HP 300s+ Scientific Calculator

User Guide

© Copyright 2012 Hewlett-Packard Development Company, L.P.
The information contained herein is subject to change without notice. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

First Edition: September 2012

Part number: 697635-001

Table of contents

About this Manual 1
Initializing the Calculator 2
Safety Precautions 2
Disposing of the Calculator 3
Other Precautions 3
Before Using the Calculator 3
About the Display 5
Display Indicators 5
Calculation Modes and Calculator Setup 6
Calculation Modes 6
Specifying the Calculation Mode 6
Configuring the Calculator Setup 6
Specifying the Input/Output Format 6
Specifying the Default Angle Unit 7
Specifying the Number of Display Digits 7
Calculation Result Display Examples 7
Specifying the Fraction Format 8
Specifying the Statistical Display Format 8
Specifying the Decimal Point Display Format 8
Initializing the Calculation Mode and Other Settings 8
Inputting Expressions and Values 9
Inputting a Calculation Expression Using Standard Format 9
Inputting a General Function 9
Omitting the Multiplication Sign 10
Final Closed Parentheses 10
Displaying a Long Expression 10
Number of Input Characters (Bytes) 10
Correcting an Expression 11
About Insert and Overwrite Input Modes 11
Changing the Character or Function You Just Input . . . 11
Deleting a Character or Function 12
Correcting a Calculation 12
Inserting Input into a Calculation 13
Displaying the Location of an Error 13
Inputting with Math Format 14
Functions and Symbols Supported for Math Format Input 14
Math Format Input Examples 14
Incorporating a Value into a Function 15

Displaying Calculation Results in a Form that Includes Irrational Number Form 16
Basic Calculations (COMP) 19
Arithmetic Calculations 19
Number of Decimal Places and Number of Significant Digits 19
Omitting a Final Closed Parentheses 19
Fraction Calculations 20
Switching Between Improper Fraction and Mixed Fraction Format 21
Switching Between Fraction and Decimal Format 21
Percent Calculations 21
Degree, Minute, Second (Sexagesimal) Calculations . . 23
Inputting Sexagesimal Values 23
Sexagesimal Calculations 23
Converting Values Between Sexagesimal and Decimal 23
Using Multi-statements in Calculations 24
Using Calculation History Memory and Replay (COMP) 24
Recalling Calculation History Memory Contents 24
Replay Function 25
Using Calculator Memory 26
Memory Name 26
Description 26
Answer Memory (Ans) 26
Independent Memory (M) 27
Variables (A, B, C, D, E, F, X, Y) 28
Clearing the Contents of All Memories 29
Function Calculations 29
Pi (π) and Natural Logarithm Base 29
Trigonometric and Inverse Trigonometric Functions . . . 30
Hyperbolic and Inverse Hyperbolic Functions 30
Converting an Input Value to the Calculator's Default Angle Unit 30
Exponential Functions and Logarithmic Functions 31
Power Functions and Power Root Functions 33
Rectangular-Polar Coordinate Conversion 34
Converting to Polar Coordinates (Pol) 34
Converting to Rectangular Coordinates (Rec) 34
Greatest Common Divisor and Least Common Multiple 35
The Integer Function and the Greatest Integer Function 36
Division with Quotient and Remainder 36

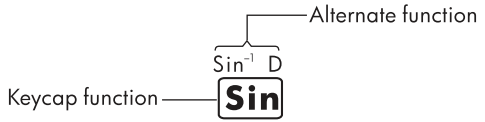
Fraction Simplification Function 37
Using CALC 38
Metric Conversion. 38
RanInt 39
Other Functions 39
Factorial (!) 40
Absolute Value Calculation (Abs) 40
Random Number (Ran#) 40
Permutation (nPr) and Combination (nCr) 41
Rounding Function (Rnd) 41
Transforming Displayed Values 42
Using Engineering Notation 42
Using S-D Transformation 43
Formats Supported for S-D Transformation 43
Examples of S-D Transformation 43
Statistical Calculation (STAT). 44
Selecting a Statistical Calculation Type 44
Statistical Calculation Types 44
Inputting Sample Data Displaying the STAT Editor Screen 45
STAT Editor Screen 45
FREQ (Frequency) Column 45
Rules for Inputting Sample Data on the STAT Editor Screen 45
STAT Editor Screen Input Precautions. 46
Precautions Concerning Sample Data Storage 46
Editing Sample Data. 46
Deleting a Line 47
Inserting Line 47
Deleting All STAT Editor Contents 47
STAT Calculation Screen 47
Using the STAT Menu 47
STAT Menu Items. 48
Single-variable (1-VAR) Statistical Calculation Commands 48
Sum Sub-menu. 48
Var Sub-menu 49
MinMax Sub-menu 49
Single-variable Statistical Calculation. 49
Commands When Linear Regression Calculation (A+Bx) Is Selected 51
Sum Sub-menu. 52
Var Sub-menu 52
MinMax Sub-menu 53
Reg Sub-menu 53
Commands when Quadratic Regression Calculation Is Selected 55

Reg Sub-menu 56
Comments for Other Typed of Regression 58
Command Usage Tips 65
Calculations of Equations (EQN) 65
Generating a Number Table from a Function (TABLE) 70
Supported Function Types 71
Start, End, and Step Value Rules 72
Number Table Screen 72
TABLE Mode Precautions 72
Using the Verify Command 72
Inputting and Editing 73
Proportion Calculations (PROP) 76
Inputting and Editing Coefficients 76
PROP Solution Display 78
Technical Information 80
Order of Operations 80
Stack Limitations 80
Calculation Ranges, Number of Digits, and Precision . . .81
Calculation Range and Precision 81
Function Calculation Input Ranges and Precision 81
Error Messages 84
When an Error Message Appears 84
Math Error 84
Stack ERROR 85
Syntax ERROR 85
Insufficient MEM Error 85
Before assuming malfunction of the calculator 85
Reference 86
Power Requirements and Battery Replacement 86
Replacing the Battery 86
Auto Power Off 87
Specifications 87
Regulatory Notices 88
European Union Regulatory Notice 88
Japanese Notice 88
Korean Notice Class B 88
Perchlorate Material 89
Disposal of Waste Equipment by Users in Private Household in the European Union 89
Chemical Substances 89
China RoHS 89

About this Manual

- The [MATH] mark indicates an example that uses Math format, while the [LINE] mark indicates Linear format. For details about input/output formats, see “Specifying the Input/Output Format.”
- Keycap markings indicate what a key inputs or what function it performs.

  Example: [1], [2], [+], [−], [√], [AC] etc.
- Press 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 they key.



- The following shows what the different colors of the alternate function key text mean.

If key marking text is this color:	It means this:
Blue	Press [SHIFT] and then the key to access the applicable function.
Orange	Press [ALPHA] and then the key to input the applicable variable, constant, or symbol.

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

  Example: [SHIFT] [sin] ($\sin^{-1}$) [1] [=]

  “sin” indicates the function that is accessed by the key operation ([SHIFT] [sin]) 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 User Guide.

  Example: [1] (Setup)

  “Setup” indicates the menu item that is selected by the number key operation ([1]).

- The cursor key is marked with four arrows indicating direction. In this User Guide, cursor key operation is indicated as [▲], [▼], [◄], and [►].

- The displays and illustrations (such as key markings) shown in this User Guide are for illustrative purposes only, and may differ somewhat from the actual items they represent.
- The contents of this manual are subject to change without notice.
- [Deg]: Specify degree for the angle unit.
  [Rad]: Specify radian for the angle unit.

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)

- For information about calculation modes and setup settings, see “Calculation Modes and Calculator Setup.”
- For information about memory, see “Using Calculator Memory.”

Safety Precautions

Before using the calculator, please read the following safety precautions carefully. Keep this manual handy so that you can refer to it when needed.

The representations of the display and the keys in this manual are for explanatory purposes only and may not exactly match what you see on the calculator.

Caution

This symbol indicates that there is a risk of injury or damage if the specified safety precautions are ignored.

Battery

- Keep battery out of reach of children. If a battery is swallowed, seek urgent medical advice.
- Do not charge, attempt to disable, short circuit, or apply heat to the battery.
- When installing a new battery, orient it such that the positive sign is facing upwards.
- Use only the battery specified in this manual.

Disposing of the Calculator

- Do not dispose of this calculator in an incinerator. It might explode and cause injury or fire.

Other Precautions

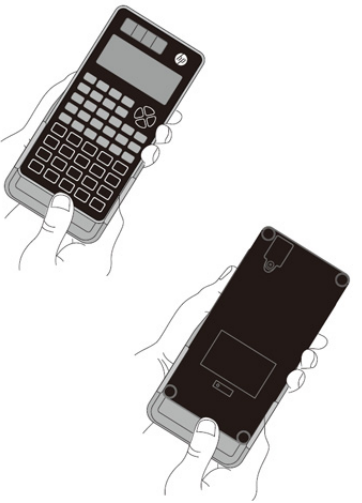
- Before using this calculator for the first time, press the % key.
- The battery may lose some charge between the time the calculator leaves the factory and the time when it is purchased. Thus the original battery may not last as long as a new battery.
- When battery power is very low, the calculator's memory may become corrupted or be lost completely. To avoid loss of important information, keep a copy of it elsewhere.
- Avoid storing or using the calculator under extreme conditions.
- Low temperature will slow the calculator's response time, cause the display to appear incomplete, and shorten the life of the battery. In addition, do not directly expose the calculator to the sun or place near a heater. High temperature may cause the casing to fade, distort the casing, or damage the internal circuitry.
- Avoid storing or using the calculator in damp conditions or when there is high humidity or excessive dust. Doing so will damage the internal circuitry.
- Do not drop the calculator or allow it to be subjected to extreme force.
- Do not twist, bend or otherwise distort the calculator.
- Note: Carrying the calculator in a pocket could cause it to twist or bend.
- Do not use a pen or other pointed object to press the calculator's keys.
- Use a soft, dry cloth to clean the calculator. Opening the calculator casing voids the warranty.
- If the calculator is very dirty, a neutral household cleanser diluted in water can be used to clean it. Dip a cloth in the solution and wring it out before applying it to the calculator. Do not use benzine, a diluting agent or any other volatile solvent to clean the calculator. Doing so may damage the casing and the keys.

Before Using the Calculator

Using the Protective Hard Case

1. Before using the calculator, slide the unit out of the protective case as shown in step 1.

2. After using the calculator, slide the unit out of the cover as shown in step 2. To use the protective case, slide it over the keyboard side of the unit.



Turning Power On and Off

- Press [ON] to turn on the calculator
- Press [SHIFT] [AC] (OFF) to turn off the calculator.

Adjusting Display Contrast

[SHIFT] [MODE] (SETUP) [▼] [6] (◄ CONT ►)

Displays the contrast adjustment screen. Use [◄] and [►] to adjust display contrast, and then press [AC].

You can also adjust contrast using [◄] and [►] while the mode menu (appears when you press [MODE]) is displayed.

IMPORTANT*:* If adjusting display contrast does not improve display readability, battery power may be low. Replace the battery.

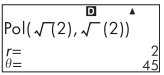
About the Display

Your calculator has a 31-dot × 96-dot LCD screen.

Example:

Input expression

Calculation result



Display Indicators

Sample Display: STAT D

Indicator:	Means this:
S	The keypad has been shifted by pressing the 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 a 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 is degrees.
R	The default angle is radians.
G	The default angle is grads.
FIX	A fixed number of decimal places is in effect.
SCI	A fixed number of significant digit is in effect.
Math	Math style is selected as the input/output 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 very complex calculations or other calculations that take a long time to execute, the display may show only the above indicators (without any value) while performing the calculation internally.

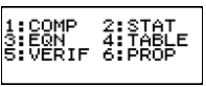
Calculation Modes and Calculator Setup

Calculation Modes

When you want to perform this type of operation:	Select this mode:
General calculations	COMP
Statistical and regression calculations	STAT
Linear equations	EQN
Generation of a number table based on an expression	TABLE
True / false	VERIF
Value of X	PROP

Specifying the Calculation Mode

(1) Press [MODE] to display the mode menu.

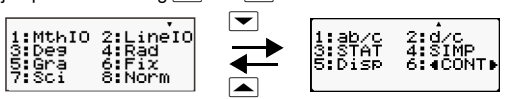


(2) Press the number key that corresponds to the mode you want to select.

For example, to select STAT mode, press [2].

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 [▼].



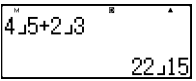
See “Adjusting Display Contrast” for information about how to use “◀ CONT ▶”

Specifying the Input/Output Format

For this input/output format:	Perform this key operation:
Math	[SHIFT] [MODE] [1] (MthIO)
Linear	[SHIFT] [MODE] [2] (LineIO)

- Math format causes fractions, irrational numbers, and other expressions to display as they are written on paper.
- Linear format causes fractions and other expressions to display in a single line.

Math Format



Linear Format

Specifying the Default Angle Unit

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

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

Specifying the Number of Display Digits

To specify this:	Perform this key operation:
Number of Decimal Places	[SHIFT] [MODE] [6] (Fix) [0] - [9]
Number of Significant Digits	[SHIFT] [MODE] [7] (Sci) [0] - [9]
Exponential Display Range	[SHIFT] [MODE] [8] (Norm) [1] (Norm1) or [2] (Norm2)

Calculation Result Display Examples

- Fix: The number 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: 100 ÷ 7 = 14.286 (Fix3)
  14.29 (Fix2)

- Sci: The value you specify (from 0 to 10) controls the number of significant digits for displayed calculation results. Calculation results are rounded off the specified digit before being displayed.

Example: $1 \div 7 = 1.4286 \times 10^{-1}$ (Sci5)

1.429×10^{-1} (Sci4)

Norm: Selecting one of the two available settings (Norm 1, Norm 2) determines the range in which results will be displayed in non-exponential format. Outside the specified range, results are displayed using exponential format.

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

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

Example: $1 \div 200 = 5 \times 10^{-3}$ (Norm1)
0.005 (Norm2)

Specifying the Fraction Format

To specify this fraction format:	Perform this key operation:
Mixed	[SHIFT] [MODE] [▼] [1] *(a b/c)*
Improper	[SHIFT] [MODE] [▼] [2] *(d/c)*

Specifying the Statistical Display Format

Use the following procedure to turn display of the frequency (FREQ) column of the STAT Mode STAT editor screen on or off.

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

Specifying the Decimal Point Display Format

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

The setting you configure here is applied for calculation results only. The decimal point for input values is always a dot (.).

Initializing the Calculation Mode and Other Settings

Performing the following procedure initializes the calculation mode and other setup settings as shown below.

[SHIFT] [9] (CLR) [1] (Setup) [=] (Yes)

This setting:	Is Initialized to this
Calculation mode	Comp
Input/Output Format	Mthlo
Angle Unit	Deg
Display Digits	Norm 1
Fraction Format	d/c
Statistical Display	OFF
Decimal Point	Dot
Simplify	AUTO

To cancel initialization without doing anything.
Press [AC] (Cancel) instead of [=].

Inputting Expressions and Values

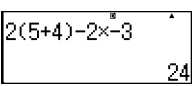
Inputting a Calculation Expression Using Standard Format

Your calculator lets you input calculation expressions just as they are written. Press the [=] key to execute. The calculator automatically judges the calculation priority sequence for addition, subtraction, multiplication, and division functions, and parentheses.

