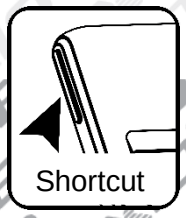
User's Guide

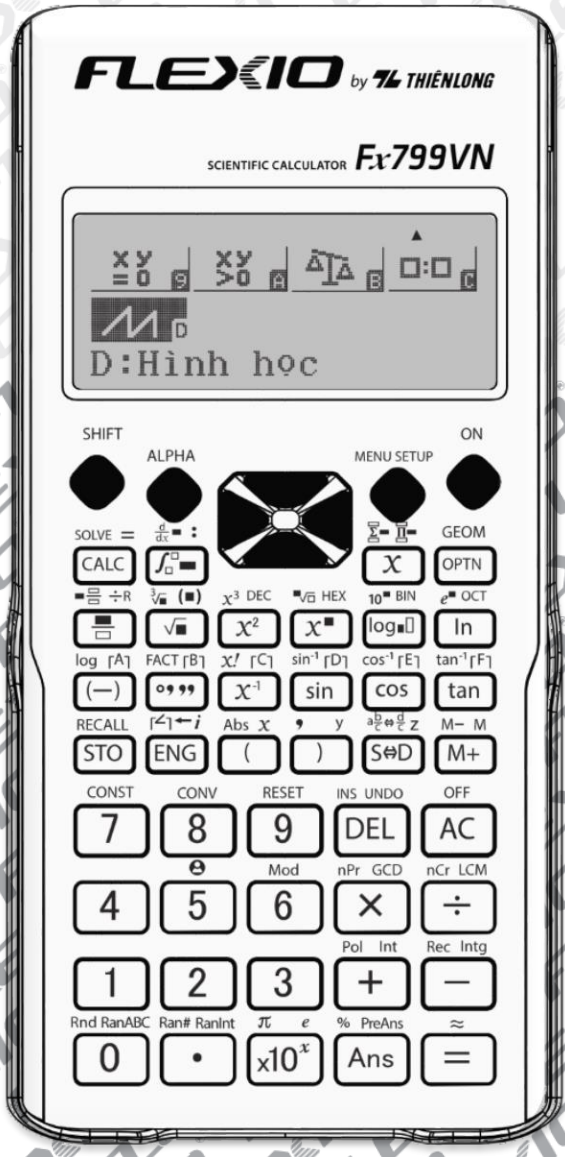
Calculator *Fx799VN*



529

+17

Functions



Visit the website for more product information:
https://baohanh.thienlong.vn/

Table of Contents

🕮 SETTING LANGUAGE

Set the language of calculator for menus and messages.

Select	Key press operations
Vietnamese Language	SHIFT MENU (SETUP) ▲ 1 (Language) 1 (Vietnamese)
English Language	SHIFT MENU (SETUP) ▲ 1 (Language) 2 (English)

🕮 INFORMATION TO NOTE

- The images used in this User Guide are for illustration purposes only to make it easier for users to use.
- The examples will be performed and calculated in default mode.
- In case the calculation mode is specifically mentioned, follow that mode.
- When not specifically mentioned, examples are calculated by default mode.

🕮 WARNING INFORMATION

- You should replace your calculator battery at least every 2 years, even when the calculator is still operating normally, to avoid the battery leaking and affecting the calculator.
- Your calculator's battery may discharge during transport and storage, so you may need to replace the battery sooner than the battery's normal lifespan.

