed{\blacktriangleleft} \boxed{\blacktriangleleft} \boxed{\text{SHIFT}} \boxed{\text{DEL}} \text{(INS)}$ $1+\dfrac{7}{6}$ Math

$\boxed{\sqrt{\blacksquare}}$ $1+\sqrt{\dfrac{7}{6}}$ Math
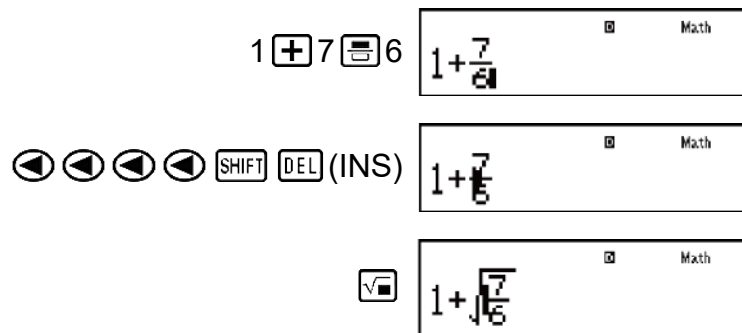
As shown above, the value or expression to the right of the cursor after $\boxed{\text{SHIFT}} \boxed{\text{DEL}}$ (INS) are pressed becomes the argument of the function that is specified next. The range encompassed as the argument is everything up to the first open parenthesis to the right, if there is one, or everything up to the first function to the right (sin(30), log(4), etc.)

This capability can be used with the following functions: $\boxed{\div}$, $\boxed{\text{SHIFT}} \boxed{\div}$ ($\blacksquare \tfrac{\blacksquare}{\blacksquare}$), $\boxed{\text{SHIFT}} \boxed{x^{\blacksquare}}$ ($\sqrt[\blacksquare]{\square}$), $\boxed{\text{SHIFT}} \boxed{\log}$ ($10^{\blacksquare}$), $\boxed{\text{SHIFT}} \boxed{\ln}$ ($e^{\blacksquare}$), $\boxed{\sqrt{\blacksquare}}$, $\boxed{x^{\blacksquare}}$, $\boxed{\text{SHIFT}} \boxed{\sqrt{\blacksquare}}$ ($\sqrt[3]{\blacksquare}$), $\boxed{\text{Abs}}$.

Overwrite Input Mode (Linear Display only)

You can select either insert or overwrite as the input mode, but only while Linear Display is selected. In the overwrite mode, text you input replaces the text at the current cursor location. You can toggle between the insert and overwrite modes by performing the operations: $\boxed{\text{SHIFT}} \boxed{\text{DEL}}$ (INS). The cursor appears as "▮" in the insert mode and as "＿" in the overwrite mode.

Note

- Natural Display always uses the insert mode, so changing display format from Linear Display to Natural Display will automatically switch to the insert mode.

Correcting and Clearing an Expression

To delete a single character or function:
Move the cursor so it is directly to the right of the character or function you want to delete, and then press $\boxed{\text{DEL}}$.

In the overwrite mode, move the cursor so it is directly under the character or function you want to delete, and then press $\boxed{\text{DEL}}$.

To insert a character or function into a calculation:

Use ◀ and ▶ to move the cursor to the location where you want to insert the character or function and then input it. Be sure always to use the insert mode if Linear Display is selected.

To clear all of the calculation you are inputting:

Press AC .

Basic Calculations

Use the $\boxed{\text{MODE}}$ key to enter the COMP Mode when you want to perform basic calculations.

$$\boxed{\text{MODE}} \; \boxed{1} \; (\text{COMP})$$
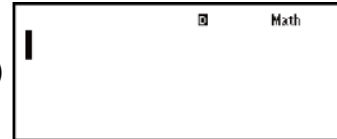
Toggling Calculation Results

Each press of $\boxed{\text{S⇔D}}$ will toggle the currently displayed calculation result between its decimal form and fraction form.

Example 1: $1 \div 5 = 0.2 = \dfrac{1}{5}$ (MthIO-LineO)

$1 \boxed{\div} 5 \boxed{=}$ 0.2 $\boxed{\text{S⇔D}}$ $\dfrac{1}{5}$

Example 2: $1 \div 5 = 0.2 = \dfrac{1}{5}$ (LineIO)

$1 \boxed{\div} 5 \boxed{=}$ 0.2 $\boxed{\text{S⇔D}}$ $1 \lrcorner 5$

Example 3: $1 - \dfrac{4}{5} = \dfrac{1}{5} = 0.2$ (LineIO)

$1 \boxed{-} 4 \boxed{} 5 \boxed{=}$ $1 \lrcorner 5$ $\boxed{\text{S⇔D}}$ 0.2

Important!

- With certain calculation results, pressing the $\boxed{\text{S⇔D}}$ key will not convert the displayed value.
- You cannot switch from decimal form to mixed fraction form if the total number of digits used in the mixed fraction (including integer, numerator, denominator, and separator symbols) is greater than 10.

Fraction Calculations

Note that the input method for fractions is different, depending upon whether you are using Natural Display or Linear Display.

Example 1: $\dfrac{2}{3} + \dfrac{1}{2} = \dfrac{7}{6}$

(MthIO-LineO) 2[▤]3[▶][+]1[▤]2[=] $\dfrac{7}{6}$

or [▤]2[▼]3[▶][+][▤]1[▼]2[=] $\dfrac{7}{6}$

(LineIO) 2[▤]3[+]1[▤]2[=]   7⌐6

Example 2: $4 - 3\dfrac{1}{2} = \dfrac{1}{2}$

(MthIO-LineO) 4[−][SHIFT][▤](▪⌐▤)3[▶]1[▼]2

[=] $\dfrac{1}{2}$

(LineIO) 4[−]3[▤]1[▤]2[=]   1⌐2

To switch a calculation result between improper fraction and mixed fraction form:

Perform the following key operation: [SHIFT] [S⇔D] ($a\dfrac{b}{c} \leftrightarrow \dfrac{d}{c}$)

To switch a calculation result between fraction and decimal form:
Press [S⇔D].

Percent Calculations

Inputting a value and pressing ⎡SHIFT⎤ ⎡(⎤(%) causes the input value to become a percent.

Example 1: 150 × 20% = 30

150 ⎡×⎤ 20 ⎡SHIFT⎤ ⎡(⎤ (%) ⎡=⎤   30

Example 2: Calculate what percentage of 880 is 660 (75%)

660 ⎡÷⎤ 880 ⎡SHIFT⎤ ⎡(⎤ (%) ⎡=⎤   75

Example 3: Increase 2500 by 15% (2875)

2500 ⎡+⎤ 2500 ⎡×⎤ 15 ⎡SHIFT⎤ ⎡(⎤ (%) ⎡=⎤   2875

Example 4: Decrease 3500 by 25% (2625)

3500 ⎡−⎤ 3500 ⎡×⎤ 25 ⎡SHIFT⎤ ⎡(⎤ (%) ⎡=⎤   2625

Degree, Minute, Second (Sexagesimal) Calculations

You can perform calculations using sexagesimal values, and convert values between sexagesimal and decimal.
Performing an addition or subtraction operation between sexagesimal values, or a multiplication or division operation between a sexagesimal value and a decimal value will cause the result to be displayed as a sexagesimal value.
You also can convert between sexagesimal and decimal.
The following is the input format for a sexagesimal value: {degrees} ⎡°'"⎤ {minutes} ⎡°'"⎤ {seconds} ⎡°'"⎤.

> **Note**
>
> • You must always input something for the degrees and minutes, even if they are zero.