Example: 2(5 + 4) - 2x(-3) =

[LINE]

[2] [(] [5] [+] [4] [)] [−]
[2] [×] [(-)] [3] [=]



Inputting a General Function

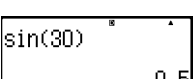
When you input any of the general functions shown below, the function is automatically input with the open parentheses (() character. Then, input the argument and the closing parentheses ()).

sin(, cos(, tan(, $\sin^{-1}$(, $\cos^{-1}$(, $\tan^{-1}$(, sinh(, cosh(, tanh(, $\sinh^{-1}$(, $\cosh^{-1}$(, $\tanh^{-1}$(, log(, ln(, e^ (, 10^ (,
$\sqrt{}$ (, $\sqrt[3]{}$ (, Abs(, Pol(, Rec(, Rnd(, GCD(, LCM(, Int(, IntG(

Example: sin 30 =

[LINE]

[sin] [3] [0] [)] [=]



Pressing [sin] inputs “sin (“.

Note that the input procedure is different if you want to use the Math format. For more information, see “Inputting with Math Format.”

Omitting the Multiplication Sign

You can omit the multiplication sign (×) in any of the following cases.

- Before an open parentheses (( ): 2×(5 + 4), etc.
- Before a general function:
  2× sin (30), 2× √ (3), etc.
- Before a variable name, constant, or random number:
  20×A, 2×π, etc.

Final Closed Parentheses

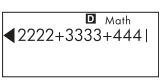
You can omit one or more closed parentheses that come at the end of a calculation immediately before pressing the = key. For details, see “Omitting a Final Closed Parentheses.”

Displaying a Long Expression

The display can show up to 15 characters at a time. Inputting the 16th character causes the expression to shift to the left. The ◀ indicator appears to the left of the expression, indicating that it runs off the left side of the screen.

Input expression: 1111 + 2222 + 3333 + 444

Displayed Portion:



- When the ◀ indicator is displayed, you can scroll left and view the hidden characters by pressing the ◄ key. This will cause the ▶ indicator to appear to the right of the expression. Use the ► key to scroll back.

Number of Input Characters (Bytes)

- You can input up to 99 bytes of data for a single expression. Each key operation uses up one byte. A function that requires two key operations to input (like SHIFT sin ($\sin^{-1}$)) also uses only one byte. Note that when you input functions with Math format, each item you input uses up more than one byte. For more information, see “Inputting with Math Format.”
- Normally the input cursor appears as a straight vertical (▮) or horizontal (_) flashing line on the display screen. When there are 10 or fewer bytes of input remaining in the current expression, the cursor changes to ■. If the ■ cursor appears, terminate the expression at a convenient point and calculate the result.

Correcting an Expression

This section explains how to correct an expression as you are inputting it. The procedure you should use depends on whether you have insert or overwrite selected as the input mode.

About Insert and Overwrite Input Modes

In insert mode, the displayed characters shift to the left to make room when your input replaces the character at the current cursor position. The initial default input mode is insert. You can change to overwrite mode as needed.

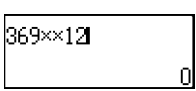
- The cursor is a vertical flashing line (I) when insert mode is selected. The cursor is a horizontal flashing line (_) when overwrite mode is selected.
- The initial default for Linear format input is insert mode. You can switch to overwrite mode by pressing [SHIFT] [DEL] (INS)
- In Math format, you can only use insert mode. Pressing [SHIFT] [DEL] (INS) when Math format is selected does not switch to overwrite mode. See “Incorporating a Value into a Function” for more information.
- The calculator automatically changes to insert mode whenever you change the input/output format from Linear to Math.

Changing the Character or Function You Just Input

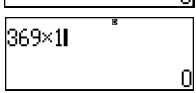
Example**:** To correct the expression 369 × 13 so it becomes 369 × 12.

[LINE]

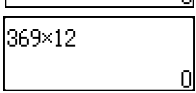
[3] [6] [9] [×] [1] [3]



[DEL]



[2]



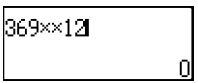
Deleting a Character or Function

Example: To correct the expression 369 × × 12 so it becomes 369 × 12.

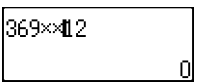
LINE

Insert Mode:

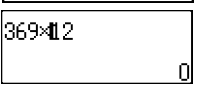
3 6 9 × × 1 2



◄ ◄

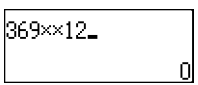


DEL

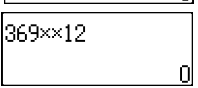


Overwrite Mode:

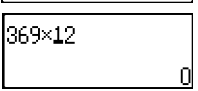
3 6 9 × 1 2



◄ ◄ ◄



DEL

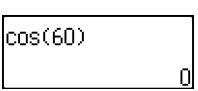


Correcting a Calculation

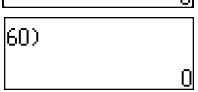
Example: To correct cos(60) so it becomes sin(60).

LINE

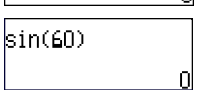
Insert Mode: cos 6 0)



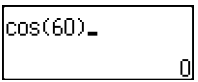
◄ ◄ ◄ DEL



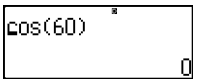
sin



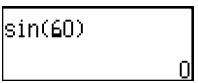
Overwrite Mode: [cos] [6] [0] [)]



[◄] [◄] [◄] [◄]



[sin]



Inserting Input into a Calculation

Always use insert mode for this operation. Use [►] or [◄] to move the cursor to the location where you want to insert new input.

Displaying the Location of an Error

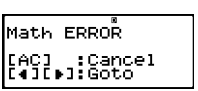
If an error message (like “Math ERROR” or “Syntax ERROR”) appears when you press [=], press [◄] or [►]. This displays the part of the calculation where the error occurred with the cursor at the error location.

Example: You input “14 ÷ 0 × 2 =” by mistake instead of “14 ÷ 10 × 2 =”.

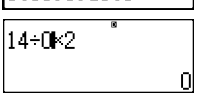
Use insert mode for the following operation.

[LINE]

[1] [4] [÷] [0] [×] [2] [=]

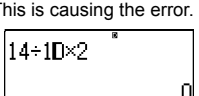


press [►] or [◄]

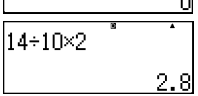


This is causing the error.

[◄] [1]



[=]



You can also clear the screen by pressing [AC] to clear the calculation.

Inputting with Math Format

When inputting with Math format, you can input and display fractions and some functions using the same format as they appear in your textbook.

IMPORTANT:

- Certain types of expressions can cause the height of a calculation formula to be greater than one display line. The maximum allowable height of a calculation formula is two display screens (31 dots × 2). Further input is not allowed if the height of the calculation exceeds the limit.
- You can nest functions and parentheses. However, if you nest too many functions and/or parentheses until input is no longer permitted, divide the calculation into multiple parts and calculate each part separately.

Functions and Symbols Supported for Math Format Input

The **Bytes** column shows the number of bytes of memory used during input.

Function/Symbol	Key Operation	Bytes
Improper Fraction	$\square/\square$	9
Mixed Fraction	SHIFT $\square/\square$ ($\square\frac{\square}{\square}$)	13
Log (a,b)(Logarithm)	$\log_{\square}(\square)$	6
10^*x*(Power of 10)	SHIFT log (10$^{\square}$)	4
e^*x*(Power of e)	SHIFT ln ($e^{\square}$)	4
Square Root	$\sqrt{\square}$	4
Cube Roof	SHIFT $\sqrt{\square}$ ($\sqrt[3]{\square}$)	9
Square, cube	x^2 x^3	4
Reciprocal	x^{-1}	5
Power	$x^{\square}$	4
Power Roof	SHIFT $x^{\square}$ ($\sqrt[\square]{\square}$)	9
Absolute Value	Abs	4
Parentheses	(or)	1

Math Format Input Examples

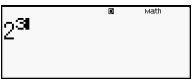
Perform the following operations with Math format selected.

Pay close attention to the location and size of the cursor on display when you input using Math format.

Example 1: To input $2^3 + 1$

MATH

2 x^n 3

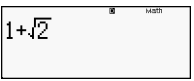


► + 1

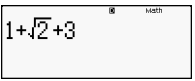
Example 2: To input $1+\sqrt{2}+3$

MATH

1 + $\sqrt{\square}$ 2



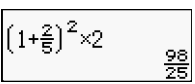
► + 3



Example 3: To input $(1 + \frac{2}{5})^2 \times 2 =$

MATH

(1 + $\frac{\square}{\square}$ 2 ▼ 5
►) x^2 × 2 =



- When you press = and obtain a calculation result using Math format, part of the expression you input can be cut off as shown in Example 3. To view the entire input expression again, press AC, and then press ►.

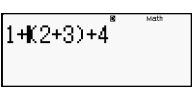
Incorporating a Value into a Function

When using Math format, you can incorporate part of an input expression (a value, an expression within parentheses, etc.) into a function.

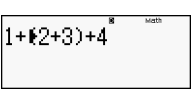
Example: To incorporate the expression inside of the parentheses of 1 + (2 + 3) + 4 into the $\sqrt{\ }$ function.

MATH

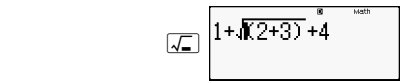
Move the cursor before (2+3)



SHIFT DEL(INS)



This changes the shape of the cursor as shown here.



This incorporates the expression in parentheses into the function √‾.

- If the cursor is located to the left of a value or fraction (instead of an open parentheses), that value or fraction is incorporated into the function specified here.
- If the cursor is located to the left of a function, the entire function is incorporated into the function specified here.
- The following examples show the other functions that you can use in the previous procedure, and the required key operations to use them.

Original Expression: 1 + l(2 + 3) + 4

Function	Key Operation	Resulting Expression
Fraction	[▤]	$1+\frac{\text{l}(2+3)}{\square}+4$
log(a,b)	[log▯]	$1+\log_{\text{l}0}((2+3))+4$
Power Root	[SHIFT] [$x^{\blacksquare}$] (√‾)	$1+\sqrt[\text{l}0]{(2+3)}+4$

You can also incorporate values into the following functions.
[SHIFT] [log] ($10^{\blacksquare}$), [SHIFT] [ln] ($e^{\blacksquare}$), [√‾], [x^{-1}], [SHIFT] [√‾] ($\sqrt[3]{\ }$), [Abs]

Displaying Calculation Results in a Form that Includes $\sqrt{2}$, π, etc. (Irrational Number Form)

When you select “Mthlo” as the input/output format, you can specify whether calculation results should display in a form that includes expressions like $\sqrt{2}$ and π (irrational number form), or in a form using decimal values without using the irrational number form.

- Pressing [=] after inputting a calculation displays the result using irrational number form.
- Pressing [SHIFT] [=] after inputting a calculation displays the result using decimal values.

In the following examples, (1) shows the result when you press [=], while (2) shows the result when you press [SHIFT] [=].

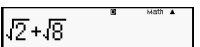
Note: When you select "lineIO" as the input/output format, calculation results are always displayed using decimal values (no irrational number form) regardless of whether you press [=] or [SHIFT] [=].

Note: π form display (includes π within irrational number display) conditions are the same as those for S-D Conversion. For details, see "Using S-D Transformation."

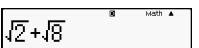
Example 1: $\sqrt{2}+\sqrt{8}=3\sqrt{2}$

[MATH]

(1) [√] [2] [+] [√] [8] [=]



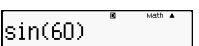
(2) [√] [2] [►] [+] [√] [8] [SHIFT] [=]



Example 2: $\sin(60)=\frac{\sqrt{3}}{2}$

[MATH]

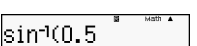
sin 60 [=]



Example 3: $\sin^{-1}(0.5)=\frac{1}{6}\pi$

[MATH]

[SHIFT] [sin] ($\sin^{-1}$) [0] [•] [5] [=]



- For details about calculations using √ and π see: "Function Calculations."
- The following are the calculations for which √ form (form that includes √ within irrational number display) results can be displayed.
  a. Arithmetic calculation of values with square root symbol (√), x^2, x^3, x^{-1}.
  b. Trigonometric function calculations
     √ form results can be produced by trigonometric functions only in the following cases.

  In all other cases, calculation results displayed in decimal form.

Angle Unit Setting	Angle Value Input	Input Value Range for √ Form Calculation Result
Deg	Units of 15°	$\|x\| < 9 \times 10^{9}$
Rad	Multiples of $\frac{1}{12}\pi$ radians	$\|x\| < 20\pi$
Gra	Multiples of $\frac{50}{3}$ grads	$\|x\| < 10000$

√ Form Calculation Range

- The following shows the internal data format and applicable value ranges for results obtained with √.

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

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

The calculation result is displayed in decimal form when any one of these ranges is exceeded.

Example: $35\sqrt{2} \times 3\ (=105\sqrt{2}) = 148.492424$

$$\frac{150\sqrt{2}}{25} = 8.485281374$$

- Actual √ calculation results are displayed using the following form.

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

$a' = a \cdot f$
$d' = c \cdot d$
$c' = c \cdot f$

Because of this, the value that is displayed can be larger than the range shown above. Example:

$$\frac{\sqrt{3}}{11}+\frac{\sqrt{2}}{10} = \frac{10\sqrt{3}+11\sqrt{2}}{110}$$

- Results that include square root symbols can have up to two terms (an integer term is also counted as a term). If the result has three or more terms, it is displayed in decimal form.

Example: $\sqrt{2}+\sqrt{3}+\sqrt{8} = \sqrt{3}+3\sqrt{2}$

$\sqrt{2}+\sqrt{3}+\sqrt{6} = 5.595754113$

- The result is displayed in decimal form even when any intermediate has three or more terms.
- Example: $(1+\sqrt{2}+\sqrt{3})\ (1-\sqrt{2}-\sqrt{3})$ $(= -4 - 2\sqrt{6})$
  $= -8.898979486$

Basic Calculations (COMP)

This section explains how to perform arithmetic, fraction, percent, and sexagesimal calculations.

All calculations in this section are performed in the COMP Mode ([MODE] [1]).

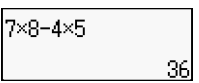
Arithmetic Calculations

Use the [+], [−], [×], and [÷] keys to perform arithmetic calculations.

Example: 7 × 8 - 4 × 5 = 36

[LINE]

[7] [×] [8] [−] [4] [×] [5] [=]



The calculator automatically judges the calculation priority sequence. For more information, see “Calculation Priority Sequence.”

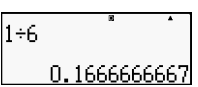
Number of Decimal Places and Number of Significant Digits

You can specify a fixed number of decimal places and significant digits for the calculation result.

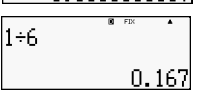
Example: 1 ÷ 6 =

[LINE]

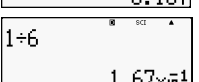
Initial Default Setting (Norm1)



3 decimal places (Fix3)



3 significant digits (Sci3)



For more information, see “Specifying the Number of Display Digits.”

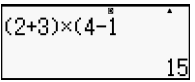
Omitting a Final Closed Parentheses

You can omit any closed parentheses ()) immediately preceding the operation of the [=] key at the end of a calculation only when using Linear format.

Example: (2 + 3) × (4 - 1) = 15

LINE

(2 + 3) ×
(4 − 1 =



Fraction Calculations

How you should input fractions depends on the input/output format that is currently selected.

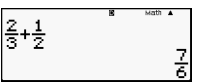
	Improper Fraction	Mixed Fraction
Math Format	$\frac{7}{3}$	$2\frac{1}{3}$
Linear Format	7 ⌟ 3 (Numerator, Denominator)	2 ⌟ 1 ⌟ 3 (Integer Part, Numerator, Denominator)

- Default settings display fractions as improper fractions.
- Fraction calculation results are always reduced before being displayed.