🕮 THE BATTERY

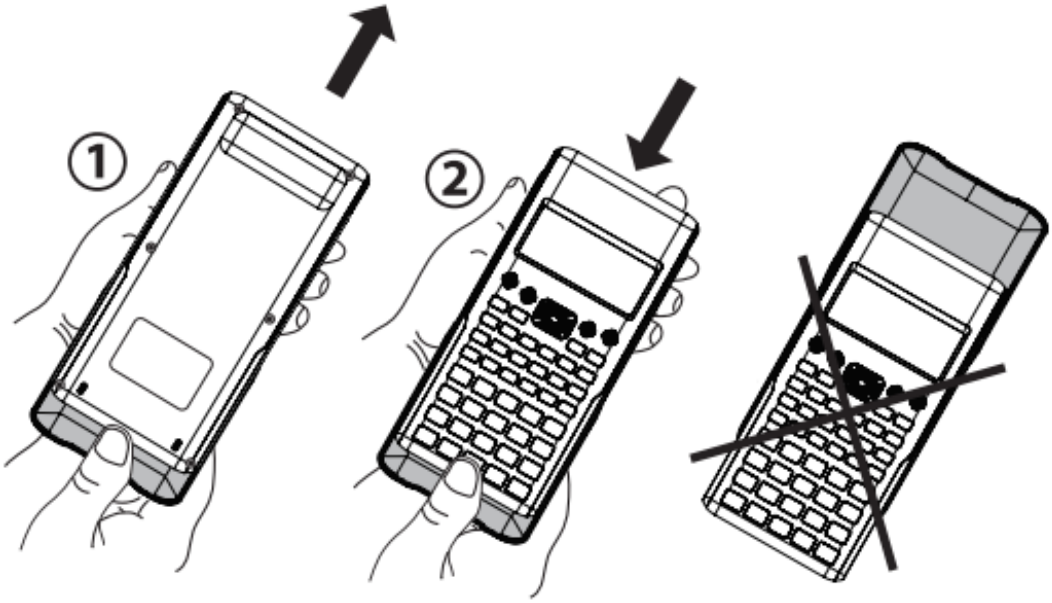
- Use only batteries recommended in the specifications in this User Guide.
- Follow the regulations of your area when disposing of batteries or calculators.
- Do not use and store the calculator in environments with humidity, too high/too low temperatures, or dusty environments.
- Do not let the calculator fall or be crushed by heavy objects, causing damage.
- Use a soft, not damp cloth to clean your calculator.

🕮 START USING THE CALCULATOR

Instructions for opening the calculator

- Before using the calculator, remove the lid by sliding the device in the direction of the arrow as shown in picture 1. Then turn the calculator upside down and insert the calculator into the lid in the correct direction as shown

in picture.



Turn on and off the power

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

Note

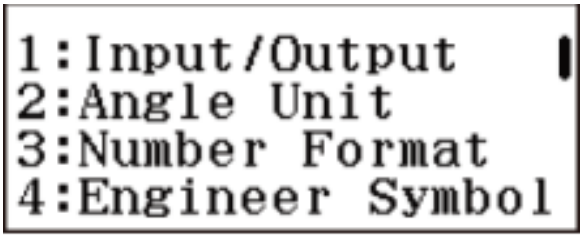
- The calculator will automatically turn off after about 7-10 minutes of non-use.
- Press the [ON] key to turn the calculator back on

Adjust screen contrast.

Press steps:

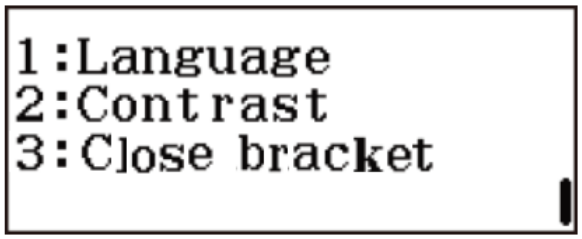
Step 1. Press [SHIFT] [MENU] (SETUP)

- Displays the settings menu:

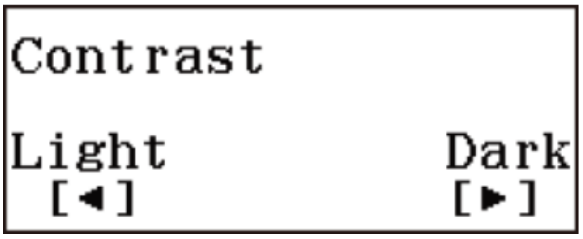


Step 2. Press [▲]

Step 3. Press [2] (Contrast)



- The screen adjusts the contrast mode.



Step 4. Use the ◄ and ► keys to adjust the contrast mode

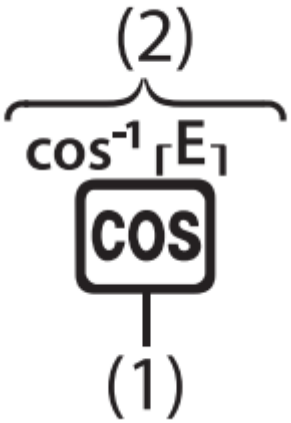
Step 5. After completing the installation, press [AC] [•]

Note

After adjusting the contrast mode, if the screen still displays dimly, the calculator's battery may be low. Please replace the battery as soon as possible.