Example 1: 2°20'30" + 39'30" = 3°00'00"

2 ⎡°'"⎤ 20 ⎡°'"⎤ 30 ⎡°'"⎤ ⎡+⎤ 0 ⎡°'"⎤ 39 ⎡°'"⎤ 30 ⎡°'"⎤ ⎡=⎤   3°0'0"

Example 2: Convert 2°15'18" to its decimal equivalent.

$$2\,\boxed{\circ\,\prime\,\prime\prime}\,15\,\boxed{\circ\,\prime\,\prime\prime}\,18\,\boxed{\circ\,\prime\,\prime\prime}\,\boxed{=} \qquad\qquad 2°15'18''$$

$$\text{(Converts sexagesimal to decimal.)}\ \boxed{\circ\,\prime\,\prime\prime} \qquad 2.255$$

$$\text{(Converts decimal to sexagesimal.)}\ \boxed{\circ\,\prime\,\prime\prime} \qquad 2°15'18''$$

Multi-Statements

You can use the colon character (:) to connect two or more expressions and execute them in sequence from left to right when you press $\boxed{=}$.

Example: 3 + 3 : 3 × 3

$$3\,\boxed{+}\,3\,\boxed{\text{ALPHA}}\,\boxed{x^3}\,(:)\,3\,\boxed{\times}\,3\,\boxed{=} \qquad\qquad 6$$

$$\boxed{=} \qquad\qquad 9$$

Using Engineering Notation

A simple key operation transforms a displayed value to engineering notation.

Example 1: Transform the value 1234 to engineering notation, shifting the decimal point to the right.

$$1234\,\boxed{=} \qquad\qquad 1234$$

$$\boxed{\text{ENG}} \qquad\qquad 1.234\times10^3$$

$$\boxed{\text{ENG}} \qquad\qquad 1234\times10^0$$

Example 2: Transform the value 123 to engineering notation, shifting the decimal point to the left.

$$123\,\boxed{=} \qquad\qquad 123$$

$$\boxed{\text{SHIFT}}\,\boxed{\text{ENG}}\,(\leftarrow) \qquad\qquad 0.123\times10^3$$

$$\boxed{\text{SHIFT}}\,\boxed{\text{ENG}}\,(\leftarrow) \qquad\qquad 0.000123\times10^6$$

Prime Factorization

In the COMP Mode, a positive integer no more than 10 digits long can be factored to prime factors.

Example 1: To perform prime factorization on 1014

$$1014 \;\boxed{=} \qquad\qquad 1014$$

$$\boxed{\text{SHIFT}}\;\boxed{\circ\,\prime\prime\prime}\,(\text{FACT})$$

$$2\times3\times13^2$$

When you perform prime factorization on a value that includes a factor that is prime number with more than three digits, the part that cannot be factored will be enclosed in parentheses on the display.

Example 2: To perform prime factorization on 4104676 (= $2^2 \times 1013^2$)

$$4104676 \;\boxed{=} \qquad\qquad 4104676$$

$$\boxed{\text{SHIFT}}\;\boxed{\circ\,\prime\prime\prime}\,(\text{FACT})$$

$$2^2\times(1026169)$$

Any one of the following operations will exit prime factorization result display.
- Pressing $\boxed{\text{SHIFT}}\;\boxed{\circ\,\prime\prime\prime}$(FACT) or $\boxed{=}$.
- Pressing any of the following keys: $\boxed{\text{ENG}}$ or $\boxed{\circ\,\prime\prime\prime}$.
- Using the setup menu to change the angle unit setting (Deg, Rad, Gra) or the display digits setting (Fix, Sci, Norm).

Note

- You will not be able to execute prime factorization while a decimal value, fraction, or negative value calculation result is displayed. Trying to do so will cause a math error (Math ERROR).
- You will not be able to execute prime factorization while the result of a calculation that uses Pol, Rec is displayed.

Calculation History and Replay

Calculation History

In the COMP Mode, the calculator remembers up to approximately 200 bytes of data for the newest calculation.
You can scroll through calculation history contents using ▲ and ▼.

Example:

1 + 1 = 2	$1\boxed{+}1\boxed{=}$	2
2 + 2 = 4	$2\boxed{+}2\boxed{=}$	4

3 + 3 = 6	3 ⊞ 3 ⊟	6
	(Scrolls back.) ⊙	4
	(Scrolls back again.) ⊙	2

> **Note**
>
> • Calculation history data is all cleared whenever you press ⟨ON⟩, when you change to a different calculation mode, when you change the display format, or whenever you perform the following operations: ⟨SHIFT⟩ ⟨9⟩ (CLR) ⟨1⟩ (Setup) ⟨=⟩ (Yes), ⟨SHIFT⟩ ⟨9⟩ (CLR) ⟨3⟩ (All) ⟨=⟩ (Yes).

Replay

While a calculation result is on the display, you can press ⊙ or ⊙ to edit the expression you used for the previous calculation.

Example: $\underline{4 \times 3} + 2 = 14$
$\underline{4 \times 3} - 7 = 5$

| | 4 ⊠ 3 ⊞ 2 ⊟ | 14 |
| | (Continuing) ⊙ ⟨DEL⟩ ⟨DEL⟩ ⊟ 7 ⊟ | 5 |

Using Memory Functions

Answer Memory (Ans)

The last calculation result obtained is stored in Ans(answer) memory.
Ans memory contents are updated whenever a new calculation result is dispalayed.
Answer Memory contents are updated whenever you execute a calculation using any one of the following keys: ⟨=⟩, ⟨SHIFT⟩ ⟨=⟩, ⟨M+⟩, ⟨SHIFT⟩ ⟨M+⟩ (M-), ⟨RCL⟩, ⟨SHIFT⟩ ⟨RCL⟩ (STO).
Answer Memory can hold up to 15 digits.

Example 1: To divide the result of 3 × 4 by 30 (LineIO)

| | 3 ⊠ 4 ⊟ | 12 |

| | (Continuing) ⊡ 30 ⊟ | Ans÷30 |
| | | 0.4 |

Example 2: To perform the calculations shown below:

$$123 + 456 = \underline{579} \qquad 789 - \underline{579} = 210$$

(MthIO-LineO)

123 $\boxed{+}$ 456 $\boxed{=}$ 579

(Continuing) 789 $\boxed{-}$ $\boxed{\text{Ans}}$ $\boxed{=}$

```
789-Ans          ▣    Math ▲


                        210
```

Variables (A, B, C, D, E, F, M, X, Y)

Your calculator has nine preset variables named A, B, C, D, E, F, M, X, and Y.
You can assign values to variables and use the variables in calculations.

Example:
To assign the result of 3 + 5 to variable A

3 $\boxed{+}$ 5 $\boxed{\text{SHIFT}}$ $\boxed{\text{RCL}}$ (STO) $\boxed{(-)}$ (A)   8

To multiply the contents of variable A by 10

(Continuing) $\boxed{\text{ALPHA}}$ $\boxed{(-)}$ (A) $\boxed{\times}$ 10 $\boxed{=}$ 80

To recall the contents of variable A

(Continuing) $\boxed{\text{RCL}}$ $\boxed{(-)}$ (A)   8

To clear the contents of variable A

0 $\boxed{\text{SHIFT}}$ $\boxed{\text{RCL}}$ (STO) $\boxed{(-)}$ (A)   0

Independent Memory (M)

You can add calculation results to or subtract results from independent memory.
The "M" indicator appears on the display when there is any value other than zero stored in independent memory.