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

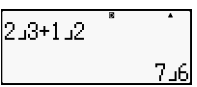
MATH

▤ 2 ▼ 3 ► +
▤ 1 ▼ 2 =



LINE

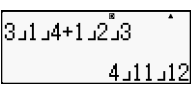
2 ▤ 3 + 1
▤ 2 =



$3\frac{1}{4} + 1\frac{2}{3} = 4\frac{11}{12}$ (Fraction format a b/c)

LINE

3 ▤ 1 ▤ 4 +
1 ▤ 2 ▤ 3 =

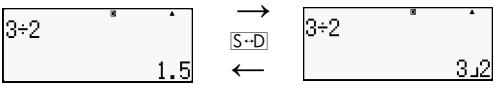


- Mixed fraction input is possible only when “a b/c” is specified for the fraction format.
- In MATH mode, press SHIFT ▤ (−▤) to input mixed fractions.
- If the total number of digits used for a mixed fraction (including integer, numerator, denominator, and separator symbols) is greater than 10, the value is automatically displayed in decimal format.
- The result of a calculation that involves both fraction and decimal values is displayed in decimal format.

Switching Between Improper Fraction and Mixed Fraction Format

Pressing the [SHIFT] [S⇔D] $a\left(\frac{b}{c} \Leftrightarrow \frac{d}{c}\right)$ key toggles the display fraction between mixed fraction and improper fraction format.

Switching Between Fraction and Decimal Format



- The format of the fraction depends on the currently selected fraction format setting (improper fraction or mixed fraction).
- You cannot switch from decimal format to mixed fraction format if the total number of digits used in the mixed fraction (including integer, numerator, denominator, and separator symbol) is greater than 10.
- For details about the [S⇔D] key, see "Using S-D Transformation."

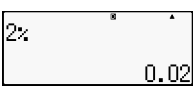
Percent Calculations

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

Example: 2% = 0.02 ($\frac{2}{100}$)

[LINE]

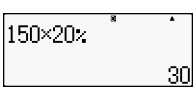
[2] [SHIFT] [(] (%) [=]



150× 20%=30 (150 × $\frac{20}{100}$)

[LINE]

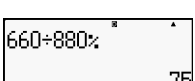
[1] [5] [0] [×] [2] [0]
[SHIFT] [(] (%) [=]



Calculate what percentage of 880 is 660. (75%)

[LINE]

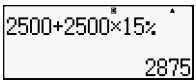
[6] [6] [0] [÷] [8] [8] [0]
[SHIFT] [(] (%) [=]



Increase 2500 by 15%. (2875)

LINE

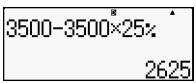
2 5 0 0 + 2 5 0 0
× 1 5 SHIFT ((%) =



Discount 3500 by 25%. (2625)

LINE

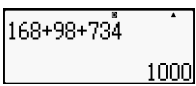
3 5 0 0 − 3 5 0 0
× 2 5 SHIFT ((%) =



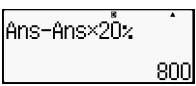
Discount the sum of 168, 98, and 734 by 20%. (80%)

LINE

1 6 8 + 9 8 +
7 3 4 =



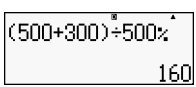
− Ans × 2 0 SHIFT ((%) =



If 300 grams are added to a test sample originally weighing 500 grams, what is the percentage increase in weight? (160%)

LINE

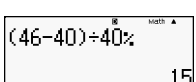
(5 0 0 + 3 0 0)
5 0 0 SHIFT ((%) =



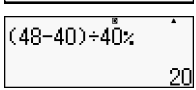
What is the percentage change when a value is increased from 40 to 46? How about 48? (15%, 20%)

LINE

(4 6 − 4 0) ÷
4 0 SHIFT ((%) =



► ► ► DEL 8 =



Degree, Minute, Second (Sexagesimal) Calculations

You can perform calculations using sexagesimal values, and convert values between sexagesimal and decimal.

Inputting Sexagesimal Values

The following is the syntax for inputting a sexagesimal value.

{Degrees} [°’’’] {Minutes} [°’’’] {Seconds} [°’’’]

Example: Input 2° 0’ 30”

[LINE]

[2] [°’’’] [0] [°’’’] [3] [0] [°’’’] [=]

Note that you must always input something for the degrees and minutes, even if they are zero.

Sexagesimal Calculations

- Performing the following types of sexagesimal calculations provides a sexagesimal result.
  - Addition or subtraction of two sexagesimal values.
  - Multiplication or division of a sexagesimal value and a decimal value.

  Example: 2° 20’ 30” + 39’ 30” = 3° 00’ 00”

[LINE]

[2] [°’’’] [2] [0] [°’’’] [3] [0] [°’’’] [+]

[0] [°’’’] [3] [9] [°’’’] [3] [0] [°’’’] [=]

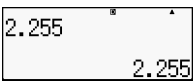
Converting Values Between Sexagesimal and Decimal

Pressing [°’’’] while a calculation result is displayed toggles the value between sexagesimal and decimal.

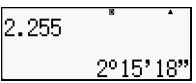
Convert 2.255 to its sexagesimal equivalent.

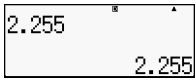
[LINE]

[2] [•] [2] [5] [5] [=]



[°’’’]



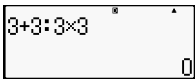
[°'''] 

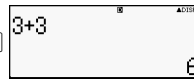
Using Multi-statements in Calculations

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

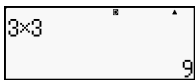
Example: To create a multi-statement that performs the following calculations: 3 + 3 and 3 × 3.

[LINE]

[3] [+] [3] [ALPHA] [x^3] (:) [3] [×] [3] 

[=] 

"Disp" indicates this is an intermediate result of a multi-statement.

[=] 

Using Calculation History Memory and Replay (COMP)

Calculation history memory maintains a record of each calculation expression you input and execute, and its result.

You can use calculation history memory in only the COMP Mode ([MODE] [1]).

Recalling Calculation History Memory Contents

Press [▲] to back-step through calculation history memory contents. Calculation history memory shows both calculation expressions and results.

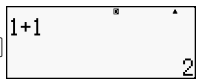
Example:

LINE

1 + 1 =
2 + 2 =
3 + 3 =

▲

▲



- Note that calculation history memory contents are cleared whenever you turn off the calculator, press the ON key, change to the calculation mode or the input/output format, or perform any reset operation.
- Calculation history memory is limited. When the calculation you are performing causes history memory to become full, the oldest calculation is deleted automatically to make room for the new calculation.

Replay Function

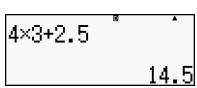
While a calculation result is on display, you can press AC and then ◄ or ► to edit the expression you used for the previous calculation. If you are using Linear format, you can display the expression by pressing ◄ or ►, without pressing AC first.

Example: 4 × 3 + 2.5 = 14.5

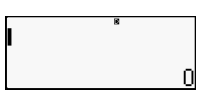
4 × 3 - 7.1 = 4.9

LINE

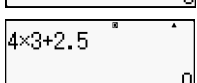
4 × 3 + 2 • 5 =



AC

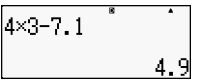


◄



[DEL] [DEL] [DEL] [DEL]

[−] [7] [•] [1] [=]



Using Calculator Memory

Memory Name	Description
Answer Memory	Stores the last calculation result obtained.
Independent Memory	Calculation results can be added to or subtracted from independent memory. The “M” display indicator indicates data in independent memory.
Variables	Eight variables named A, B, C, D, E, F, X, and Y can be used for storage of individual values.

This section uses the COMP Mode ([MODE] [1]) to demonstrate how you can use memory.

Answer Memory (Ans)

Answer Memory Overview

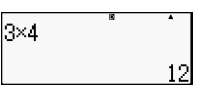
- Answer Memory contents are updated whenever you execute a calculation using any one of the following keys: [=], [SHIFT] [=], [M+], [SHIFT] [M+] (M+), [RCL], [SHIFT] [RCL] (STO). Answer memory can hold up to 15 digits.
- Answer contents are not changed if an error occurs during the current calculation.
- Answer Memory contents are maintained even if you press the [AC] key, change the calculation mode, or turn off the calculator.

Using Answer Memory to Perform a Series of Calculations

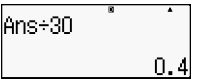
Example: To divide the result of 3 × 4 by 30.

[LINE]

[3] [×] [4] [=]



(Continuing) [÷] [3] [0] [=]



Pressing [÷] automatically inputs the “Ans” command.

- In this procedure, you need to perform the second calculation immediately after the first one. If you need to recall Answer Memory contents after pressing [AC], press the [Ans] key.

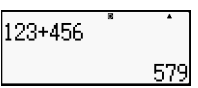
Inputting Answer Memory Contents into an Expression

Example: To perform the calculations shown below:

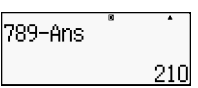
123 + 456 = 579 789 - 579 = 210

[LINE]

[1] [2] [3] [+] [4] [5] [6] [=]



[7] [8] [9] [−] [Ans] [=]



Independent Memory (M)

You can add calculation results to or subtract results from an independent memory. The “M” appears on the display when independent memory contains a value.

Independent Memory Overview

The following is a summary of the different operations you can perform using independent memory.

To do this:	Perform this key operation:
Add the displayed value or result of the expression to independent memory	[M+]
Subtract the displayed value or result of the expression from independent memory	[SHIFT] [M+] (M-)
Recall current independent memory contents	[RCL] [M+] (M)

- You can also insert the M variable into a calculation, which tells the calculator to use the current independent memory contents at that location. The following is the key operation for inserting the M variable: [ALPHA] [M+] (M)

- The “M” indicator appears in the upper left of the display when there is any value other than zero stored in the independent memory.
- Independent memory contents are maintained even if you press the [AC] key, change the calculation mode, or turn off the calculator.

Calculation Examples Using Independent Memory

- If the “M” indicator is on the display, perform the procedure under “Clearing Independent Memory” before performing this example.

Example: 23+9=32	[2] [3] [+] [9] [M+]
53- 6=47	[5] [3] [−] [M+]
-)45×2=90	[4] [5] [×] [2] [SHIFT] [M+] (M-)
99÷3=33	[9] [9] [÷] [3] [M+]
(Total) 22	[RCL] [M+] (M)

Clearing Independent Memory

Press [0] [SHIFT] [RCL] (STO) [M+]. This clears independent memory and causes the “M” indicator to disappear from the display.

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

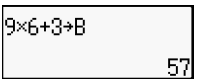
Variable Overview

- You can assign a specific value or a calculation result to a variable.
  Example: To assign the result of 3+5 to variable A.
  [3] [+] [5] [SHIFT] [RCL] (STO) [(-)] (A)
- Use the following procedure when you want to check the contents of variable A.
  Example: To recall the contents of variable A.
  [RCL] [(-)] (A)
- The following shows how you can include variables inside of an expression.
  Example: To multiply the contents of variable A by the contents of variable B.
  [ALPHA] [(-)] (A) [×] [ALPHA] [°’’’] (B) [=]
- Variable contents are maintained even if you press the [AC] key, change the calculation mode, or turn off the calculator.

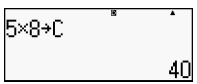
Example: $\frac{9\times6+3}{5\times8} = 1.425$

LINE

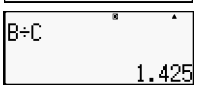
9 × 6 + 3
SHIFT RCL (STO) √ (B)



5 × 8 SHIFT RCL (STO) ▤ (C)



ALPHA √ (B) ÷ ALPHA ▤ (C) =



Clearing the Contents of a Specific Variable

Press 0 SHIFT RCL (STO) and then press the key for the name of the variable whose contents you want to clear. For example, to clear the contents of variable A, press 0 SHIFT RCL (STO) (-) (A).

Clearing the Contents of All Memories

Use the following procedure to clear the contents of Answer Memory, independent memory, and all of the variables.

Press SHIFT 9 (CLR) 2 (Memory) = (Yes).

To cancel the clear operation without doing anything, press AC (Cancel) instead of =.

Function Calculations

This section explains how to use the calculator's built- in functions.

Note: The functions available to you depends on the calculation mode you are in. The explanations in this section are mainly about the functions that are available in calculation modes. All of the examples in this section show operation in the COMP Mode (MODE 1).

Certain function calculations may take some time to display calculation results. Before performing an operation, be sure to wait until execution of the current operation is complete. You can interrupt an ongoing operation by pressing AC.

Pi (π) and Natural Logarithm Base

You can input pi (π) or natural logarithm base *e* into a calculation.

The following shows the required key operations and the values this calculator uses for pi (π) and *e:*

π = 3.14159265358980 (SHIFT ×10^x (π))

e = 2.71828181845904 (ALPHA ×10^x (*e*))

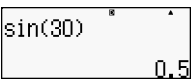
Trigonometric and Inverse Trigonometric Functions

The angle unit required by trigonometric and inverse trigonometric functions is one specified as the calculator's default angle unit. Before performing a calculation, be sure to specify the default angle unit you want to use. See "Specifying the Default Angle Unit" for more information.

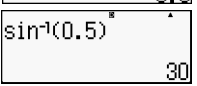
Example: sin 30 = 0.5, $\sin^{-1}$ 0.5 = 30

LINE Deg

sin 3 0) =



SHIFT sin ($\sin^{-1}$) 0 • 5) =



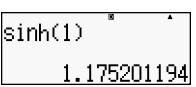
Hyperbolic and Inverse Hyperbolic Functions

Pressing the hyp key displays a menu of functions. Press the number key that corresponds to the function you want to input.

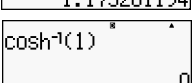
Example: sinh 1 = 1.175201194, $\cosh^{-1}$ 1 = 0

LINE

hyp 1 (sinh) 1) =

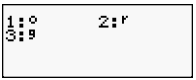


hyp 5 ($\cosh^{-1}$) 1) =



Converting an Input Value to the Calculator's Default Angle Unit

After inputting a value, press SHIFT Ans (DRG ►) to display the angle unit specification menu shown below. Press the number key that corresponds to the angle unit of the input value. The calculator will automatically convert it to the calculator's default angle unit.



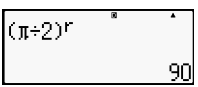
Example 1: To convert the following values into degrees:

$\frac{\pi}{2}$ radians=90°, 50 grads = 45°

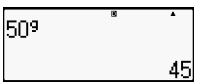
The following procedure assumes that the calculator's default angle unit is degrees.

[LINE]

[(] [SHIFT] [×10^x] (π) [÷] [2] [)]
[SHIFT] [Ans] DRG ▶ [2] (^{r}) [=]



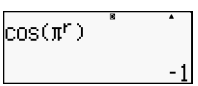
[5] [0] [SHIFT] [Ans] (DRG ▶)
[3] (g) [=]



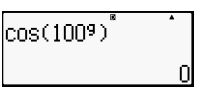
Example 2: cos(π radians) = -1, cos (100 grads) = 0

[LINE] [Deg]

[cos] [SHIFT] [×10^x] (π) [SHIFT] [Ans]
(DRG ▶) [2] (*r*) [)] [=]



[1] [0] [0] [SHIFT] [Ans] (DRG ▶)
[3] (g) [)] [=]

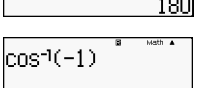


Example 3: $\cos^{-1}(-1) = 180$

$\cos^{-1}(-1) = \pi$

[MATH]

[Deg] [SHIFT] [cos] ($\cos^{-1}$) [(-)] [1] [)]
[=]



[Rad] [SHIFT] [cos] ($\cos^{-1}$) [(-)] [1] [)]
[=]

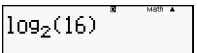
Exponential Functions and Logarithmic Functions

- For the logarithm function "log(", you can specify base *m* using the syntax "log (*m*,*n*)".
  If you input only a single value, a base of 10 is used for the calculation.