Use Sub-function keys

Press [SHIFT] or [ALPHA], then press the key with the secondary function to use. Secondary functions are printed above the keys.



1_Main function

2_Secondary function

- Instruction sheet for Sub-functions:

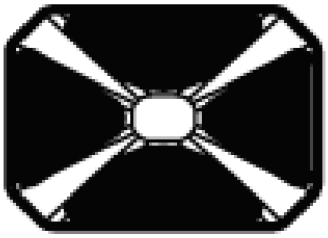
Font color, symbols	Explain

Yellow (or color according to the SHIFT character)	To use the yellow sub-functions, press the SHIFT key first, then press the function key to use
Red (or color according to the ALPHA character)	To use the red sub-functions, press the ALPHA key first, then press the function key to use.
Purple (or enclosed in purple parentheses)	These functions can only be used in complex number mode.
Blue (or blue parenthesis)	These functions are only available in Base-N mode.

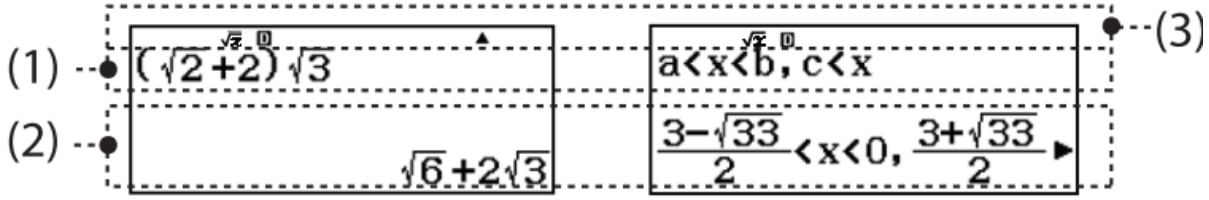
For example: SHIFT COS (Cos^{-1*}) 1 =

(* is the operation using the function (Cos^{-1}).

- The navigation keys in this manual are represented by the corresponding arrow icons as shown below.

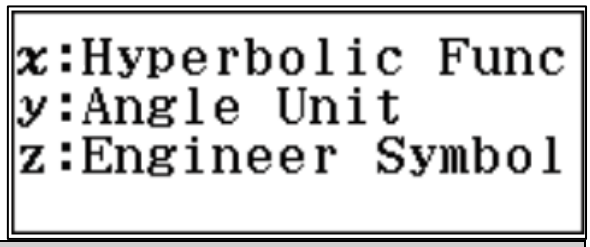


The reading content displayed on the screen:



1_Input expression
2_Calculation results
3_Notification icons

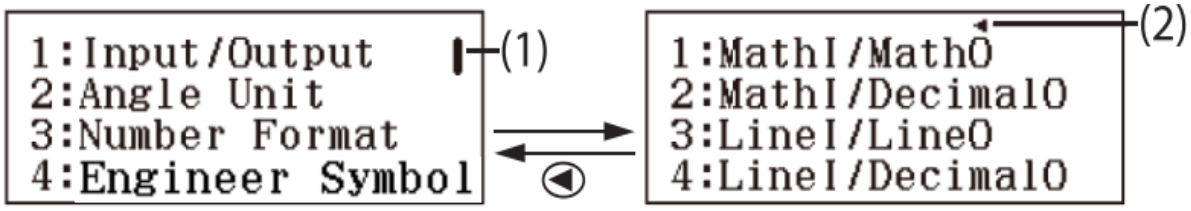
If it symbolizes or appears to the right of the input expression line (1) or calculation result line (2) meaning that the input expression or calculation result content continues to the right. Use the ◀ and ▶To scroll the result line:



Symbols	Explain
S	This icon will appear when the key SHIFT is pressed
D/R/G	Indicates the unit of Angle unit (D: Degree, R: Radian, or G: Gradian) on the settings menu.
A	This icon will be displayed when the key ALPHA is pressed. ALPHA input mode will turn off and the icon will disappear when you press this key.
FIX	Select the number of digits after the comma.
SCI	Select the total number of digits to display.
M	Store values in independent memory.
	This symbol will appear when the key STO is pressed.
	This symbol will appear when the calculator is in MathI/MathO or MathI/DecimalO mode.
	The screen is showing the results of a calculation combining multiple expressions.
	Low battery indicator icon.