Example:
To clear the contents of M

0 $\boxed{\text{SHIFT}}$ $\boxed{\text{RCL}}$ (STO) $\boxed{\text{M+}}$ (M)   0

To add the result of 10 × 5 to M

(Continuing) 10 $\boxed{\times}$ 5 $\boxed{\text{M+}}$ 50

25

To subtract the result of 10 + 5 from M

(Continuing) 10 [+] 5 [SHIFT] [M+] (M−)   15

To recall the contents of M

(Continuing) [RCL] [M+] (M)   35

> **Note**
>
> • Variable M is used for independent memory.

▌Clearing the Contents of All Memories

Ans memory, independent memory, and variable contents are retained even if you press [AC], change the calculation mode, or turn off the calculator.
Perform the following procedure when you want to clear the contents of all memories.

[SHIFT] [9] (CLR) [2] (Memory) [=] (Yes)

Function Calculations

Use the `MODE` key to enter the COMP Mode when you want to perform function calculations.

`MODE` `1` (COMP)
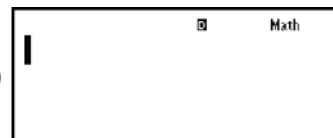
Note: Using functions can slow down a calculation, which may delay display of the result. Do not perform any subsequent operation while waiting for the calculation result to appear. To interrupt an ongoing calculation before its result appears, press `AC`.

Pi (π), Natural Logarithm Base e

π is displayed as 3.141592654, but π = 3.14159265358980 is used for internal calculations.

e is displayed as 2.718281828, but e = 2.71828182845904 is used for internal calculations.

Trigonometric Functions

Specify the angle unit before performing calculations.

Example 1: sin 30° = 0.5 (LineIO) (Angle unit: Deg)

$\boxed{\text{sin}}$ 30 $\boxed{)}$ $\boxed{=}$ 0.5

Example 2: sin^{-1} 0.5 = 30° (LineIO) (Angle unit: Deg)

$\boxed{\text{SHIFT}}$ $\boxed{\text{sin}}$ (sin^{-1}) 0 $\boxed{.}$ 5 $\boxed{)}$ $\boxed{=}$ 30

Hyperbolic Functions

Input a function from the menu that appears when you press $\boxed{\text{hyp}}$.
The angle unit setting does not affect calculations.

Example 1: sinh 1 = 1.175201194

[hyp] [1] (sinh) 1 [)] [=]   1.175201194

Example 2: cosh[-1] 1 = 0

[hyp] [5] (cosh[-1]) 1 [)] [=]   0

Angle Unit Conversion

°, ^{r}, ^{g} : These functions specify the angle unit. ° specifies degrees, ^{r} radians, and ^{g} grads.
Input a function from the menu that appears when you perform the following key operation: [SHIFT] [Ans] (DRG►).

Example: $\pi/2$ radians = 90°, 50 grads = 45° (Angle unit: Deg)

[(] [SHIFT] [x10ˣ](π) [÷] 2 [)] [SHIFT] [Ans] (DRG►) [2] (^{r}) [=]   90

50 [SHIFT] [Ans] (DRG►) [3] (^{g}) [=]   45

Exponential Functions

Note that the input method is different depending upon whether you are using Natural Display or Linear Display.

Example: To calculate $e^5 \times 2$ to three significant digits (Sci 3)

[SHIFT] [MODE] (SETUP) [7] (Sci) [3]

(MthIO-LineO) [SHIFT] [ln] ($e^\blacksquare$) 5 [▶] [×] 2 [=] 2.97×10^2

(LineIO) [SHIFT] [ln] ($e^\blacksquare$) 5 [)] [×] 2 [=] 2.97×10^2

Logarithmic Functions

Example 1: $\log_{10} 1000 = \log 1000 = 3$

[log] 1000 [)] [=]   3

Example 2: To calculate ln 90 (= $\log_e 90$) to three significant digits (Sci 3)

[SHIFT] [MODE] (SETUP) [7] (Sci) [3]
[ln] 90 [)] [=] 4.50×10^0

Power Functions and Power Root Functions

Note that the input methods for $x^{\blacksquare}$, $\sqrt{\blacksquare}$, $^3\sqrt{\blacksquare}$, and $^{\blacksquare}\sqrt{\square}$ are different depending upon whether you are using Natural Display or Linear Display.

Example 1: $1.2 \times 10^3 = 1200$ (MthIO-LineO)

<div align="center">1 [·] 2 [×] 10 [x■] 3 [=]</div> <div align="right">1200</div>

Example 2: $(1 + 1)^{2+2} = 16$ (MthIO-LineO)

<div align="center">[(] 1 [+] 1 [)] [x■] 2 [+] 2 [=]</div> <div align="right">16</div>

Example 3: $(5^2)^3 = 15625$

<div align="center">[(] 5 [x²] [)] [x³] [=]</div> <div align="right">15625</div>

Example 4: $^5\sqrt{32} = 2$

<div align="center">(MthIO-LineO) [SHIFT] [x■] ($^{\blacksquare}\sqrt{\square}$) 5 [▶] 32 [=]</div> <div align="right">2</div>

<div align="center">(LineIO) 5 [SHIFT] [x■] ($^{\blacksquare}\sqrt{\square}$) 32 [)] [=]</div> <div align="right">2</div>

Example 5: To calculate $\sqrt{2} \times 3$ (= 4.242640687...) to three decimal places (Fix 3)

<div align="center">[SHIFT] [MODE] (SETUP) [6] (Fix) [3]</div>

<div align="center">(MthIO-LineO) [√■] 2 [▶] [×] [3] [=]</div> <div align="right">4.243</div>

<div align="center">(LineIO) [√■] 2 [)] [×] 3 [=]</div> <div align="right">4.243</div>

Example 6: $^3\sqrt{5} + {}^3\sqrt{-27} = -1.290024053$

<div align="center">(LineIO) [SHIFT] [√■] ($^3\sqrt{\blacksquare}$) 5 [)] [+]
[SHIFT] [√■] ($^3\sqrt{\blacksquare}$) [(−)] 27 [)] [=]</div> <div align="right">-1.290024053</div>

Example 7: $\dfrac{1}{\frac{1}{3} - \frac{1}{4}} = 12$

<div align="center">(LineIO) [(] 3 [x⁻¹] [−] 4 [x⁻¹] [)] [x⁻¹] [=]</div> <div align="right">12</div>

Rectangular-Polar Coordinate Conversion

Pol converts rectangular coordinates to polar coordinates, while Rec converts polar coordinates to rectangular coordinates.

$$\text{Pol}(x, y) = (r, \theta) \qquad \text{Rec}(r, \theta) = (x, y)$$
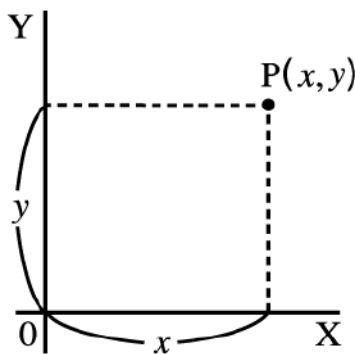
(1) Rectangular Coordinates (Rec)
(2) Polar Coordinates (Pol)
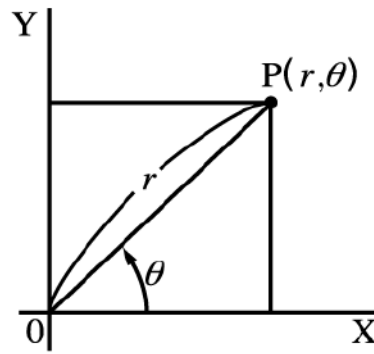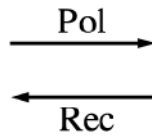
Specify the angle unit before performing calculations.
The calculation result for r and θ and for x and y are each assigned respectively to variables X and Y.
Calculation result θ is displayed in the range of $-180° < \theta \leqq 180°$.