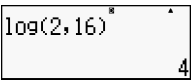
- "ln(" is a natural logarithm function with base e.
- You can also use the [log▪] key when inputting an expression with the form of "log*mn*" while using Math format.

Example: $\log_2 16 = 4$

[MATH] [log▪] [2] [►] [1] [6] [=]



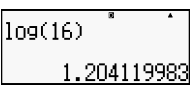
[LINE] [log] [2] [SHIFT] [)] (,) [1] [6] [)] [=]



Note that when you must input the base (base *m*) when using the [log▪] key for input.

[LINE] log16=1.204119983

[log] [1] [6] [)] [=]

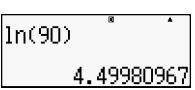


Note: A base of 10 (common logarithm) is used if no base is specified.

[LINE]

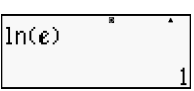
ln90(=$\log_e 90$) = 4.49980967

[ln] [9] [0] [)] [=]



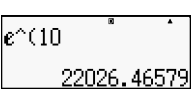
ln*e*= 1

[ln] [ALPHA] [×10ˣ] (*e*) [)] [=]



e^{10}=22026.4659

[SHIFT] [ln] (e^x) [1] [0] [=]



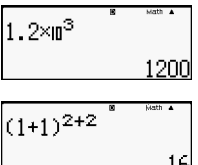
Power Functions and Power Root Functions

x^2, x^3, x^{-1}, $x^{\blacksquare}$, $\sqrt{\ }$(, $\sqrt[3]{\ }$(, $\sqrt[\blacksquare]{\ }$(

Example 1: $1.2 \times 10^3 = 1200$

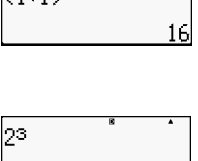
MATH

1 • 2 × SHIFT log (10^) 3 =



$(1+1)^{2+2} = 16$

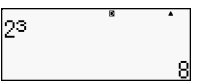
(1 + 1) $x^{\blacksquare}$ 2 + 2 =



Example 2: $2^3 = 8$

MATH

2 x^3 =

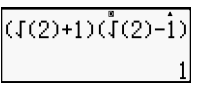


$(\sqrt{2}+1)(\sqrt{2}-1) = 1$

LINE

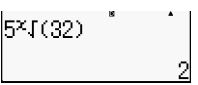
($\sqrt{\ }$ 2) + 1)

($\sqrt{\ }$ 2) − 1) =



$\sqrt[5]{32} = 2$

5 SHIFT $\sqrt{\ }$ ($\sqrt[3]{\ }$) 3 2) =

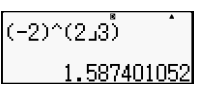


Example 3: $(-2)^{2/3} = 1.587401052$

LINE

((-) 2) $x^{\blacksquare}$

2 ÷ 3) =

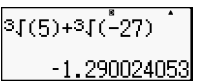


$\sqrt[3]{5} + \sqrt[3]{-27} = -1.290024053$

LINE

SHIFT $\sqrt{\ }$ ($\sqrt[3]{\ }$) 5) +

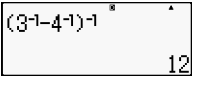
$\sqrt{\ }$ ($\sqrt[3]{\ }$) (-) 2 7) =



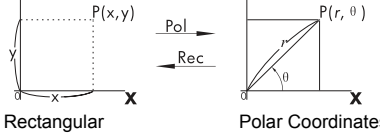
Example 4: $\dfrac{1}{\frac{1}{3}-\frac{1}{4}} = 12$

LINE

(3 x^{-1} − 4 x^{-1}) x^{-1} =



Rectangular-Polar Coordinate Conversion



Rectangular Coordinates (Rec)

Polar Coordinates (Pol)

Coordinate conversion can be performed in the COMP and STAT calculation modes.

Converting to Polar Coordinates (Pol)

Pol(X,Y) X: Specifies the rectangular coordinate X value

Y: Specifies the rectangular coordinate Y value

- Calculation result θ is displayed using the range of $-180° < \theta \leq 180°$
- Calculation result θ is displayed using the calculator's default angle unit.
- Calculation result *r* is assigned to variable X, while *y* is assigned to Y.

Converting to Rectangular Coordinates (Rec)

Rec(*r*, θ) *r* : Specifies *r* value of polar coordinate

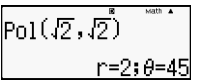
θ : Specifies θ value of polar coordinate

- Input value θ is treated as an angle value, in accordance with the calculator's default angle unit setting.
- Calculation result *x* is assigned to variable X, while θ is assigned to Y.
- If you perform coordinate conversion inside of an expression instead of a stand-alone operation, the calculation is performed using the only first value (either the *r*-value or the X-value) produced by the conversion.

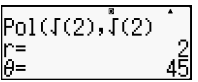
Example: Pol $(\sqrt{2}, \sqrt{2}) + 5 = 2 + 5 = 7$

Deg (X,Y) = $(\sqrt{2} + \sqrt{2}) \rightarrow r, \theta$

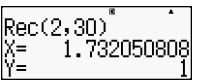
MATH SHIFT + (Pol) √ 2 ►
SHIFT) (,) √ 2 ►) =



LINE
SHIFT + (Pol) √ 2)
SHIFT) (,) √ 2)) =



LINE Deg (r, θ) = (2,30) → (X,Y)
SHIFT − (Rec) 2 SHIFT) (,)
3 0) =



Greatest Common Divisor and Least Common Multiple

- These functions exist in all modes.
- Greatest Common Divisor (GCD): To calculate the greatest common divisor of two positive integers.
- Least Common Multiple (LCM): To calculate the least common multiple among two positive integers.
- The argument value can be either a number and/or expression.
- Input range:

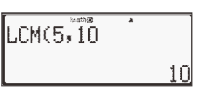
  LCM: $0 \leqq |a|, |b| < 1 \times 10^{10}$

  GCD: $-1 \times 10^{10} < a; b < 1 \times 10^{10}$
- Error message:

  Math ERROR: When users input decimal or negative integers, an error message will be displayed.

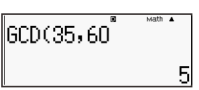
Example: Find the Least Common Multiple of 5 and 10.

MATH
SHIFT 5 (LCM) SHIFT 5)
(,) 1 0 =



Example: Find the Greatest Common Divisor of 35 and 60.

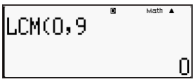
MATH
SHIFT 4 (GCD) 3 5
SHIFT) (,) 6 0 =



Example: When an argument includes zero.

LINE

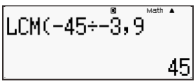
SHIFT 5 (LCM) 0 SHIFT) (,) 9 =



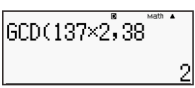
Example: When an argument includes expression.

MODE

SHIFT 5 (LCM) − 4 5 ÷ − 3 SHIFT) (,) 9 =



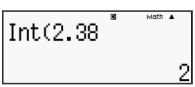
4 (GCD) 1 3 7 × 2 SHIFT) (,) 3 8 =



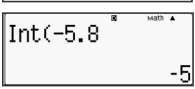
The Integer Function and the Greatest Integer Function

- Int: The integer function extracts the integer part of the value by removing the digits to the right of the decimal point.
- IntG: The greatest integer function rounds down the value to the nearest integer.

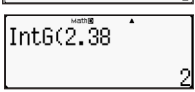
SHIFT 6 (Int) 2 • 3 8 =



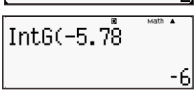
SHIFT 6 (Int) − 5 • 7 8 =



SHIFT 3 (IntG) 2 • 3 8 =



SHIFT 3 (IntG) − 5 • 7 8 =



Division with Quotient and Remainder

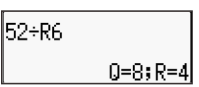
- You can use the function ÷R to get the quotient and the remainder in a division calculation.
- At ÷R calculation, only the quotient is stored in the Ans memory.
- The completion of operation 5 [÷R] 3 [STO] [X] assigns the quotient value of 1 to X.

- If ÷R is part of a series of multiple statements, only the quotient will be transferred to the next operation.
  Example: [1] [0] [+] [1] [7] [÷R] [6] (2) [=] [1] [2] (10+2)
- The operation buttons [S⇔D] [a b/c] [ENG] [SHIFT] [ENG] [°,,,] [SHIFT] [°,,,] are disabled during display of the result of an operation with calculation and display of remainder.
- If one of the following conditions is present when performing an operation with calculation will be treated as a normal division without calculation or display of remainder.
  A. When the dividend is greater than 1×10^{10}.
  B. When the quotient is not a positive value or the remainder is not an entire positive or a positive fraction.
  Example: [−] [5] [÷R] [2] is calculated as: -5 ÷ 2.

Example:

[MATH]

[5] [2] [÷R] [6] [=]



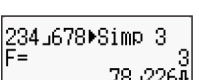
Fraction Simplification Function

- This function simplifies a fraction using the smallest divisor. If necessary, you can also specify the divisor.
- This setting is valid in COMP mode only.
- This function is disabled if SIMP is set as **AUTO** in the setup menu.
- Message:
  A. "Fraction irreduc" display indicates that further simplification is impossible.
  B. "Non simplifiable" appears when the value you specify is invalid as a divisor for simplification.

Example: Simplify $\frac{234}{678}$ by 3.

[LINE]

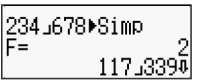
[3] [4] [▤] [6] [7] [8]
[►] [Simp] [3] [=]



Example: Simplify $\frac{234}{678}$ (without specifying the divisor).

LINE

2 3 4 ▤ 6 7 8
► Simp =



Simp =

Using CALC

- You can store a single mathematical expression, with up to 99 steps. Note that the CALC command can only be used in the COMP Mode.
- The CALC command lets you temporarily store a mathematical expression that you need to perform several times. Once you store an expression, you can recall it, input variables, and calculate quickly.
- The following shows the kind of expressions that you can save with the CALC function.

  A. Expressions: 2X + 3Y, 2AX + 3BY + C

  B. Multiple instructions: X + Y: X(X + Y)

  C. Equations with unique variable on left and one expression contains variables on right: A = B+C, Y = X^2 + X + 3 (note: we must use specific [=] key to input equality symbol of the equation).
- The variable input screen shows the current value from the assigned variables.
- Wherever you start a new calculation, ensure that the stored expression is cleared by changing the mode or by pressing the ON key.

Example: To store 3A + B and then substitute the variables with the following values (A:B) = (5:10). Calculate the value of the expression.

LINE

3 ALPHA x^2 (A) + ALPHA $\sqrt{\ }$
(B) CALC 5 = 1 0 =

Metric Conversion

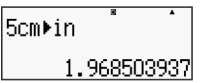
- The calculator's built-in metric conversion commands make it easy to convert values from one unit to another. You can use the metric conversion commands in any calculation mode except for BASE-N and TABLE.

- To input a metric conversion command into a calculation, press [SHIFT] [8] (CONV) and then input the two-digit number that corresponds to the command you want.

Example: To convert 5 cm into inches:

[LINE]

[5] [SHIFT] [8] (CONV) [0] [2] [=]



The following table shows the two-digit numbers for each of the metric conversion commands.

01: in▶cm	02: cm▶in	03: ft▶m	04: m▶ft
05: yd▶m	06: m▶yd	07: mile▶km	08: km▶mile
09: n mile▶m	10: m▶n mile	11: acre▶m^2	12: m^2▶acre
13: gal(US)▶ℓ	14: ℓ▶gal(US)	15: gal(UK)▶ℓ	16: ℓ▶gal(UK)
17: pc▶km	18: km▶pc	19: km/h▶m/s	20: m/s▶km/h
21: oz▶g	22: g▶oz	23: lb▶kg	24: kg▶lb
25: atm▶Pa	26: Pa▶atm	27: mmHg▶Pa	28: Pa▶mmHg
29: hp▶kW	30: kW▶hp	31: kgf/cm^2▶Pa	32: Pa▶kgf/cm^2
33: kgf_m▶J	34: J▶kgf_m	35: lbf/in^2▶kPa	36: kPa▶lbf/in^2
37: °F▶°C	38: °C▶°F	39: J▶cal	40: cal▶J

Conversion formula data is based on the "NIST Special Publication 811(1995)."

Note: The J▶cal command performs conversion for values at a temperature of 15°C.

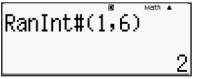
RanInt

Function RanInt#(a,b) generates a random integer within the range of a to b.

Example: To generate a random integer from 1 to 6.

[LINE]

[SHIFT] [log▪] (RanInt#() [1] [SHIFT] [)] (,) [6] [)] [=]



Other Functions

This section explains how to use the functions shown below.

!, Abs (, Ran #, ${}_nP_r$, ${}_nC_r$, Rnd(

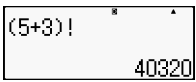
Factorial (!)

This function obtains the factorials of a value that is zero or a positive integer.

Example: (5 + 3)! = 40320

LINE

(5 + 3) SHIFT x^{-1} ($x!$) =



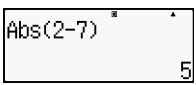
Absolute Value Calculation (Abs)

When you are performing a real number calculation, this function simply obtains the absolute value.

Example: Abs(2 - 7) = 5

LINE

SHIFT hyp Abs 2 − 7) =

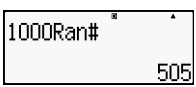


Random Number (Ran#)

This function generates a 3 digit pseudo random number that is less than 1.

LINE

1 0 0 0
SHIFT • (Ran#) =



=

=

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

Note that values shown here are examples only. Values actually generated by your calculator will be different.

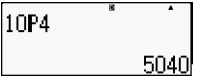
Permutation ($_nP_r$) and Combination ($_nC_r$)

These functions make it possible to perform permutation and combination calculations. *n* and *r* must be integers in the range of $0 \le r \le n < 1 \times 10^{10}$.

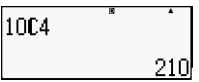
How many four-person permutations and combinations are possible for a group of 10 people?

[LINE]

[1] [0] [SHIFT] [×] ($_nP_r$) [4] [=]



[1] [0] [SHIFT] [÷] ($_nC_r$) [4] [=]



Rounding Function (Rnd)

This function rounds the value or the result of the expression in the function's argument to the number of significant digits specified by the number of display digits setting.

Display Digits Setting: Norm1 or Norm2

The mantissa is rounded to 10 digits.

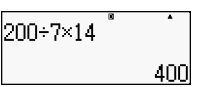
Display Digits Setting: Fix or Sci

The value is rounded to the specified number of digits.

Example: 200 ÷ 7 × 14 = 400

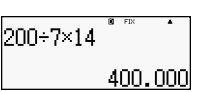
[LINE]

[2] [0] [0] [÷] [7] [×] [1] [4] [=]



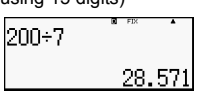
(Specifies three decimal places.)

[SHIFT] [MODE] [6] (Fix) [3]

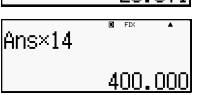


(Calculations are performed internally using 15 digits)

[2] [0] [0] [÷] [7] [=]



[×] [1] [4] [=]



The following performs the same calculation with rounding.

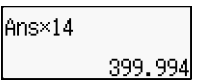
2 0 0 ÷ 7 =

(Round the value to the specified number of digits.)

SHIFT 0 (Rnd) =

(Check rounded result.)

× 1 4 =



Transforming Displayed Values

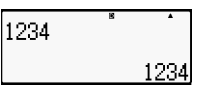
You can use procedures in this section to transform a displayed value to engineering notation, or to transform between standard form and decimal form.

Using Engineering Notation

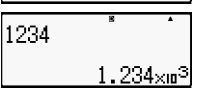
A simple key operation transforms a displayed value to engineering notation. Transform the value 1,234 to engineering notation, shifting the decimal point to the right.