Use menus

- Use the menu by pressing OPTN or SHIFT MENU (SETUP)
- Press OPTN to display the options screen. The options screen displays the functions used in calculations. The functions listed on the options screen will depend on the calculation modes.
- At the menu screen, to select any feature, press the letter or letter representing that feature.

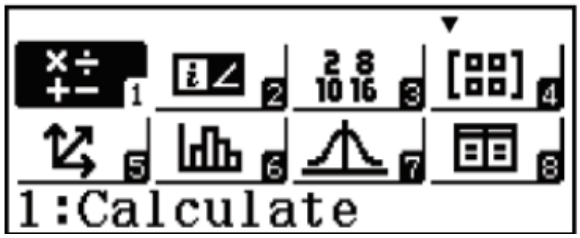


(1) Vertical scroll bar, when the menu screen appears the meaningful vertical scroll bar still has many functions below.

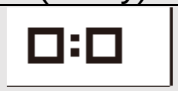
(2) This icon indicates that the screen being displayed is a sub-menu screen. Press ◀) to return to the main menu screen.

🕮 CALCULATION MODES

Below is a table of major calculation modes of the calculator:



Symbols	Explain
(Calculate)	Calculation mode.
(Complex)	Complex number mode.
(Base - N)	Base-N mode.
(Matrix)	Matrix mode.
(Vector)	Vector mode.
(Statistics)	Statistical and Regression mode.
(Distribution)	Distribution mode.
(Table)	Creating a Number Table mode.
(Equation/Func)	Equation/System of Equations mode.
	Inequality solving mode.

(Inequality)	
 (Verify)	Verify the Correctness of the Expression mode
 (Ratio)	Ratio mode.
 (Geometry)	Calculation geometry mode

Select calculation mode and perform the following steps:

1. Press [MENU] to input the menu screen.
2. Use the navigation keys to move the cursor to the function you need to use.
3. Press [=] to enter calculation mode.'

Note

- In addition, to quickly access the calculation mode, we go to the menu screen and then press the number or letter of the mode we need to access.
- The default calculation mode is Calculate mode.

🕮 CONFIGURING THE CALCULATOR SETUP

Press [SHIFT] [MENU] (SETUP) to access advanced settings for the display of input expressions, calculation results and calculation modes.

1. Press [SHIFT] [MENU] (SETUP) to display the settings menu
2. Press ▲ or ▼ to scroll the screen. Press the number or letter to select the setting to be adjusted.

Optional available items and settings.

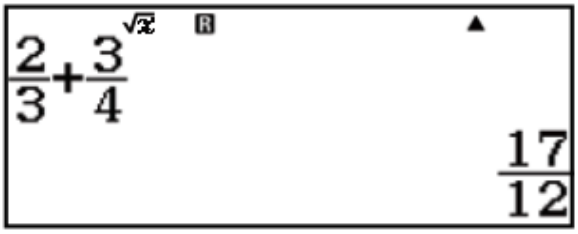
"º" The modes, Function with this symbol are the default modes and function when the device is turned on.

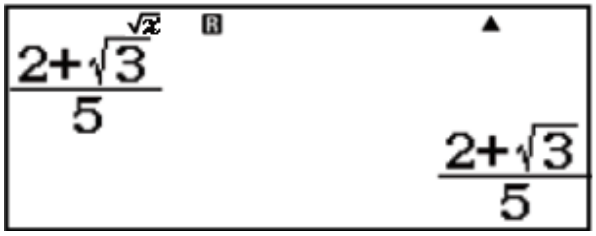
Input/ Output

Types of data input/ Output	Key press operations
The input expression is l the same as a textbook, the result is a fraction	[ALPHA] [MENU] (STEUP) [1] (Input/Output) [1] (Mathl/MathO)
The input expression is the same as a textbook, the result is a decimal number	[ALPHA] [MENU] (STEUP) [1] (Input/Output) [2] (Mathl/DecimalO)

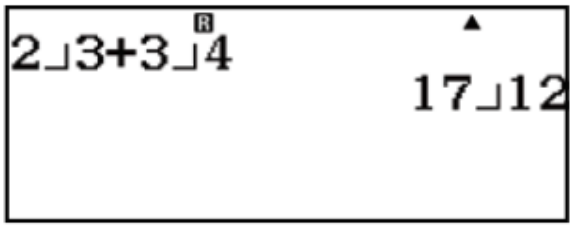
Input expression as line, result as decimal number or fraction.	ALPHA MENU (STEUP) 1 (Input/Output) 3 (Linel/LineO)
Input expression as line, result as decimal number.	ALPHA MENU (STEUP) 1 (Input/Output) 4 (Linel/DecimalO)