Example 1: To convert rectangular coordinates ($\sqrt{2}$, $\sqrt{2}$) to polar coordinates (Angle unit: Deg)
(MthIO-LineO)

$\boxed{\text{SHIFT}}$ $\boxed{+}$ (Pol) $\boxed{\sqrt{\blacksquare}}$ 2 $\boxed{\blacktriangleright}$ $\boxed{\text{SHIFT}}$ $\boxed{)}$ (,) $\boxed{\sqrt{\blacksquare}}$ 2 $\boxed{\blacktriangleright}$ $\boxed{)}$ $\boxed{=}$ $r = 2$, $\theta = 45$

(LineIO)

$\boxed{\text{SHIFT}}$ $\boxed{+}$ (Pol) $\boxed{\sqrt{\blacksquare}}$ 2 $\boxed{)}$ $\boxed{\text{SHIFT}}$ $\boxed{)}$ (,) $\boxed{\sqrt{\blacksquare}}$ 2 $\boxed{)}$ $\boxed{)}$ $\boxed{=}$ $r = 2$
$\theta = 45$

Example 2: To convert polar coordinates ($\sqrt{2}$, 45°) to rectangular coordinates (Angle unit: Deg)

(MthIO-LineO)

[SHIFT] [−](Rec)[√▪]2 [▶] [SHIFT] [)](,) 45 [)] [=]   X = 1, Y = 1

Factorial Function (!)

Example: (5 + 3)! = 40320

[(]5[+]3[)][x!][=]   40320

Absolute Value Function (Abs)

Note that the input method is different depending upon whether you are using Natural Display or Linear Display.

Example: |2 - 7| × 2 = 10
(MthIO-LineO)

[Abs]2[−]7[▶][×]2[=]   10

(LineIO)

[Abs]2[−]7[)][×]2[=]   10

Random Number (Ran#)

Function that generates a pseudo random number in the range of 0.000 to 0.999.
The result is displayed as a fraction when Natural Display is selected.

Example: Generate three 3-digit random numbers.
The random 3-digit decimal values are converted to 3-digit integer values by multiplying by 1000.

1000 [SHIFT] [•](Ran#)[=]   634

[=]   92

[=]   175

(Results shown here are for illustrative purposes only. Actual results will differ.)

Random Integer (RanInt#)

For input of the function of the form RanInt#(a, b), which generates a random integer within the range of a to b.

Example: To generate random integers in the range of 1 to 6

[ALPHA] [•](RanInt) 1 [SHIFT] [)](,) 6 [)] [=]	2
[=]	6
[=]	1

(Results shown here are for illustrative purposes only. Actual results will differ.)

Permutation (nPr) and Combination (nCr)

Example: To determine the number of permutations and combinations possible when selecting four people from a group of 10.

Permutations: 10 [SHIFT] [×](nPr) 4 [=]	5040
Combinations: 10 [SHIFT] [÷](nCr) 4 [=]	210

Rounding Function (Rnd)

The argument of this function is made a decimal value and then rounded in accordance with the current number of display digits setting (Norm, Fix, or Sci).
With Norm 1 or Norm 2, the argument is rounded off to 10 digits.
With Fix and Sci, the argument is rounded off to the specified digit.
When Fix 3 is the display digits setting, for example, the result of 10 ÷ 3 is displayed as 3.333, while the calculator maintains a value of 3.33333333333333 (15 digits) internally for calculation.
In the case of Rnd(10÷3) = 3.333 (with Fix 3), both the displayed value and the calculator's internal value become 3.333.
Because of this a series of calculations will produce different results depending on whether Rnd is used (Rnd(10÷3) × 3 = 9.999) or not used (10 ÷ 3 × 3 = 10.000).

$$\boxed{\text{SHIFT}}\ \boxed{\text{MODE}}\ \text{(SETUP)}\ \boxed{6}\ \text{(Fix)}\ \boxed{3}$$

$$10\ \boxed{÷}\ 3\ \boxed{×}\ 3\ \boxed{=} \qquad\qquad 10.000$$

$$\boxed{\text{SHIFT}}\ \boxed{0}\ \text{(Rnd)}\ 10\ \boxed{÷}\ 3\ \boxed{)}\ \boxed{×}\ 3\ \boxed{=} \qquad\qquad 9.999$$

Greatest Common Divisor (GCD) and Least Common Multiple (LCM)

Greatest Common Divisor (GCD)

GCD determines the greatest common divisor of two values.

Example: To determine the greatest common divisor of 28 and 35

$$\boxed{\text{ALPHA}}\ \boxed{×}\ \text{(GCD)}\ 28\ \boxed{\text{SHIFT}}\ \boxed{)}\ \text{(,)}\ 35\ \boxed{)}\ \boxed{=} \qquad\qquad 7$$

Least Common Multiple (LCM)

LCM determines the least common multiple of two values.

Example: To determine the least common multiple of 9 and 15

$$\boxed{\text{ALPHA}}\ \boxed{÷}\ \text{(LCM)}\ 9\ \boxed{\text{SHIFT}}\ \boxed{)}\ \text{(,)}\ 15\ \boxed{)}\ \boxed{=} \qquad\qquad 45$$

Using Calculation Modes

Statistical Calculations (STAT)

To start a statistical calculation, perform the key operation [MODE] [2](STAT) to enter the STAT Mode and then use the screen that appears to select the type of calculation you want to perform.

```
1:1-VAR  2:A+BX
3:_+cX²  4:ln X
5:e^X    6:A•B^X
7:A•X^B  8:1/X
```

To select this type of statistical calculation: (Regression formula shown in parentheses)	Press this key:
Single-variable (X)	[1](1-VAR)
Paired-variable (X, Y), linear regression $(y = A + Bx)$	[2](A+BX)
Paired-variable (X, Y), quadratic regression $(y = A + Bx + Cx^2)$	[3](_+CX²)
Paired-variable (X, Y), logarithmic regression $(y = A + B\ln x)$	[4](ln X)
Paired-variable (X, Y), e exponential regression $(y = A\, e^{Bx})$	[5](e^X)
Paired-variable (X, Y), ab exponential regression $(y = AB^x)$	[6](A•B^X)
Paired-variable (X, Y), power regression $(y = Ax^B)$	[7](A•X^B)
Paired-variable (X, Y), inverse regression $(y = A + B/x)$	[8](1/X)

Pressing any of the above keys ([1] to [8]) displays the Statistics Editor.

Inputting Data

Use the Statistics Editor to input data. Perform the following key operation to display the Statistics Editor: [SHIFT] [1] (STAT) [2] (Data).
The Statistics Editor provides 40 rows for data input when there is an X column only or when there are X and Y columns, 20 rows when there are X and FREQ columns, or 26 rows when there are X, Y, and FREQ columns.
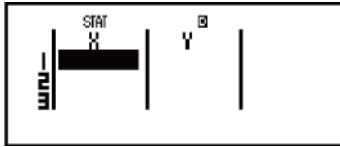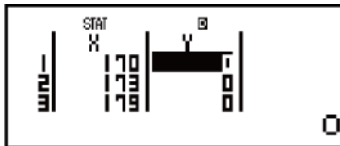
Example 1: To select linear regression and input the following data:
(170, 66), (173, 68), (179, 75)
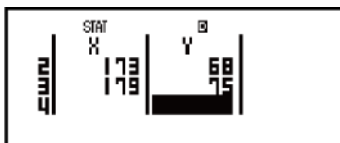
[MODE] [2] (STAT) [2] (A+BX)

170 [=] 173 [=] 179 [=] ⊙ ▶

66 [=] 68 [=] 75 [=]

To change the data in a cell:

In the Statistics Editor, move the cursor to the cell that contains the data you want to change, input the new data, and then press ☐.