LINE

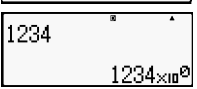
1 2 3 4 =



ENG



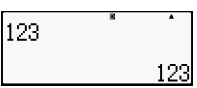
ENG



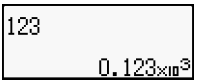
Transform the value 123 into engineering notation, shifting the decimal point to the left.

LINE

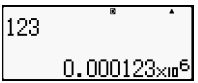
1 2 3 =



SHIFT ENG (←)



SHIFT ENG (←)



Using S-D Transformation

You can use S-D transformation to transform a value between its decimal (D) form and its standard (S) form (fraction, π).

Formats Supported for S-D Transformation

S-D transformation can be used to transform a displayed decimal calculation result to one of the forms described below. Performing S-D transformation again converts back to the original decimal value.

Note: When you transform from decimal form to standard form, the calculator automatically decides the standard form to use. You cannot specify the standard form.

Fraction: The current fraction format setting determines whether the result is an improper fraction or mixed fraction.

π: The following are the π forms that are supported. This is true only in the case of Math format. $n\,\pi$ (n is an integer).

$\frac{a}{b}\,\pi$ or $a\frac{b}{c}\,\pi$ (depending on fraction format setting).

Transformation to a fractional π form is limited to inverse trigonometric function result and values that are normally expressed in radians.

After obtaining a calculation result in √ form, you can convert it to decimal form by pressing the S⇔D key. When the original calculation result is in decimal form, it cannot be converted into √ form.

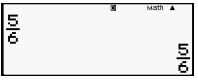
Examples of S-D Transformation

Note that S-D transformation can take some time to perform.

Example: Fraction → Decimal

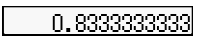
MATH

(▤) 5 ▼ 6 =

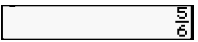


Each press of the S⇔D key toggles between the two forms.

S⇔D



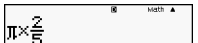
S⇔D



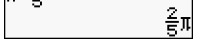
π Fraction → Decimal

MATH

SHIFT ×10^ (π) × ▤ 2 ▼ 5 =



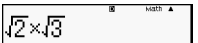
S⇔D



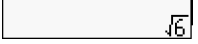
√ → Decimal

MATH

√ 2 ► × √ 3 =



S⇔D



Statistical Calculation (STAT).

All the calculations in this section are performed in the STAT Mode (MODE 2).

Selecting a Statistical Calculation Type

In the STAT Mode, display the statistical calculation type selection screen.

Statistical Calculation Types

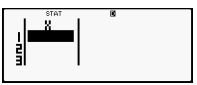
Key	Menu Item	Statistical Calculation
1	1-VAR	Single-variable
2	A+B*X*	Linear regression
3	_+C*X*^{2}	Quadratic regression
4	ln *X*	Logarithmic regression
5	*e*^ *X*	*e* exponential regression
6	A • B^*X*	*ab* exponential regression
7	A • *X*^B	Power regression
8	1/*X*	Inverse regression

Inputting Sample Data Displaying the STAT Editor Screen

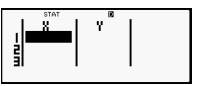
The STAT editor screen appears after you enter the STAT Mode from another mode. Use the STAT menu to select a statistical calculation type. To display the STAT editor from another STAT Mode screen, press [SHIFT] [1] (STAT) [2] (Data).

STAT Editor Screen

There are two STAT editor screen formats, depending on the type of statistical calculation you selected.



Single-variable Statistics



Paired-variable Statistics

The first line of the STAT editor screen shows the value for the first sample or the values for their first pair of samples.

FREQ (Frequency) Column

If you turn on the Statistical Display item on the calculator's setup screen, a column labeled "FREQ" will also be included on the STAT editor screen. You can use FREQ column to specify the frequency (the number of times the same sample appears in the group of data) of each sample value.

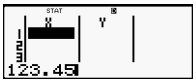
Rules for Inputting Sample Data on the STAT Editor Screen

- Data you input is inserted into the cell where the cursor is located. Use the cursor keys to move the cursor between cells. The cursor in the following image is located below the letter x.

- The values and expressions you can input on the STAT editor screen are the same as those you can input in the COMP Mode with Linear format.
- Pressing [AC] while inputting data clears your current input.
- After inputting a value, press [=]. This registers the value and displays up to six digits in the currently selected cell.

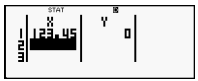
Example: To input the value 123.45 in cell *X*1 (Move the cursor to cell *X*1)

[1] [2] [3] [•] [4] [5]



The value you input appears in the formula area (123.45).

[=]



Registering a value causes the cursor to move down one cell.

STAT Editor Screen Input Precautions

The number of lines in STAT editor screen (the number of sample data values you can input) depends on the type of statistical data you selected and on the Statistical Display setting of the calculator's setup screen.

Statistical Display	OFF (No FREQ column)	On (FREQ column)
Statistic Type		
Single-variable	80 lines	40 lines
Paired-variable	40 lines	26 lines

The following types of input are not allowed on the STAT editor screen:

- [M+] [SHIFT] [M+] (M-) operations
- Assignment to variables (STO)

Precautions Concerning Sample Data Storage

Sample data you input is deleted automatically whenever you change to another mode from the STAT Mode or change the Statistical Display setting (which causes the FREQ column to be shown or hidden) on the calculator's setup screen.

Editing Sample Data

Replacing the Data in a Cell

(1) On the STAT editor screen, move the cursor to the cell you want to edit.

(2) Input the new data value or expression, and then press [=].

Important: Note that you must totally replace the existing data of the cell with new input. You cannot edit parts of the existing data.

Deleting a Line

- (1) On the STAT editor screen, move the cursor to the line you want to delete.
- (2) Press [DEL].

Inserting Line

- (1) On the STAT editor screen, move the cursor to the line that will be under the line you will insert.
- (2) Press [SHIFT] [1] (STAT) [3] (Edit).
- (3) Press [1] (Ins).

Important: Note that the insert operation will not work if the maximum number of lines allowed for the STAT editor screen are already used.

Deleting All STAT Editor Contents

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

(2) Press [2] (Del-A).

This clears all of the sample data on the STAT editor screen.

Note: You can perform the procedures under “Inserting a Line” and “Deleting All STAT Editor Contents” only when the STAT editor screen is on the display.

STAT Calculation Screen

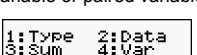
The STAT calculation screen is for performing statistical calculations with the data you input with the STAT editor screen. Pressing the [AC] key while the STAT editor screen is displayed switches to the STAT calculation screen.

The STAT calculation screen also uses Linear format, regardless of the current input/output format setting on the calculator’s setup screen.

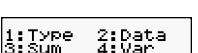
Using the STAT Menu

While the STAT editor or STAT calculation screen is on display, press [SHIFT] [1] (STAT) to display the STAT menu.

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



Single-variable Statistics



Paired-variable Statistics

STAT Menu Items

Common Items

Select this menu item:	When you want to do this:
[1] Type	Display the statistical calculation type selection screen
[2] Data	Display the STAT editor screen
[3] Sum	Display the Sum sub-menu of commands for calculating sums.
[4] Var	Display the Var sub-menu of commands for calculating the mean, standard deviation, etc.
[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".
[6] MinMax	Display the MinMax sub-menu of commands for obtaining maximum and minimum values.

Single-variable (1-VAR) Statistical Calculation Commands

The following are the commands that appear when you select [3] (Sum), [4] (Var), or [6] (MinMax) on the STAT menu while a single-variable statistical calculation type is selected.

$$\bar{x} = \frac{\sum x}{n}$$

$$x\sigma_n = \frac{\sum (x - \bar{x})^2}{n}$$

$$x\sigma_{n-1} = \frac{\sum (x - \bar{x})^2}{n - 1}$$

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 sample data
[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 $x\sigma_n$	Population standard deviation
4 $x\sigma_{n-1}$	Sample standard deviation

MinMax Sub-menu (SHIFT 1 (STAT) 6 (MinMax))

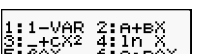
Select this menu item:	When you want to obtain this:
1 min$X$	Minimum value
2 max$X$	Maximum value

Single-variable Statistical Calculation

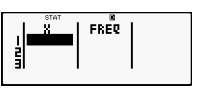
Select single-variable (1-VAR) and input the following:

Data: {1,2,3,4,5,6,7,8,9,10} (FREQ:ON)

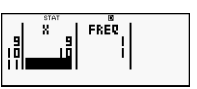
SHIFT MODE ▼ 3 (STAT) 1 (ON)
MODE 2 (STAT)



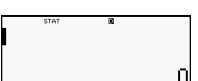
1 (1-VAR)



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



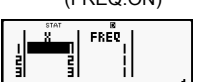
AC



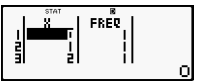
Edit the data to the following, using insert and delete:

{1,2,3,4,5,6,7,8,9,10} (FREQ:ON)

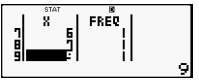
SHIFT 1 (STAT) 2 (Data)



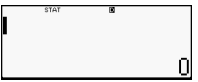
SHIFT 1 (STAT) 3 (Edit) 1 (Ins)



▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼ DEL



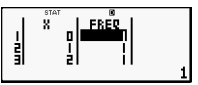
AC



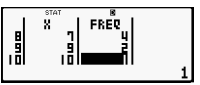
Edit the FREQ data to the following:

{1,2,1,2,2,2,3,4,2,1} (FREQ:ON)

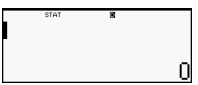
SHIFT 1 (STAT) 2 (Data) ►



▼ 2 = ▼ 2 = 2 =
2 = 3 = 4 = 2 =



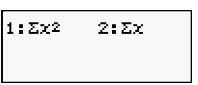
AC



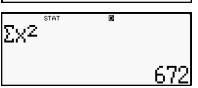
Examples:

Calculate the sum of squares of the sample data and sum of the sample data.

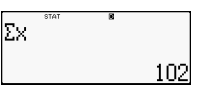
SHIFT 1 (STAT) 3 (Sum)



1 ($\sum x^2$) =

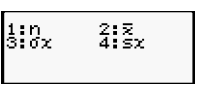


1 (STAT) 3 (Sum)
2 ($\sum x$) =

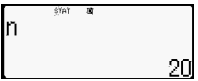


Calculate the number of samples, mean, and population standard deviation.

SHIFT 1 (STAT) 5 (Var)

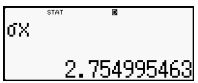


1 (n) =



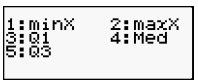
SHIFT 1 (STAT) 5 (Var) 2 ($\bar{x}$) =

SHIFT 1 (STAT) 4 (Var) 3 ($x\sigma_n$) =

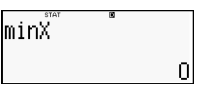


Calculate minimum value and maximum value.

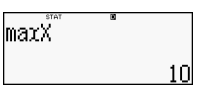
SHIFT 1 (STAT) 5 (Quart1)



1 (Minx) =



SHIFT 1 (STAT) 6 (MinMax) 2 (Max*X*) =



Commands When Linear Regression Calculation (A+Bx) Is Selected

With linear regression, regression is performed in accordance with the following model equation.

y = A + B*X*

The following are the commands that appear on the sub-menus that appear when you select 4 (Sum), 5 (Var), 6 (MinMax), or 7 (Reg) on the STAT menu while linear regression is selected as the statistical calculation type.

$\bar{x} = \frac{\sum x}{n}$

$\bar{y} = \frac{\sum y}{n}$

$x\sigma_n = \frac{\sum (x - \bar{x})^2}{n}$

$y\sigma_n = \sqrt{\frac{\sum (y - \bar{y})^2}{n}}$

$x\sigma_{n-1} = \frac{\sum (x - \bar{x})^2}{n - 1}$

$y\sigma_{n-1} = \sqrt{\frac{\sum (y - \bar{y})^2}{n - 1}}$

$A = \frac{\sum y - B \bullet \sum x}{n}$

$$B = \frac{n \bullet \sum xy - \sum x \bullet \sum y}{n\sum x^2 - (\sum x)^2}$$

$$r = \frac{n \bullet \sum xy - \sum x \bullet \sum y}{\sqrt{\left\{n\sum x^2 - (\sum x)^2\right\}\left\{n \bullet \sum y^2 + (-\sum y)^2\right\}}}$$

$$\hat{x} = \frac{y - A}{B} \qquad \hat{y} = A + Bx$$

Sum Sub-menu (SHIFT 1 (STAT) 4 (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 the 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
7 $\sum x^2 y$	Sum of (*X*-data squares X *Y*-data)
8 $\sum x^4$	Sum of biquadrate of the *X*-data

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

Select this menu item:	When you want to obtain this:
1 n	Number of samples
2 $\bar{x}$	Mean of the *X*-data
3 $x\sigma_n$	Population standard deviation of the *X*-data
4 $x\sigma_{n-1}$	Sample standard deviation of the *X*-data
5 $\bar{y}$	Mean of the *Y*-data
6 $y\sigma_n$	Population standard deviation of the *Y*-data
7 $y\sigma_{n-1}$	Sample standard deviation of the *Y*-data

MinMax Sub-menu (SHIFT 1 (STAT) 6 (MinMax))

Select this menu item:	When you want to obtain this:
1 Min*X*	Minimum value of the *X*-data
2 Max*X*	Maximum value of the *X*-data
3 Min*Y*	Minimum value of the *Y*-data
4 Max*Y*	Maximum value of the *Y*-data

Reg Sub-menu (SHIFT 1 (STAT) 7 (Reg))

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

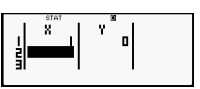
Linear Regression Calculation:

Examples use all the data input in this table:

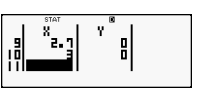
x	*y*	*x*	*y*
1.0	1.0	2.1	1.5
1.2	1.1	2.4	1.6
1.5	1.2	2.5	1.7
1.6	1.3	2.7	1.8
1.9	1.4	3.0	2.0

SHIFT MODE ▼ 3 (STAT) 2 (OFF)
MODE 2 (STAT)

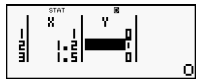
2 (A+BX) 1 =



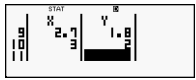
1 • 2 = 1 • 5 =
1 • 6 = 1 • 9 =
2 • 1 = 2 • 4 =
2 • 5 = 2 • 7 =
3 =



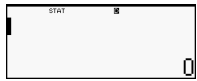
[▼] [▶] [1] [=]



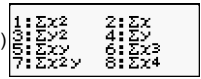
[1] [•] [1] [=] [1] [•] [2] [=]
[1] [•] [3] [=] [1] [•] [4] [=]
[1] [•] [5] [=] [1] [•] [6] [=]
[1] [•] [7] [=] [1] [•] [8] [=]
[2] [=]



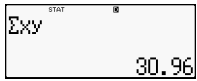
[AC]



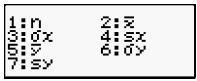
[SHIFT] [1] (STAT) [3] (Sum)



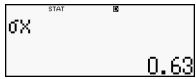
[5] ($\sum xy$) [=]



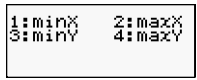
[SHIFT] [1] (STAT) [4] (Var)



[3] ($x\sigma_n$) [=]

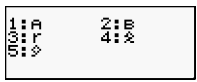


[SHIFT] [1] (STAT) [6] (MinMax)

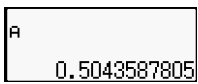


[4] (Max *Y*) [=]