To delete a line:

In the Statistics Editor, move the cursor to the line that you want to delete and then press [DEL].

To insert a line:

In the Statistics Editor, move the cursor to the location where you want to insert the line and then perform the following key operation:

[SHIFT] [1] (STAT) [3] (Edit) [1] (Ins).

To delete all Statistics Editor contents:

In the Statistics Editor, perform the following key operation:

[SHIFT] [1] (STAT) [3] (Edit) [2] (Del-A).

Statistics Calculation Screen

The Statistics Calculation Screen is for performing statistical calculations with the data you input with the Statistics Editor. Pressing the [AC] key while the Statistics Editor is displayed switches to the Statistics Calculation Screen.

Using the Statistics Menu

While the Statistics Calculation Screen is on the display, press [SHIFT] [1] (STAT) to display the Statistics Menu.

The content to the Statistics Menu depends on whether the currently selected statistical operation type uses a single variable or paired variables.

```
1:Type   2:Data
3:Sum    4:Var
5:MinMax
```

Single-variable Statistics

```
1:Type   2:Data
3:Sum    4:Var
5:Reg    6:MinMax
```

Paired-variables Statistics

Statistics Menu Items
Common Items

Select this menu item:	When you want to obtain this:
$\boxed{1}$ (Type)	Display the calculation type selection screen
$\boxed{2}$ (Data)	Display the Statistics Editor
$\boxed{3}$ (Sum)	Display the Sum sub-menu of commands for calculating sums
$\boxed{4}$ (Var)	Display the Var sub-menu of commands for calculating the mean, standard deviation, etc.
Paired-variable: $\boxed{5}$ (Reg)	Display the Reg sub-menu of commands for regression calculations • For details see "Commands when Linear Regression Calculation (A+BX) Is Selected" and "Commands when Quadratic Regression Calculation (_+CX^2) Is Selected".
Single-variable: $\boxed{5}$ (MinMax) Paired-variable: $\boxed{6}$ (MinMax)	Display the MinMax sub-menu of commands for obtaining maximum and minimum values

Single-variable (1-VAR) Statistical Calculation Commands
Sum Sub-menu ($\boxed{\text{SHIFT}}$ $\boxed{1}$ (STAT) $\boxed{3}$ (Sum))

Select this menu item:	When you want to obtain this:
$\boxed{1}$ ($\sum x^2$)	Sum of squares of the sample data
$\boxed{2}$ ($\sum x$)	Sum of the sample data

Var Sub-menu (　SHIFT 　1 (STAT) 4 (Var))

Select this menu item:	When you want to obtain this:
1 (n)	Number of samples
2 ($\bar{x}$)	Mean of the sample data
3 (σ_x)	Population standard deviation
4 (s_x)	Sample standard deviation

MinMax Sub-menu (　SHIFT 　1 (STAT) 5 (MinMax))

Select this menu item:	When you want to obtain this:
1 (minX)	Minimum value
2 (maxX)	Maximum value
3 (Q1)	First quartile
4 (med)	Median
5 (Q3)	Third quartile

Commands when Linear Regression Calculation (A+BX) Is Selected Sum Sub-menu (　SHIFT 　1 (STAT) 3 (Sum))

Select this menu item:	When you want to obtain this:
1 ($\sum x^2$)	Sum of squares of the X-data
2 ($\sum x$)	Sum of the X-data
3 ($\sum y^2$)	Sum of squares of the Y-data
4 ($\sum y$)	Sum of the Y-data
5 ($\sum xy$)	Sum of products of the X-data and Y-data
6 ($\sum x^3$)	Sum of cubes of the X-data

$\boxed{7}(\sum x^2 y)$	Sum of (X-data squares × Y-data)
$\boxed{8}(\sum x^4)$	Sum of biquadrate of the X-data

Var Sub-menu ($\boxed{\text{SHIFT}}$ $\boxed{1}$(STAT)$\boxed{4}$(Var))

Select this menu item:	When you want to obtain this:
$\boxed{1}(n)$	Number of samples
$\boxed{2}(\bar{x})$	Mean of the X-data
$\boxed{3}(\sigma_x)$	Population standard deviation of the X-data
$\boxed{4}(s_x)$	Sample standard deviation of the X-data
$\boxed{5}(\bar{y})$	Mean of the Y-data
$\boxed{6}(\sigma_y)$	Population standard deviation of the Y-data
$\boxed{7}(s_y)$	Sample standard deviation of the Y-data

Reg Sub-menu ($\boxed{\text{SHIFT}}$ $\boxed{1}$(STAT)$\boxed{5}$(Reg))

Select this menu item:	When you want to obtain this:
$\boxed{1}$(A)	Regression coefficient constant term A
$\boxed{2}$(B)	Regression coefficient B
$\boxed{3}(r)$	Correlation coefficient r
$\boxed{4}(\hat{x})$	Estimated value of X
$\boxed{5}(\hat{y})$	Estimated value of Y

MinMax Sub-menu ($\boxed{\text{SHIFT}}$ $\boxed{1}$(STAT)$\boxed{6}$(MinMax))

Select this menu item:	When you want to obtain this:
$\boxed{1}$(minX)	Minimum value of the X-data

$\boxed{2}$ (maxX)	Maximum value of the X-data
$\boxed{3}$ (minY)	Minimum value of the Y-data
$\boxed{4}$ (maxY)	Maximum value of the Y-data

Commands when Quadratic Regression Calculation (_+CX^2) Is Selected
Reg Sub-menu ($\boxed{\text{SHIFT}}$ $\boxed{1}$ (STAT) $\boxed{5}$ (Reg))
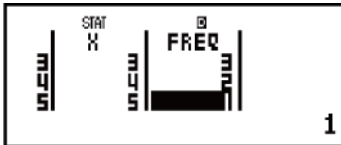
Select this menu item:	When you want to obtain this:
$\boxed{1}$ (A)	Regression coefficient constant term A
$\boxed{2}$ (B)	Linear coefficient B of the regression coefficients
$\boxed{3}$ (C)	Quadratic coefficient C of the regression coefficients
$\boxed{4}$ ($\hat{x}_1$)	Estimated value of x_1
$\boxed{5}$ ($\hat{x}_2$)	Estimated value of x_2
$\boxed{6}$ ($\hat{y}$)	Estimated value of y

Note

- $\hat{x}$, $\hat{x}_1$, $\hat{x}_2$ and $\hat{y}$ are not variables. They are commands of the type that take an argument immediately before them. See "Calculating Estimated Values" for more information.

Example 2: To input the single-variable data x = {1, 2, 2, 3, 3, 3, 4, 4, 5}, using the FREQ column to specify the number of repeats for each items ({x_n; freq$_n$} = {1;1, 2;2, 3;3, 4;2, 5;1}), and calculate the mean and population standard deviation.