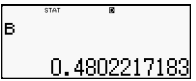
[SHIFT] [1] (STAT) [5] (Reg)



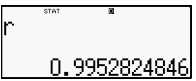
[1] (A) [=]



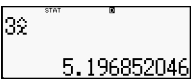
SHIFT 1 (STAT) 5 (Reg)
2 (B) =



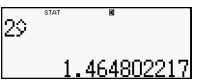
1 (STAT) 7 (Reg) 3 (r) =



* 3 SHIFT 1 (STAT) 5 (Reg)
4 ($\hat{x}$) =



** 2 SHIFT 1 (STAT) 5 (Reg)
5 ($\hat{y}$) =



* Estimated Value ($y = 3 \longrightarrow \hat{x} = ?$)

** Estimated Value ($x = 2 \longrightarrow \hat{y} = ?$)

Commands when Quadratic Regression Calculation (_+CX) Is Selected

With quadratic regression, regression is performed in accordance with the following model equation.

$$y = A + BX + CX^2$$

For example:

$$A = \frac{\sum y}{n} - B\left(\frac{\sum x}{n}\right) - C\left(\frac{\sum x^2}{n}\right)$$

$$B = \frac{Sxy \bullet Sx^2x^2 - Sx^2y \bullet Sxx^2}{Sxx \bullet Sx^2x^2 - (Sxx^2)^2}$$

$$C = \frac{Sx^2y \bullet Sxx - Sxy \bullet Sxx^2}{Sxx \bullet Sx^2x^2 - (Sxx^2)^2}$$

$$Sxx = \sum x^2 - \frac{(\sum x)^2}{n}$$

$$Sxy = \sum xy - \frac{\sum x \bullet \sum y}{n}$$

$$Sxx^2 = \sum x^3 - \frac{\sum x \bullet \sum x^2}{n}$$

$$Sx^2x^2 = \sum x^4 - \frac{(\sum x^2)^2}{n}$$

$$Sx^2y = \sum x^2y - \frac{\sum x^2 \bullet \sum y}{n}$$

$$\hat{x}1 = \frac{-B + \sqrt{B^2 - 4C(A-y)}}{2C}$$

$$\hat{x}2 = \frac{-B - \sqrt{B^2 - 4C(A-y)}}{2C}$$

$$\hat{y} = A + Bx + Cx^2$$

Reg Sub-menu ([SHIFT] [1] (STAT) [7] (Reg))

Select this menu item:	When you want to obtain this:
[1] A	Regression coefficient constant term A
[2] B	Linear coefficient B of the regression coefficients
[3] C	Quadratic coefficient C of the regression coefficients
[4] $\hat{x}1$	Estimated value of *x*1
[5] $\hat{x}2$	Estimated value of *x*2
[6] $\hat{y}$	Estimated value of *y*

Sum sub-menu (sums), Var sum-menu (number of samples, mean, standard deviation), and MinMax sub-menu (maximum value, minimum value) operations are the same those for linear regression calculations.

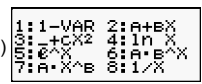
Quadratic Regression Calculation

For example:

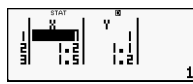
All the data used as the following table:

x	*y*	*x*	*y*
1.0	1.0	2.1	1.5
1.2	1.1	2.4	1.6
1.5	1.2	2.5	1.7
1.6	1.3	2.7	1.8
1.9	1.4	3.0	2.0

SHIFT 1 (STAT) 1 (Type)



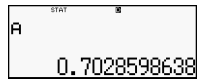
3 (_+CX^2)



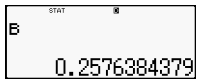
AC

SHIFT 1 (STAT) 5 (Reg)

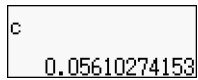
1 (A) =



SHIFT 1 (STAT) 7 (Reg)
2 (B) =

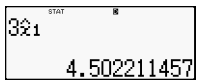


SHIFT 1 (STAT) 7 (Reg)
3 (C) =



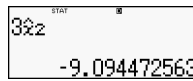
y = 3 ⟶ $\hat{x}1$ = ?

3 SHIFT 1 (STAT) 7 (Reg)
4 ($\hat{x}1$) =



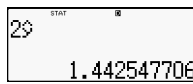
y = 3 ⟶ $\hat{x}2$ = ?

3 SHIFT 1 (STAT) 7 (Reg)
5 ($\hat{x}2$) =



x = 2 ⟶ y = ?

2 SHIFT 1 (STAT) 7 (Reg)
6 ($\hat{y}$) =



Comments for Other Typed of Regression

For details about the calculation formula of the command included in each regression type, refer to the indicated calculation formulas.

For example:

Logarithm Regression (ln *X*)

$y = A + B\ln X$

$$A = \frac{\sum y - B \bullet \sum \ln x}{n}$$

$$B = \frac{n \bullet \sum (\ln x) y - \sum \ln x \bullet \sum y}{n \bullet \sum (\ln x)^2 - \left(\sum \ln x\right)^2}$$

$$r = \frac{n \bullet \sum (\ln x) y - \sum \ln x \bullet \sum y}{\left\{n \bullet \sum (\ln x)^2 - \left(\sum \ln x\right)^2\right\}\left\{n \bullet \sum y^2 - \left(\sum y\right)^2\right\}}$$

$$\hat{x} = e^{\frac{y - A}{B}}$$

$\hat{y} = A + B\ln x$

***e* Exponential Regression (*e*^ *X*)**

$y = Ae^{Bx}$

$$A = \exp\frac{\sum \ln y - B \bullet \sum x}{n}$$

$$B = \frac{n \bullet \sum x \ln y - \sum x \bullet \sum \ln y}{n \bullet \sum x^2 - \left(\sum x\right)^2}$$

$$r = \frac{n \bullet \sum x \ln y - \sum x \bullet \sum \ln y}{\left\{n \bullet \sum x^2 - \left(\sum x\right)^2\right\}\left\{n \bullet \sum (\ln y)^2 - \left(\sum \ln y\right)^2\right\}}$$

$$\hat{x} = \frac{\ln y - \ln A}{B}$$

$$\hat{y} = Ae^{Bx}$$

***ab* Exponential Regression (A·B^*X*)**

$y = AB^X$

$$A = \exp\frac{\sum \ln y - B \bullet \sum x}{n}$$

$$B = \frac{n \bullet \sum x \ln y - \sum x \bullet \sum \ln y}{n \bullet \sum x^2 - (\sum x)^2}$$

$$r = \frac{n \bullet \sum x \ln y - \sum x \bullet \sum \ln y}{\left\{n \bullet \sum x^2 - (\sum x)^2\right\}\left\{n \bullet \sum (\ln y)^2 - (\sum \ln y)^2\right\}}$$

$$\hat{x} = \frac{\ln y - \ln A}{B} \qquad \hat{y} = ABx$$

Power Regression (A・*X*^B)

$y = AX^B$

$$A = \exp\frac{\sum \ln y - B \bullet \sum \ln x}{n}$$

$$B = \frac{n \bullet \sum x \ln y - \sum \ln x \bullet \sum \ln y}{n \bullet \sum (\ln x)^2 - (\sum \ln x)^2}$$

$$r = \frac{n \bullet \sum \ln x \ln y - \sum \ln x \bullet \sum \ln y}{\left\{n \bullet \sum (\ln x)^2 - (\sum \ln x)^2\right\}\left\{n \bullet \sum (\ln y)^2 - (\sum \ln y)^2\right\}}$$

$$\hat{x} = e^{\frac{\ln y - \ln A}{B}}$$

$\hat{y} = Ax^B$

Inverse Regression (1/*X*)

$$y = A + \frac{B}{X}$$

$$A = \frac{\sum y - B \bullet \sum x^1}{n}$$

$$B = \frac{Sxy}{Sxx}$$

$$r = \frac{Sxy}{\sqrt{Sxx \bullet Syy}}$$

$$Sxx = (\sum x^{-1})^2 - \frac{(\sum x^1)^2}{n}$$

$$Syy = \sum y^2 - \frac{(\sum y)^2}{n}$$

$$Sxy = \sum (x^{-1})y - \frac{\sum x^1 \bullet \sum y}{n}$$

$$\hat{x} = \frac{B}{y - A}$$

$$\hat{y} = A + \frac{B}{x}$$

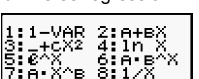
Comparison Regression Curves

The following example uses the data input in as following table:

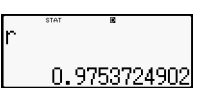
x	*y*	*x*	*y*
1.0	1.0	2.1	1.5
1.2	1.1	2.4	1.6
1.5	1.2	2.5	1.7
1.6	1.3	2.7	1.8
1.9	1.4	3.0	2.0

Compare the correlation coefficient for logarithmic, *e* exponential, *ab* exponential, Power, and inverse regression.

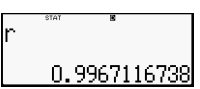
[SHIFT] [1] (STAT) [1] (Type)



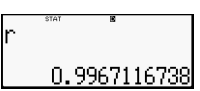
[4] (ln*X*) [AC] [SHIFT] [1] (STAT)
[7] (Reg) [3] (r) [=]



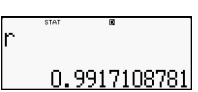
[SHIFT] [1] (STAT) [1] (Type)
[5] (e^*X*) [AC] [SHIFT] [1] (STAT)
[7] (Reg) [3] (r) [=]



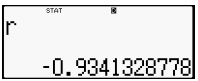
[SHIFT] [1] (STAT) [1] (Type)
[6] (A·B^*X*) [AC] [SHIFT] [1] (STAT)
[7] (Reg) [3] (r) [=]



[SHIFT] [1] (STAT) [1] (Type)
[7] (A·B^*X*) [AC] [SHIFT] [1] (STAT)
[7] (Reg) [3] (r) [=]



[SHIFT] [1] (STAT) [1] (Type)
[8] (1/*X*) [AC] [SHIFT] [1] (STAT)
[7] (Reg) [3] (r) [=]



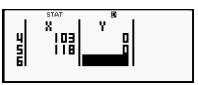
Other types of Regression Calculation:

y = A + Bln*x*

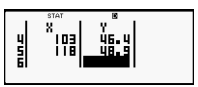
x	y
29	1.6
50	23.5
74	38.0
103	46.4
118	48.9

[SHIFT] [MODE] [▼] [3] (STAT) [2] (OFF)
[MODE] [2] (STAT) [4] (ln*x*)

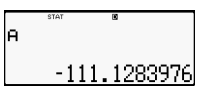
[2] [9] [=] [5] [0] [=] [7] [4] [=]
[1] [0] [3] [=] [1] [1] [8] [=]



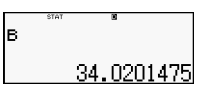
[▼] [▶] [1] [•] [6] [=]
[2] [3] [•] [5] [=]
[3] [8] [=] [4] [6] [•] [4] [=]
[4] [8] [•] [9] [=]



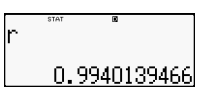
[AC] [SHIFT] [1] (STAT) [5] (Reg)
[1] (A) [=]



[SHIFT] [1] (STAT) [7] (Reg)
[2] (B) [=]

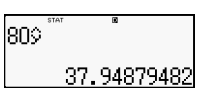


[1] (STAT) [7] (Reg)
[3] (*r*) [=]



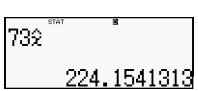
$X = 80 \longrightarrow \hat{y}$ = ?

[8] [0] [SHIFT] [1] (STAT) [7] (Reg)
[5] ($\hat{y}$) [=]



$Y = 73 \longrightarrow \hat{x}$ =?

[7] [3] [SHIFT] [1] (STAT) [5] (Reg)
[4] ($\hat{x}$) [=]



$y = Ae^{Bx}$

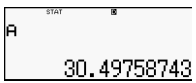
x	y
6.9	21.4
12.9	15.7
19.8	12.1
26.7	8.5
35.1	5.2

SHIFT MODE ▼ 3 (STAT) 2 (OFF)
MODE 2 (STAT) 5 (*e*^*X*)

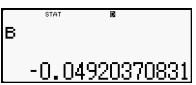
6 • 9 = 1 2 • 9 =
1 9 • 8 =
2 6 • 7 =
3 5 • 1 =

▼ ▶ 2 1 • 4 =
1 5 • 7 =
1 2 • = 1 8 • 5 =
5 • 2 =

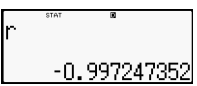
AC SHIFT 1 (STAT) 7 (Reg)
1 (A) =



SHIFT 1 (STAT) 7 (Reg)
2 (B) =

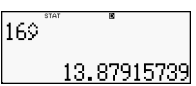


SHIFT 1 (STAT) 7 (Reg)
3 (r) =



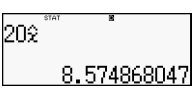
$x = 16 \longrightarrow \hat{y}$ = ?

1 6 SHIFT 1 (STAT) 7 (Reg)
5 ($\hat{y}$) =



$y = 20 \longrightarrow \hat{x}$ = ?

2 0 SHIFT 1 (STAT) 7 (Reg)
4 ($\hat{x}$) =



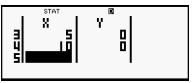
$y = AB^x$

x	y
-1	0.24
3	4
5	16.2
10	513

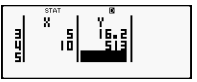
SHIFT MODE ▼ 3 (STAT) 2 (OFF)

MODE 2 (STAT) 6 (A•B^X)

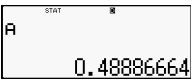
(-) 1 = 3 = 5 = 1 0 =



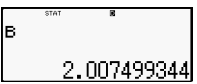
▼ ► 0 • 2 4 = 4 = 1 6 • 2 = 5 1 3 =



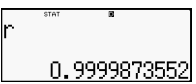
AC SHIFT 1 (STAT) 7 (Reg) 1 (A) =



SHIFT 1 (STAT) 7 (Reg) 2 (B) =

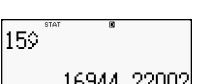


SHIFT 1 (STAT) 7 (Reg) 3 (*r*) =



$x = 15 \longrightarrow \hat{y} = ?$

1 5 SHIFT 1 (STAT) 7 (Reg) 5 ($\hat{y}$) =



$y = 1.02 \longrightarrow \hat{x} = ?$

1 • 0 2 SHIFT 1 (STAT) 7 (Reg) 4 ($\hat{x}$) =

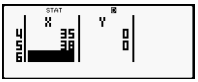
$y = Ax^B$

x	y
28	2410
30	3033
33	3895
35	4491
38	5717

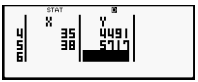
SHIFT MODE ▼ 3 (STAT) 2 (OFF)

MODE 2 (STAT) 7 (A•X^B)

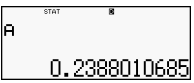
2 8 = 3 0 = 3 3 =
3 5 = 3 8 =



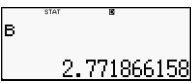
▼ ► 2 4 1 0 =
3 0 3 3 =
3 8 9 5 =
4 4 9 1 =
5 7 1 7 =



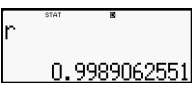
AC SHIFT 1 (STAT) 7 (Reg)
1 (A) =



SHIFT 1 (STAT) 7 (Reg)
2 (B) =

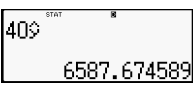


SHIFT 1 (STAT) 7 (Reg)
3 (*r*) =



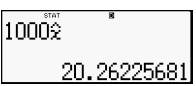
$x = 40 \longrightarrow \hat{y} = ?$

4 0 SHIFT 1 (STAT) 7 (Reg)
5 ($\hat{y}$) =



$y = 1000 \longrightarrow \hat{x} = ?$

1 0 0 0 SHIFT 1 (STAT)
(Reg) 4 ($\hat{x}$) =



$y = A + \frac{B}{x}$

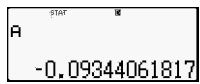
x	*y*
1.1	18.3
2.1	9.7
2.9	6.8
4.0	4.9
4.9	4.1

SHIFT MODE ▼ 3 (STAT) 2 (OFF)
MODE 2 (STAT) 8 (1/X)

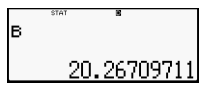
[1] [•] [1] [=] [2] [•] [1] [=]
[2] [•] [9] [=] [4] [=]
[4] [•] [9] [=]

[▼] [▶] [1] [8] [•] [3] [=]
[9] [•] [7] [=] [6] [•] [8] [=]
[4] [•] [9] [=] [4] [•] [1] [=]

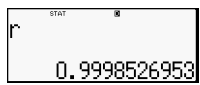
[AC] [SHIFT] [1] (STAT) [5] (Reg)
[1] (A) [=]



[SHIFT] [1] (STAT) [7] (Reg)
[2] (B) [=]

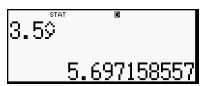


[SHIFT] [1] (STAT) [7] (Reg)
[3] (*r*) [=]



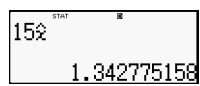
$x = 3.5 \longrightarrow \hat{y}$ = ?