$\boxed{\text{SHIFT}}$ $\boxed{\text{MODE}}$ (SETUP) $\boxed{\blacktriangledown}$ $\boxed{3}$ (STAT) $\boxed{1}$ (ON)
$\boxed{\text{MODE}}$ $\boxed{2}$ (STAT) $\boxed{1}$ (1-VAR)
1 $\boxed{=}$ 2 $\boxed{=}$ 3 $\boxed{=}$ 4 $\boxed{=}$ 5 $\boxed{=}$ $\boxed{\blacktriangledown}$ $\boxed{\blacktriangleright}$
1 $\boxed{=}$ 2 $\boxed{=}$ 3 $\boxed{=}$ 2 $\boxed{=}$

$\boxed{\text{AC}}$ $\boxed{\text{SHIFT}}$ $\boxed{1}$ (STAT) $\boxed{4}$ (Var) $\boxed{2}$ ($\bar{x}$) $\boxed{=}$ 3

$\boxed{\text{AC}}$ $\boxed{\text{SHIFT}}$ $\boxed{1}$ (STAT) $\boxed{4}$ (Var) $\boxed{3}$ (σ_x) $\boxed{=}$ 1.154700538

Results: Mean: 3, Population Standard Deviation: 1.154700538

Example 3: To calculate the linear regression and logarithmic regression correlation coefficients for the following paired-variable data and determine the regression formula for the strongest correlation: (x, y) = (20, 3150), (110, 7310), (200, 8800), (290, 9310). Specify Fix 3 (three decimal places) for results.

$\boxed{\text{SHIFT}}$ $\boxed{\text{MODE}}$ (SETUP) $\boxed{\blacktriangledown}$ $\boxed{3}$ (STAT) $\boxed{2}$ (OFF)
$\boxed{\text{SHIFT}}$ $\boxed{\text{MODE}}$ (SETUP) $\boxed{6}$ (Fix) $\boxed{3}$
$\boxed{\text{MODE}}$ $\boxed{2}$ (STAT) $\boxed{2}$ (A+BX)
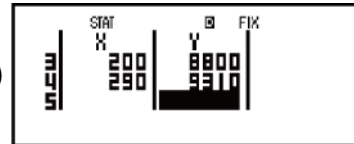20 $\boxed{=}$ 110 $\boxed{=}$ 200 $\boxed{=}$ 290 $\boxed{=}$ $\boxed{\blacktriangledown}$ $\boxed{\blacktriangleright}$
3150 $\boxed{=}$ 7310 $\boxed{=}$ 8800 $\boxed{=}$ 9310 $\boxed{=}$

$\boxed{\text{AC}}$ $\boxed{\text{SHIFT}}$ $\boxed{1}$ (STAT) $\boxed{5}$ (Reg) $\boxed{3}$ (r) $\boxed{=}$ 0.923

$\boxed{\text{AC}}$ $\boxed{\text{SHIFT}}$ $\boxed{1}$ (STAT) $\boxed{1}$ (Type) $\boxed{4}$ (ln X)
$\boxed{\text{AC}}$ $\boxed{\text{SHIFT}}$ $\boxed{1}$ (STAT) $\boxed{5}$ (Reg) $\boxed{3}$ (r) $\boxed{=}$ 0.998

$\boxed{\text{AC}}$ $\boxed{\text{SHIFT}}$ $\boxed{1}$ (STAT) $\boxed{5}$ (Reg) $\boxed{1}$ (A) $\boxed{=}$ -3857.984

$\boxed{\text{AC}}$ $\boxed{\text{SHIFT}}$ $\boxed{1}$ (STAT) $\boxed{5}$ (Reg) $\boxed{2}$ (B) $\boxed{=}$ 2357.532

Results: Linear Regression Correlation Coefficient: 0.923
Logarithmic Regression Correlation Coefficient: 0.998
Logarithmic Regression Formula: y = -3857.984 + 2357.532ln$x$

Calculating Estimated Values

Based on the regression formula obtained by paired-variable statistical calculation, the estimated value of y can be calculated for a given x-value. The corresponding x-value (two values, x_1 and x_2, in the case of quadratic regression) also can be calculated for a value of y in the regression formula.

Example 4: To determine the estimate value for x when y = -130 in the regression formula produced by logarithmic regression of the data in Example 3. Specify Fix 3 for the result. (Perform the following operation after completing the operations in Example 3.)

$\boxed{\text{AC}}$ $\boxed{(-)}$ 130 $\boxed{\text{SHIFT}}$ $\boxed{1}$ (STAT) $\boxed{5}$ (Reg) $\boxed{4}$ ($\hat{x}$) $\boxed{=}$ 4.861

Important!

- Regression coefficient, correlation coefficient, and estimated value calculations can take considerable time when there are a large number of data items.

Using VERIFY (VERIF)

VERIFY is a function you can use to verify whether an input equality or inequality is true (indicated by TRUE) or false (indicated by FALSE). The following shows the general procedure for using VERIFY.

Example: To verify whether $4\sqrt{9} = 12$ is true   (MthIO-LineO)
1. Press MODE 3 (VERIF) to enter the VERIFY Mode.
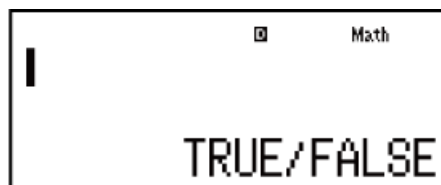
2. Input $4\sqrt{9} = 12$.
   4 √■ 9 ▶ SHIFT 6 (VERIFY) 1 (=) 12
   • You can select the equality symbol or inequality symbol from the menu that appears when you press SHIFT 6 (VERIFY).
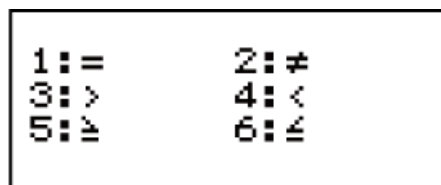
3. To verify, press =.
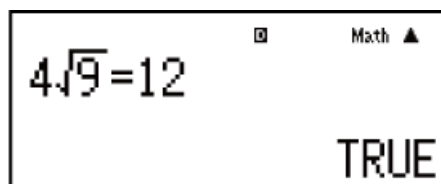
You can input the following expressions for verification in the VERIFY Mode.
 • Equalities or inequalities that include one relational operator $4 = \sqrt{16}$, $4 \neq 3$, $\pi > 3$, $1 + 2 \leqq 5$, $(3 \times 6) < (2 + 6) \times 2$, etc.
 • Equalities or inequalities that include multiple relational operators $1 \leqq 1 < 1 + 1$, $3 < \pi < 4$, $2^2 = 2 + 2 = 4 < 6$, $2 + 3 = 5 \neq 2 + 5 = 8$, etc.

> **Note**
>
> • The verification result will cause 1 to be assigned to Ans memory when TRUE and 0 when FALSE.
> • The input expression can be a total of 99 bytes, including the left side, right side, and relational operators.
> • Any variable (A, B, C, D, E, F, X, Y, M) input into an expression is treated as a value, using the value currently assigned to the variable.

- Pol and Rec functions cannot be used in an expression.
- In the VERIFY Mode, the calculator performs a mathematical operation on the input expression and then displays TRUE or FALSE based on the result. Because of this, calculation error can occur or a mathematically correct result may not be able to be displayed when the input calculation expression includes calculation that approaches the singular point or inflection point of a function, or when the input expression contains multiple calculation operations.