[3] [•] [5] [SHIFT] [1] (STAT) [7] (Reg)
[5] ($\hat{y}$) [=]



$y = 15 \longrightarrow x$ = ?

[1] [5] [SHIFT] [1] (STAT)
[7] (Reg) [4] (x) [=]

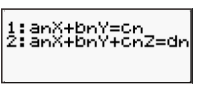
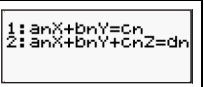
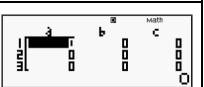


Command Usage Tips

The commands include in the Reg sub-menu can take a long time to execute in logarithmic, *e* exponential, *ab* exponential, or power regression calculation when there are a large number of data samples.

Calculations of Equations (EQN)

Use the [MODE] key to enter the EQN mode when you want to solve an equation. In EQN mode, you can solve simultaneous linear equations with up to three unknowns.

	Two unknowns	Three unknowns
KEY IN	DISPLAY	DISPLAY
MODE		
3		
1 or 2		

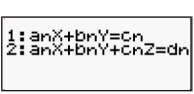
Simultaneous Linear Equations

1. Simultaneous Linear Equations with Two Unknowns:
   $a_1x + b_1y = c_1$
   $a_2x + b_2y = c_2$
2. Simultaneous Linear Equations with Three Unknowns:
   $a_1x + b_1y + c_1z = d_1$
   $a_2x + b_2y + c_2z = d_2$
   $a_3x + b_3y + c_3z = d_3$

- Use the coefficient editor screen to input the coefficients of an equation. The coefficient editor screen shows input cells for each of the coefficients required by the currently selected equation type.
- When simultaneous linear equations with three unknowns are selected as the equation type, the d column will not be visible on the display when the coefficient editor screen is first displayed. The d column will become visible when you move the cursor to it, which causes the screen to shift.

Example: To solve the following equations x + 2y = 5 and 3x - 2y = 3 (x = 2, y = 1.5)

MODE 3 (EQN) 1



1

[=] [2] [=] [5] [=] [3] [=]
[−] [2] [=] [3] [=]

[=]

[=]

Example: To solve the following simultaneous equations:

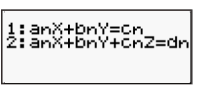
2x + 3y - z = 15

3x - 2y + 2z = 4

5x + 3y - 4z = 9 (x = 2, y = 5, z = 4)

[LINE]

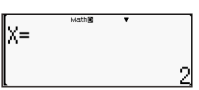
[MODE] [3] (EQN)



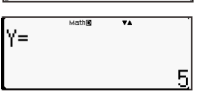
[2]

[=] [2] [=] [3] [=] [−] [1] [=] [1] [5]
[=] [3] [=] [−] [2] [=] [2] [=] [4] [=]
[5] [=] [3] [=] [−] [4] [=] [9] [=]

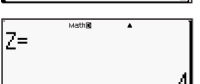
[=]



[=]



[=]



Inputting and editing coefficients

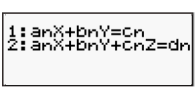
1. Rules for inputting and editing coefficients:
   - Data is inserted into the cell where the cursor is located. When you register input into a cell, the cursor moves to the next cell on the right.
   - The values and expressions you can input on the coefficient editor screen are the same as those you can input in the COMP Mode with Linear format.
   - Press [AC] while inputting data clears your current input.
   - After inputting data, press [=]. This registers the value and displays up to six of its digits in the currently selected cell.
   - To change the contents of a cell, use the cursor keys to move the cursor to the cell and then input the new data.
2. You can clear all coefficients to zero by pressing the [AC] key while inputting values on the coefficient editor screen.
3. The following operations are not supported by the Coefficient Editor:

   [M+] [M−] [STO] [Pol(] [Rec(] and multi-statements also cannot be input with the Coefficient Editor.

   Example: Solve the following linear equations:
   x - y + z = 2; x + y - z = 0; -x + y + z = 4

[MATH]

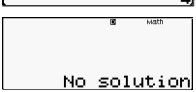
[MODE] [3] (EQN)

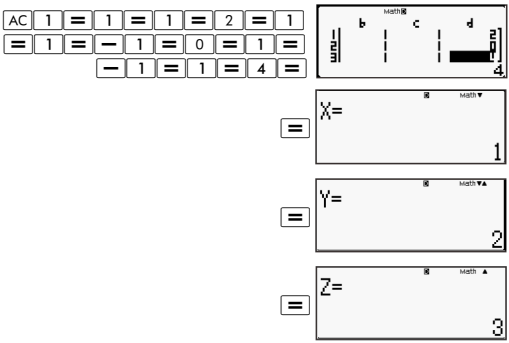


[2]

[=] [1] [=] [1] [=] [2] [=] [1] [=]
[=] [1] [=] [0] [=] [1] [=] [1] [=]
[1] [=] [4] [=]

[=]





Solution Display

After inputting and registering values on the coefficient editor screen, press [=] to display the solution(s) for the equation.

- Each press of [=] display the next solution, if there is one. Pressing [=] while the final solution is displayed returns to the coefficient editor screen.
- In the case of simultaneous linear equations, you can use [▲] and [▼] to switch the display between the solutions for X and Y (and Z).
- To return to the coefficient editor method:

  (1) Press [AC] while a solution is displayed.

  (2) Press [=] while the final solution is displayed.
- The display format of solutions is in accordance with the input/output format settings of the calculator's setup screen.
- You cannot transform values to engineering notation while an equation solution is displayed.

Special Solution Display

“Infinite of sol" appears on the solution screen when the solution of an equation is all numbers.

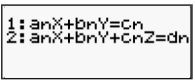
“No solution" appears on the solution screen when no solution exists for an equation.

Press [MODE] [3] and then select an equation type form the menu that appears. Changing the equation type causes the values of all coefficients to change to zero.

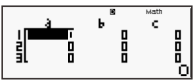
Example:

[MATH]

[MODE] [3] (EQN)

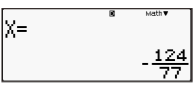


[1]



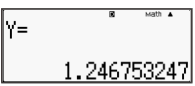
[1] [÷] [4] [=] [2] [÷] [3] [=] [3]
[÷] [7] [=] [2] [=] [9] [=] [8] [=]

[=]

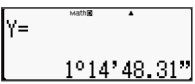


[=]

[S⇔D]



[°,,,]



Generating a Number Table from a Function (TABLE)

All calculations in this section are performed in the TABLE Mode ([MODE] [4]).

Configuring a Number Table Generation Function

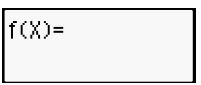
The procedure below configures the number table generation function with the following settings.

Function: $f(x) = x^2 + \frac{1}{2}$

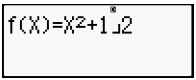
Start Value: 1; End Value: 5; Step Value:1

[LINE]

(1) Press [MODE] [4] (TABLE).

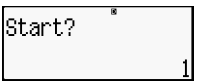


(2) Input the function.



(3) After making sure the function is the way you want, press [=].

This displays the start value input screen.

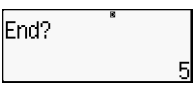


Indicates the initial default start value of

If the initial value is not 1, press [1] to specify the initial start value for this example.

(4) After specifying the start value, press [=].

This displays the end value input screen.

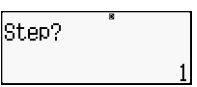


Indicates the initial default start value of

Specify the end value.

(5) After specifying the end value, press [=].

This displays the step value input screen.

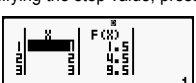


Indicates the initial default start value

Specify the step value.

For details about specifying the start, end, and step values, see “Start, End, and Step Value Rules.”

(6) After specifying the step value, press [=].



Pressing the [AC] key returns to the function editor screen.

Supported Function Types

- Except for the X variable, other variables (A, B, C, D, Y) and independent memory (M) are all treated as values (the current variable assigned to the variable or stored in independent memory).
- Only variable X can be used as the variable of a function.

- The coordinate conversion (Pol, Rec) functions cannot be used for a number table generation function.
- Note that the number table generation operation causes the contents of variable X to be changed.

Start, End, and Step Value Rules

- Linear format is always used for value input.
- You can specify either values or calculation expressions (which must produce a numeric result) for Start, End, and Step.
- Specifying an end value that is less than the Start value causes an error, so the number table is not generated.
- The specified Start, End, and Step values should produce a maximum of 30 *x*-values for the number table being generated. Executing a number generation table using a Start, End, and Step value combination that produces more than 30 *x*-value causes an error.

Note*:* Certain functions and Start, End, Step value combinations can cause number generation to take a long time.

Number Table Screen

The number table screen shows *x*-values calculated using the specified Start, End, as well as the values obtained when each *x*-value is substituted in the function *f(x).*

- Note that you can use the number table screen for viewing values only. Table contents cannot be edited.
- Pressing the [AC] key returns to the function editor screen.

TABLE Mode Precautions

Note that changing the input/output format settings (Math format or Linear format) on the calculator's setup screen while in the TABLE Mode clears the number table generation function.

Using the Verify Command

Use the [MODE] key to enter the VERIF Mode when you want to compare and check two values.

Key in	Display
[MODE]	1:COMP 2:STAT 3:EQN 4:TABLE 5:VERIF 6:PROP
[6]	TRUE/FALSE

Inputting and Editing

- You can enter the following expressions for check mode VERIFY.

  A. Equalities or inequalities involving a relational operator.

  $4 = \sqrt{16}$; $4 \neq 3$; $\pi > 3$; $1 + 2 \leq 5$; $(3 \times 6) < (2 + 6) \times 2$; etc.

  B. Equalities or inequalities involving multiple relational operator

  $1 \leq 1 < 1 + 1$; $3 < \pi < 4$; $2^2 = 2 + 2 = 4$; $2 + 2 = 4 < 6$; $2 + 3 = 5 \neq 2 + 5 = 8$; etc.
- The values and expressions you can input on the display are the same as those you can input in the COMP Mode.
- The expression entry is up to 99 bytes, including the left, the right side and the relational operators.
- Pressing the [SHIFT] [2] keys displays a menu of functions. Press the number key that corresponds to the function you want to input.

Key in	Display	
[SHIFT]	1: =	2: ≠
[2] (Verify)	3: >	4: <
	5: ≥	6: ≤

- In the expression with no relational operator, press [=], the system will automatically join "= 0" as the end of the expression.
- The following operations are not supported: [M+] [M−] [STO] [Pol(] [Rec(] and multi-statements also cannot be input with the VERIFY mode.
- The following expression type cause a Syntax ERROR:

  A. An expression with no end to the left or right (Example: $= 5\sqrt{7}$)

  B. An expression in which a relational operator is fraction or function (Example: $\frac{(1 = 1)}{2}$, cos (8 • 9))

  C. An expression in which relational operators are surrounded by parentheses. (Example: 8 < (9 < 10))

  D. An expression in which there are multiple relational operators which are not oriented in the same direction (Example: 5 ≤ 6 ≥ 4)

  E. An expression that contains two of the following relational operators in any combination (Example: 4 < 6 • 8)

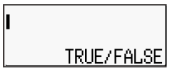
  F. An expression contains relational operators consecutive (Example: 5 ≥ > 4)

Example: To verify if 7 ÷ 9 < 14 ÷ 9 (TRUE)

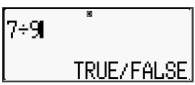
LINE

MODE

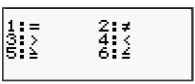
5 (VERIFY)



7 ÷ 9

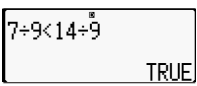


SHIFT 2 (VERIFY)



4 (<)

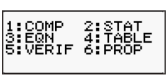
1 4 ÷ 9 =



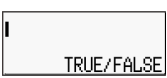
Example:

MATH

MODE

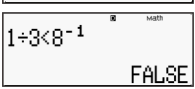


5 (VERIFY)



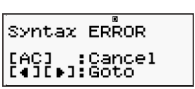
1 ÷ 3 SHIFT 2 (VERIFY) 4 (<)

8 x^{-1} =

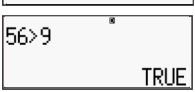


Example: Syntax ERROR - An expression with no end to the left or right.

SHIFT 2 (VERIFY) 3 (>) 9



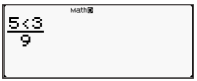
◀ 5 6 =



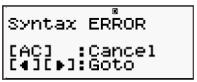
Example: Syntax ERROR - An expression in which a relationship operator is a fraction or function.

[5] [SHIFT] [2] (VERIFY)
[4] (<) [3] [►] [9] [=]

[◄]



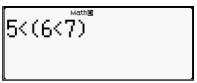
[DEL] [=]



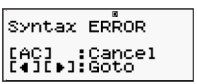
Example: Syntax ERROR - An expression in which relational operators are surrounded by parentheses.

[5] [SHIFT] [2] (VERIFY) [4] [(]

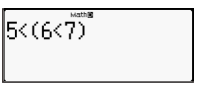
[6] [SHIFT] [2] (VERIFY) [4] (<) [7] [)]



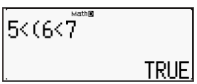
[=]



[◄]

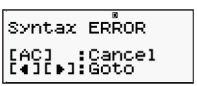


[►] [DEL] [=]

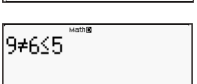


Example: Syntax ERROR.

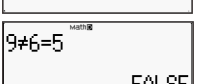
[9] [SHIFT] [2] (VERIFY) [2] (•) [6]
[SHIFT] [2] (VERIFY) [6] (≤) [5] [=]



[◄]



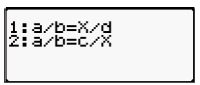
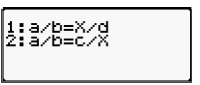
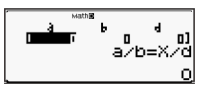
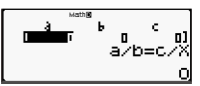
[►] [DEL] [SHIFT] [2] (VERIFY) [1] [=]



Proportion Calculations (PROP)

Use the key to enter the PROP mode when you want to solve a ratio expression.