Expression Input Precautions

The following types of expressions cause a Syntax ERROR and cannot be verified.
- An expression with nothing on the left side or right side (Example: = $5\sqrt{7}$)
- An expression in which a relational operator is inside of a fraction or function (Example: $\dfrac{1=1}{2}$, cos (8 ≦ 9))
- An expression in which a relational operator is enclosed in parentheses (Example: 8 < (9 < 10))
- An expression in which multiple relational operators that are not oriented in the same direction (Example: 5 ≦ 6 ≧ 4)
- An expression that contains two of the following operators in any combination (Example: 4 < 6 ≠ 8)
- An expression that contains consecutive relational operators (Example: 5 ≧ > 9)

VERIFY Mode Calculation Examples

Example 1: To verify log2 < log3 < log4

[log] 2 [)] [SHIFT] [6] (VERIFY) [4] (<)
[log] 3 [)] [SHIFT] [6] (VERIFY) [4] (<)
[log] 4 [)] [=]

$$\log(2)<\log(3)<1\triangleright$$
$$\text{TRUE}$$

Example 2: To verify $0 < (\dfrac{8}{9})^2 - \dfrac{8}{9}$ (MthIO-LineO)

0 [SHIFT] [6] (VERIFY) [4] (<)
8 [▤] 9 [▶] [x^2] [−] 8 [▤] 9 [=]

$$0<\dfrac{8}{9}^2-\dfrac{8}{9}$$
$$\text{FALSE}$$

Example 3: To verify $5^2 = 25 = \sqrt{625}$ (MthIO-LineO)

43

5 x^2 [SHIFT] [6] (VERIFY) [1] (=)
25 [SHIFT] [6] (VERIFY) [1] (=) $\sqrt{\square}$ 625 [=]

$$5^2 = 25 = \sqrt{625}$$

Math ▲

TRUE

Technical Information

Errors

The calculator will display an error message whenever an error occurs for any reason during a calculation.

There are two ways to exit an error message display: Pressing ◀ or ▶ to display the location of the error, or pressing AC to clear the message and calculation.

Displaying the Location of an Error

While an error message is displayed, press ◀ or ▶ to return to the calculation screen. The cursor will be positioned at the location where the error occurred, ready for input. Make the necessary corrections to the calculation and execute it again.

Example: When you input 14 ÷ 0 × 2 by mistake instead of 14 ÷ 10 × 2 (MthIO-LineO)

14÷0×2=

```
             ⊠      Math
Math ERROR

[AC]   :Cancel
[◀][▶]:Goto
```

▶(or ◀)

```
          ⊠      Math
14÷0×2
```

◀1=

```
            ⊠    Math ▲
14÷10×2

              2.8
```
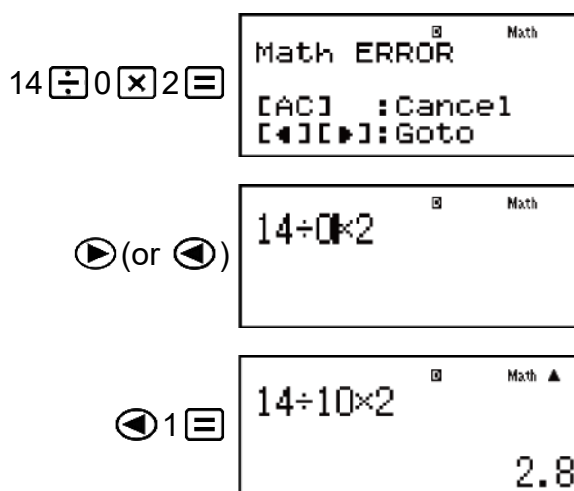
Clearing the Error Message

While an error message is displayed, press AC to return to the calculation screen. Note that this also clears the calculation that contained the error.

Error Messages

Math ERROR

Cause:
- 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).

Action:
- 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.

Stack ERROR

Cause:
- The calculation you are performing has caused the capacity of the numeric stack or the command stack to be exceeded.

Action:
- Simplify the calculation expression so it does not exceed the capacity of the stack.
- Try splitting the calculation into two or more parts.

Syntax ERROR

Cause:
- There is a problem with the format of the calculation you are performing.

Action:
- Make necessary corrections.

Argument ERROR

Cause:
- There is a problem with the argument of the calculation you are performing.

Action:
- Make necessary corrections.

Before Assuming Malfunction of the Calculator...

Perform the following steps whenever an error occurs during a calculation or when calculation results are not what you expected. If one step does not correct the problem, move on to the next step.

Note that you should make separate copies of important data before performing these steps.

1. Check the calculation expression to make sure that it does not contain any errors.
2. Make sure that you are using the correct mode for the type of calculation you are trying to perform.
3. If the above steps do not correct your problem, press the ⎡ON⎤ key. This will cause the calculator to perform a routine that checks whether calculation functions are operating correctly. If the calculator discovers any abnormality, it automatically initializes the calculation mode and clears memory contents. For details about initialized settings, see "Configuring the Calculator Setup".
4. Initialize all modes and settings by performing the following operation: ⎡SHIFT⎤ ⎡9⎤(CLR)⎡1⎤(Setup)⎡=⎤(Yes).

Replacing the Battery

The battery needs to be replaced after a specific number of years. Also, replace the battery immediately after display figures become dim.
A low battery is indicated by a dim display, even if contrast is adjusted, or by failure of figures to appear on the display immediately after you turn on the calculator. If this happens, replace the battery with a new one.

Important!

• Removing the battery will cause all of the calculator's memory contents to be deleted.

1. Press ⎡SHIFT⎤ ⎡AC⎤(OFF) to turn off the calculator.
2. On the back of the calculator, remove the screws and the cover.
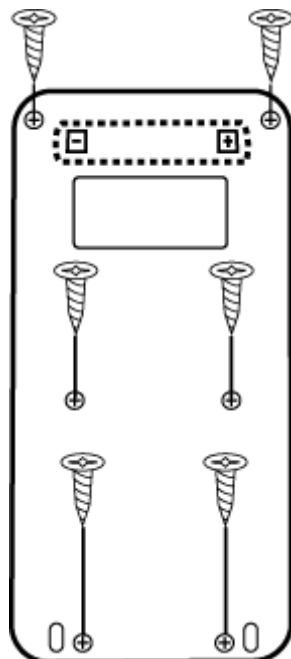
3. Remove the battery, and then load a new battery with its plus (+) and minus (-) ends facing correctly.
4. Replace the cover.
5. Initialize the calculator: [ON] [SHIFT] [9] (CLR) [3] (All) [=] (Yes).
   • Do not skip the above step!

Calculation Priority Sequence

The priority sequence of input calculations is evaluated in accordance with the rules below.
When the priority of two expressions is the same, the calculation is performed from left to right.

1	Parenthetical expressions
2	Functions that require an argument to the right and a closing parenthesis ")" following the argument
3	Functions that come after the input value (x^2, x^3, x^{-1}, $x!$, $°'$ ", $°$, ^{r}, ^{g}, %), powers ($x^\blacksquare$), roots ($\sqrt[\blacksquare]{\square}$)
4	Fractions
5	Negative sign ((-))
6	STAT Mode estimated values ($\hat{x}$, $\hat{y}$, $\hat{x}_1$, $\hat{x}_2$)
7	Multiplication where the multiplication sign is omitted

8	Permutation (nPr), combination (nCr)
9	Multiplication (×), division (÷)
10	Addition (+), subtraction (-)

Note

- When squaring a negative value (such as -2), the value being squared must be enclosed in parentheses ($($ $(-)$ 2 $)$ x^2 $=$). Since x^2 has a higher priority than the negative sign, inputting $(-)$ 2 x^2 $=$ would result in the squaring of 2 and then appending a negative sign to the result.
- Always keep the priority sequence in mind, and enclose negative values in parentheses when required.

Calculation Ranges, Number of Digits, and Precision

The calculation range, number of digits used for internal calculation, and calculation precision depends on the type of calculation you are performing.

Calculation Range and Precision

Calculation Range	$\pm 1 \times 10^{-99}$ to $\pm 9.999999999 \times 10^{99}$ or 0
Number of Digits for Internal Calculation	15 digits
Precision	In general, ±1 at the 10th digit for a single calculation. Precision for exponential display is ±1 at the least significant digit. Errors are cumulative in the case of consecutive calculations.