In PROP mode, you can solve the value of X in the ratio expression.

	a/b = x/d	a/b = c/x
Key in	**Display**	**Display**
MODE		
6		
1 or 2		

Inputting and Editing Coefficients

- The PROP mode lets you determine the value of X in the ratio expression a/b = X/d (or a/b = c/X) when the values of a, b, c and d are known.
- Use the coefficient editor screen to input the coefficients of a ratio expression. The coefficient editor screen shows input cells for each of the coefficients required by the currently selected ratio expression type.
- Rules for inputting and editing coefficients
  - Data you input is inserted into the cell where the cursor is located. When you register input into a cell, the cursor moves to the next cell to the right.
  - The values and expressions you can input on the coefficient editor screen are the same as those you can input in the COMP mode with linear format.
  - Press AC while inputting data clears your current input.
  - After inputting data, press =. This registers the value and displays up to six of its digits in the currently selected cell.
  - To change the contents of a cell, use the cursor keys to move the cursor to the cell and then input the new data.
- You can clear all coefficients to zero by pressing the AC key while inputting values on the coefficient editor screen.

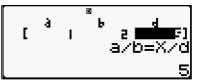
- The following operations are not supported by the coefficient editor: M+ M− STO Pol(Rec(and multi statements also cannot be input with the coefficient editor.

Example: 1:2 = X:5

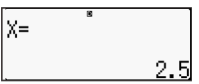
LINE

MODE 6 (PROP) 1

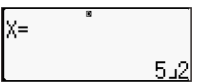
1 = 2 = 5 =



=



S⇔D

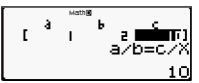


Example: 1:2 = 10:X

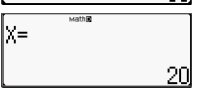
MATH

MODE 6 (PROP) 2

1 = 2 = 1 0 =



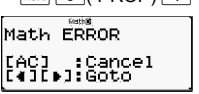
=



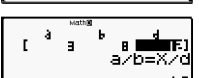
Example: 3:8 = X:12

MODE 6 (PROP) 1

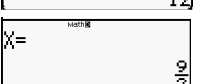
3 M+ = =



AC = 8 1 2 =



=

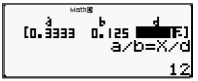


Example: $\frac{1}{3}:8^{-1} = X:12$

MATH

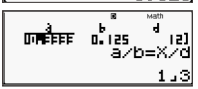
MODE 6 (PROP) 1

1 ▤ 3 = 8 x^{-1} = 1 2 =

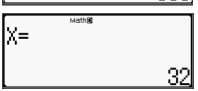


◄

◄



=



PROP Solution Display

- After inputting and registering values on the coefficient editor screen, press = to display the solution for the ratio expression.
- To return to the coefficient editor method:

  A. Pressing AC while a solution is displayed.

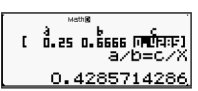
  B. Pressing = while the final solution is displayed.
- The display format of solutions is in accordance with the input/output format settings of the calculator's setup screen.
- You cannot transform values to engineering notation while a ratio expression solution is displayed.
- Press MODE 6 (PROP) and then select a ratio expression type form the menu that appears. Changing the ratio expression type causes the values of all coefficients to change to zero.
- A Math ERROR will occur if you perform a calculation with 0 as a coefficient.

Example:

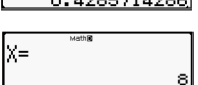
MATH

MODE 6 2 1 ÷ 4 =

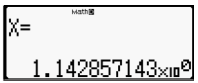
2 ÷ 3 = 3 ÷ 7 =



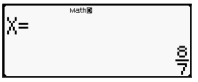
=



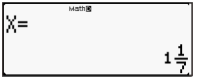
[ENG]



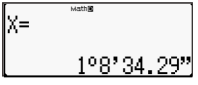
[S⇔D]



[SHIFT] [a b/c d/e]

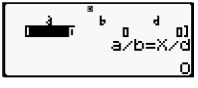


[°,,,]



[SHIFT] [SETUP] [2]

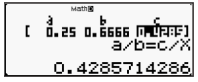
[SHIFT] [OFF] [ON] [MODE] [6] [1]



Example:

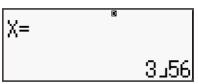
[LINE]

[MODE] [6] [1] [1] [÷] [4] [=]
[2] [÷] [3] [=] [7] [x^{-1}] [=]

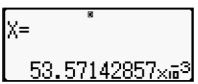


[◄] [S⇔D]

[=]



[ENG]



Technical Information

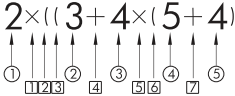
Order of Operations

The calculator performs calculations from left to right and in the following order of sequence:

1. Expression within the parentheses.
2. Functions with parentheses:
   Pol(, Rec(, GCD(, LCM(, sin(, cos(, tan(, $\sin^{-1}$(, $\cos^{-1}$(, $\tan^{-1}$(, sinh(, cosh(, tanh(, $\sinh^{-1}$(, $\cosh^{-1}$(, $\tanh^{-1}$(, log(, ln(, Rnd(, Int(, IntG(
3. Functions preceded by values, powers, power roots, for example: x^2, x^3, x^{-1}, x!, °’”, °, r, g, x^y, x•., %, •, 3•, 10^x, e^x, Abs
4. Fractions: a b/c
5. Prefix symbol: (-) (negative sign)
6. Statistical estimated value calculation: x^, y^, 1x^, 2x^.
   Metric conversion commands (cm▶in, etc.),
7. Multiplication where sign is omitted.
8. ${}_nP_r$, ${}_nC_r$
9. ×, ÷, ÷R
10. +, -

Stack Limitations

This calculator uses memory areas called stacks to temporarily store lower calculation priority sequence values, commands, and functions. The numeric stack has 10 levels and the command stack has 24 levels, as shown in the illustration below.



Numeric Stack

(1)	2
(2)	3
(3)	4
(4)	5
(5)	4
⋮	

Command Stack

(1)	×
(2)	(
(3)	(
(4)	+
(5)	×
(6)	(
(7)	+
⋮	

A Stack ERROR occurs when the calculation you are performing causes the capacity of either stack to be exceeded.

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 $\pm 9.9999999 \times 10^{-99}$ 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	
$\sin x$	DEG	$0 \leqq \lvert x \rvert < 9 \times 10^{9}$
	RAD	$0 \leqq \lvert x \rvert < 157079632.7$
	GRA	$0 \leqq \lvert x \rvert < 1 \times 10^{10}$

$\cos x$	DEG	$0 \leqq \lvert x \rvert < 9 \times 10^{9}$
	RAD	$0 \leqq \lvert x \rvert < 157079632.7$
	GRA	$0 \leqq \lvert x \rvert < 1 \times 10^{10}$
$\tan x$	DEG	Same as $\sin x$, except when $\lvert x \rvert = (2n-1) \times 90$
	GRA	Same as $\sin x$, except when $\lvert x \rvert = (2n-1) \times \frac{\pi}{2}$
	RAD	Same as $\sin x$, except when $\lvert x \rvert = (2n-1) \times 100$
$\sin^{-1} x$	$0 \leqq \lvert x \rvert \leqq 1$	
$\cos^{-1} x$		
$\tan^{-1} x$	$0 \leqq \lvert x \rvert \leqq 9.999999999 \times 10^{99}$	
$\sinh x$	$0 \leqq \lvert x \rvert \leqq 230.2585092$	
$\cosh x$		
$\sinh^{-1} x$	$0 \leqq \lvert x \rvert \leqq 4.999999999 \times 10^{99}$	
$\cosh^{-1} x$	$0 \leqq x \leqq 4.999999999 \times 10^{99}$	
$\tanh x$	$0 \leqq \lvert x \rvert \leqq 9.999999999 \times 10^{99}$	
$\tanh^{-1} x$	$0 \leqq \lvert x \rvert \leqq 4.999999999 \times 10^{-1}$	
$\mathrm{Log}\, x / \ln x$	$0 < \lvert x \rvert \leqq 9.999999999 \times 10^{99}$	
10^{x}	$-9.999999999 \times 10^{99} \leqq x \leqq 99.999999999$	
e^{x}	$-9.999999999 \times 10^{99} \leqq x \leqq 230.2585092$	
$\sqrt{x}$	$0 \leqq x < 1 \times 10^{100}$	
x^{2}	$\lvert x \rvert < 1 \times 10^{50}$	
$1/x$	$\lvert x \rvert < 1 \times 10^{100}$; $x \neq 0$	

$\sqrt[3]{x}$	$\lvert x\rvert < 1 \times 10^{10}$
$x!$	$0 \leqq x \leqq 69$ (x is an integer)
${}_nP_r$	$0 \leqq n < 1 \times 10^{10}$, $0 \leqq r \leqq n$ (n, r are integers) $1 \leqq \{n!/(n-r)!\} < 1 \times 10^{100}$
${}_nC_r$	$0 \leqq n < 1 \times 10^{10}$, $0 \leqq r \leqq n$ (n, r are integers) $1 \leqq [n!/\{r!(n-r)!\}] < 1 \times 10^{100}$
Pol(x, y)	$\lvert x\rvert$, $\lvert y\rvert \leqq 9.999999999 \times 10^{49}$ $(x^2 + y^2) \leqq 9.999999999 \times 10^{99}$
Rec(r, θ)	$0 \leqq r \leqq 9.999999999 \times 10^{99}$ θ : Same as for $\sin x$
° ’ ” ←	$\lvert a\rvert$, b, c$< 1 \times 10^{100}$ $0 \leqq$ b,c
° ’ ”	$\lvert x\rvert < 1 \times 10^{100}$ Decimal ↔ Sexagesimal Conversions $0° 0' 0" \leqq \lvert x\rvert \leqq 999999°59'59"$
$\wedge(x^y)$	$x > 0$; $-1 \times 10^{100} < y \log x < 100$ $x = 0$; $y > 0$ $x < 0 : y = n$, $\frac{m}{2n+1}$ (m, n are integers) However, $-1 \times 10^{100} < 1/y \log \lvert x\rvert < 100$
$\sqrt[x]{y}$	$y > 0 : x \neq 0$, $-1 \times 10^{100} < 1/x \log y < 100$ $y = 0$; $x > 0$ $y < 0$; $x = 2n+1$, $\frac{2n+1}{m}$ ($m \neq 0$, m, n are integers) However, $-1 \times 10^{100} < 1/x \log \lvert y\rvert < 100$
a b/c	The total number of integer, numerator, and denominator digits must be 10 or less (including division marks)
GCD	$-1 \times 10^{10} < x < 1 \times 10^{10}$ $-1 \times 10^{10} < y < 1 \times 10^{10}$

LCM	$0 \leqq \lvert x \rvert < 1 \times 10^{10}$ $0 \leqq \lvert y \rvert < 1 \times 10^{10}$
Simp	$1 \leqq n \leqq 9999$ (n is an integer)
RanInt#(a,b)	$a < b$, $\lvert a \rvert$ $\lvert b \rvert < 1 \times 10^{10}$, $b-a < 1 \times 10^{10}$

- Precision is basically the same as that described under "Calculation Range and Precision," above.
- $\wedge(x^y)$, $\sqrt[x]{y}$, $\sqrt[3]{\ }$, $x!$, ${}_nP_r$, ${}_nC_r$ 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.

Error Messages

The calculator will display an error message when a result exceeds the calculation range, when you attempt an illegal input, or whenever any other similar problem occurs.

When an Error Message Appears

The following are general operations you can use when any error message appears.

- Pressing [◄] or [►] displays to the calculation expression editing screen you were using before the error message appeared, with the cursor located at the position of error. For more information see "Displaying the Location of an Error."
- Pressing [AC] clears the calculation expression you were using before the error message appeared, You can then re-input and re-execute the calculation, if you want. Note that in this case, the original calculation will not be retained in calculation history memory.

Math Error

Cause

- The intermediate or final result of the calculation you are performing exceeds the allowable calculations 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.

Insufficient MEM Error

Cause

- There is not enough memory to perform your calculation.

Action

- Narrow the table calculation range by changing the Start, End, and Step values, and try again.

Before assuming malfunction of the calculator

Perform the following steps whenever an error occurs during a calculation or when calculation 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 that 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 "Initializing the Calculation Mode and Other Calculator Setup."

(4) Initialize all modes and settings by performing the following operations:

SHIFT 9 (CLR) 1 (Setup) = (Yes).

Reference

Power Requirements and Battery Replacement

This calculator is powered by solar with a battery (LR44) backup.

Replacing the Battery

Dim figures on the display of the calculator indicate that battery power is low. Continued use of the calculator when the battery is low can result in improper operation. Replace the battery as soon as possible when display figures becomes dim. Even if the calculator is operating normally, replace the battery at least once every two years,

Important: Removing the battery from the calculator causes independent memory contents and values assigned to variables to be cleared.

1) Press SHIFT AC (OFF)

2) Remove the battery cover.

3) Load a new battery into the calculator with its positive [+] and negative [−] ends facing correctly.
4) Replace the battery cover.
5) Perform the following key operation:
[ON] [SHIFT] [9] (CLR) [3] (All) [=] (Yes).

Make sure to perform the key operation.

Auto Power Off

Your calculator will turn off automatically if you do not perform any operation for about eight minutes. If this happens, press the [ON] key to turn the calculator back on.

Specifications

Power Requirements:

Battery: LR44

1 year (when used 1 hr/day)

Operating Temperature: 0°C to 40°C

Bundled Items: Hard Case

Regulatory Notices

European Union Regulatory Notice

Products bearing the CE marking comply with the following EU Directives:

- Low Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC
- Ecodesign Directive 2009/125/EC, where applicable
- RoHS Directive 2011/65/EU

CE compliance of this product is valid if powered with the correct CE-marked AC adapter provided by HP.

Compliance with these directives implies conformity to applicable harmonized European standards (European Norms) that are listed in the EU Declaration of Conformity issued by HP for this product or product family and available (in English only) either within the product documentation or at the following web site: www.hp.eu/certificates (type the product number in the search field).

The compliance is indicated by one of the following conformity markings placed on the product:

Please refer to the regulatory label provided on the product.

The point of contact for regulatory matters is:

Hewlett-Packard GmbH, Dept./MS: HQ-TRE, Herrenberger Strasse 140, 71034 Boeblingen, GERMANY.

Japanese Notice

この装置は，クラスB情報技術装置です。この装置は，家庭環境で使用することを目的としていますが，この装置がラジオやテレビジョン受信機に近接して使用されると，受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。　　VCCI－B

Korean Notice Class B

B급 기기 (가정용 방송통신기기)	이 기기는 가정용(B급)으로 전자파적합등록을 한 기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모든 지역에서 사용할 수 있습니다.

Perchlorate Material – special handling may apply

This calculator's Memory Backup battery may contain perchlorate and may require special handling when recycled or disposed in California.

Disposal of Waste Equipment by Users in Private Household in the European Union

This symbol means do not dispose of your product with your other household waste. Instead, you should protect human health and the environment by handing over your waste equipment to a designated collection point for the recycling of waste electrical and electronic equipment. For more information, please contact your household waste disposal service or go to http://www.hp.com/recycle.

Chemical Substances

HP is committed to providing our customers with information about the chemical substances in our products as needed to comply with legal requirements such as REACH (Regulation EC No 1907/2006 of the European Parliament and the Council). A chemical information report for this product can be found at: www.hp.com/go/reach.

China RoHS

产品中有毒有害物质或元素的名称及含量

根据中国《电子信息产品污染控制管理办法》

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCA	X	O	O	O	O	O
外壳和电缆	O	O	O	O	O	O

O：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T 11363-2006 标准规定的限量要求以下。

X：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T 11363-2006 标准规定的限量要求。

表中标有"X"的所有部件都符合欧盟RoHS法规

"欧洲议会和欧盟理事会2003年1月27日关于电子电器设备中限制使用某些有害物质的2002/95/EC号指令"

注：环保使用期限的参考标识取决于产品正常工作的温度和湿度等条件