Function Calculation Input Ranges and Precision

Functions	Input Range	
$\sin x$ $\cos x$	Deg	$0 \leqq |x| < 9 \times 10^9$
	Rad	$0 \leqq |x| < 157079632.7$
	Gra	$0 \leqq |x| < 1 \times 10^{10}$
$\tan x$	Deg	Same as $\sin x$, except when $|x| = (2n\text{-}1) \times 90$.
	Rad	Same as $\sin x$, except when $|x| = (2n\text{-}1) \times \pi/2$.
	Gra	Same as $\sin x$, except when $|x| = (2n\text{-}1) \times 100$.
$\sin^{-1}x$, $\cos^{-1}x$	$0 \leqq |x| \leqq 1$	
$\tan^{-1}x$	$0 \leqq |x| \leqq 9.999999999 \times 10^{99}$	
$\sinh x$, $\cosh x$	$0 \leqq |x| \leqq 230.2585092$	
$\sinh^{-1}x$	$0 \leqq |x| \leqq 4.999999999 \times 10^{99}$	
$\cosh^{-1}x$	$1 \leqq x \leqq 4.999999999 \times 10^{99}$	
$\tanh x$	$0 \leqq |x| \leqq 9.999999999 \times 10^{99}$	
$\tanh^{-1}x$	$0 \leqq |x| \leqq 9.999999999 \times 10^{-1}$	
$\log x$, $\ln x$	$0 < x \leqq 9.999999999 \times 10^{99}$	
10^x	$\text{-}9.999999999 \times 10^{99} \leqq x \leqq 99.99999999$	
e^x	$\text{-}9.999999999 \times 10^{99} \leqq x \leqq 230.2585092$	
$\sqrt{x}$	$0 \leqq x < 1 \times 10^{100}$	
x^2	$|x| < 1 \times 10^{50}$	
x^{-1}	$|x| < 1 \times 10^{100}$; $x \neq 0$	
$\sqrt[3]{x}$	$|x| < 1 \times 10^{100}$	

$x!$	$0 \leqq x \leqq 69$ (x is an integer)
$n\mathrm{P}r$	$0 \leqq n < 1 \times 10^{10}$, $0 \leqq r \leqq n$ (n, r are integers) $1 \leqq \{n!/(n-r)!\} < 1 \times 10^{100}$
$n\mathrm{C}r$	$0 \leqq n < 1 \times 10^{10}$, $0 \leqq r \leqq n$ (n, r are integers) $1 \leqq n!/r! < 1 \times 10^{100}$ or $1 \leqq n!/(n-r)! < 1 \times 10^{100}$
Pol(x, y)	$|x|$, $|y| \leqq 9.999999999 \times 10^{99}$ $\sqrt{x^2 + y^2} \leqq 9.999999999 \times 10^{99}$
Rec(r, θ)	$0 \leqq r \leqq 9.999999999 \times 10^{99}$ θ: Same as sin$x$
°’ ”	$a°b’c”$: $|a|$, b, $c < 1 \times 10^{100}$; $0 \leqq b$, c The display seconds value is subject to an error of ±1 at the second decimal place.
$\overset{\leftarrow}{°’\,”}$	$|x| < 1 \times 10^{100}$ Decimal ↔ Sexagesimal Conversions $0°0’0” \leqq |x| \leqq 9999999°59’59”$
x^y	$x > 0$: $-1 \times 10^{100} < y\log x < 100$ $x = 0$: $y > 0$ $x < 0$: $y = n$, $\dfrac{m}{2n + 1}$ (m, n are integers) However: $-1 \times 10^{100} < y\log |x| < 100$
$\sqrt[x]{y}$	$y > 0$: $x \neq 0$, $-1 \times 10^{100} < 1/x \log y < 100$ $y = 0$: $x > 0$ $y < 0$: $x = 2n+1$, $\dfrac{2n + 1}{m}$ ($m \neq 0$; 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 separator symbol).
RanInt#(a, b)	$a < b$; $|a|$, $|b| < 1 \times 10^{10}$; $b - a < 1 \times 10^{10}$
GCD(a, b)	$|a|$, $|b| < 1 \times 10^{10}$ (a, b are integers)
LCM(a, b)	$0 \leqq a$, $b < 1 \times 10^{10}$ (a, b are integers)

- Precision is basically the same as that described under "Calculation Range and Precision", above.
- x^y, $\sqrt[x]{y}$, $\sqrt[3]{}$, $x!$, $n\mathrm{P}r$, $n\mathrm{C}r$ type functions require consecutive internal calculation, which can cause accumulation of errors that occur with each calculation.
- Error is cumulative and tends to be large in the vicinity of a function's singular point and inflection point.

Specifications

Power Requirements:
AAA-size battery R03 (UM-4) × 1

Approximate Battery Life:
2 years (based on one hour of operation per day)

Power Consumption:
0.0002 W

Operating Temperature:
0°C to 40°C (32°F to 104°F)

Dimensions:
13.8 (H) × 77 (W) × 161.5 (D) mm
$^1/_2$" (H) × 3" (W) × 6$^3/_8$" (D)

Approximate Weight:
105 g (3.7 oz) including the battery

Verifying the Authenticity of Your Calculator

Use the steps below to verify that your calculator is a genuine CASIO calculator.

1. Press MODE.
2. Press 0.
   - This displays the information below.
     - Calculator ID number (24-character string)
     - QR Code for accessing the Worldwide Education Service (https://wes.casio.com/calc/)
3. Access the above site.

4. Follow the instructions on the display to verify the authenticity of your calculator.

Press AC to return to the mode menu.

Frequently Asked Questions

Frequently Asked Questions

■ **How can I perform input and display results the same way I did on a model that does not have Natural Textbook Format?**

→ Perform the following key operation: ⌨SHIFT ⌨MODE(SETUP)⌨2(LineIO). See "Configuring the Calculator Setup" for more information.

■ **How can I change a fraction form result to decimal form?**
How can I change a fraction form result produced by a division operation to decimal form?

→ See "Toggling Calculation Results" for the procedure.

■ **What is the difference between Ans memory, independent memory, and variable memory?**

→ Each of these types of memory acts like "containers" for temporary storage of a single value.

Ans Memory:
Stores the result of the last calculation performed. Use this memory to carry the result of one calculation on to the next.

Independent Memory:
Use this memory to totalize the results of multiple calculations.

Variables:
This memory is helpful when you need to uses the same value multiple times in one or more calculations.

■ **What is the key operation to take me from the STAT Mode to a mode where I can perform arithmetic calculations?**

→ Press ⌨MODE⌨1(COMP).

■ **How can I return the calculator to its initial default settings?**

→ Perform the following key operation: ⌨SHIFT ⌨9(CLR)⌨1(Setup)⌨=(Yes).

■ **When I execute a function calculation, why do I get a calculation result that is completely different from older CASIO calculator models?**

→ With a Natural Textbook Display model, the argument of a function that uses parentheses must be followed by a closing parenthesis. Failing to press ⌨) after the argument to close the parentheses may cause unwanted values or expressions to be included as part of the argument.

Example: (sin 30) + 15 (Angle Unit: Deg)

Older (S-V.P.A.M.) Model: ⌈sin⌉ 30 ⊞ 15 ⊟   15.5

Natural Textbook Display Model:

(LineIO)   ⌈sin⌉ 30 ⌈)⌉ ⊞ 15 ⊟   15.5

Failure to press ⌈)⌉ here as shown below will result in calculation of sin 45.

⌈sin⌉ 30 ⊞ 15 ⊟   0.7071067812

CASIO ®