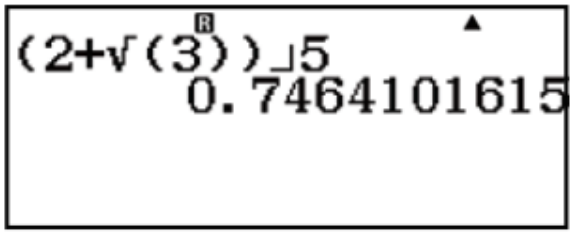
Below are examples of data import and export types:
MathI/MathO



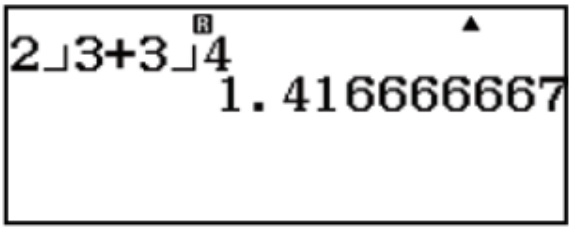


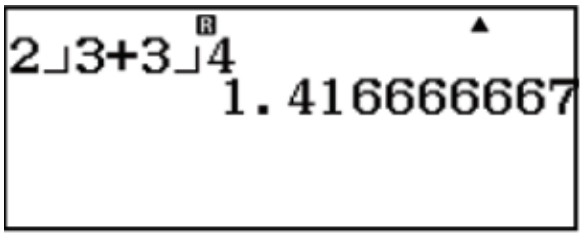
MathI/DecimalO



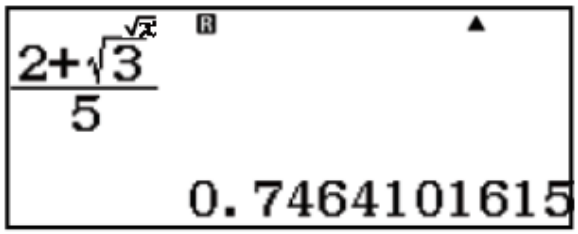


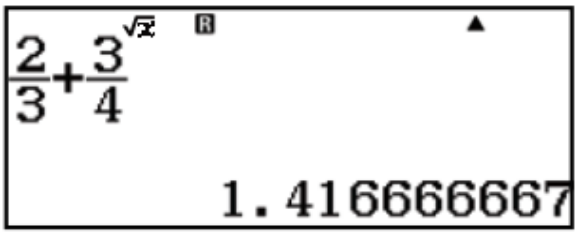
Linel/LineO





Linel/DecimalO





Angular unit

There are 3 angle units. To set the angle unit when calculating, do the following:

Select	Key press operations

Degree	ALPHA MENU (SETUP) 2 (Angle Unit) 1 (Degree)
Radians	ALPHA MENU (SETUP) 2 (Angle Unit) 2 (Radian)
Grads	ALPHA MENU (SETUP) 2 (Angle Unit) 3 (Gradian)

$90^0 = \pi/2$ radians = 100 grads

Number format

Select the number of digits displayed after the "**.**" Mark:

Select	Key press operations
Number of decimal places_Fix	SHIFT MENU (SETUP) 3 (Number Format) 1 (Fix) 0 - 9
Number of significant digits_Sci	SHIFT MENU (SETUP) 3 (Number Format) 2 (Sci) 0 - 9
Exponential display range_Norm	SHIFT MENU (SETUP) 3 (Number Format) 3 (Norm) 1 (Norm1) or 2 (Norm 2)

- Fix: The value you specify (from 0 to 9) controls the number of decimal places for displayed calculation results. Calculation results are rounded off to the specified digit before being displayed.

Example: 200 ÷ SHIFT 9 = (≈) 22.222 (Fix 3)

22.22 (Fix 2)

- Sci: The value you specify (from 1 to 10) controls the number of significant digits for displayed calculation results. Calculation results are rounded off to the specified digit before being displayed.

Example: 1 ÷ 9 SHIFT = (≈) 1.1111×10^{-1} (Sci 5)

1.111×10^{-1} (Sci 4)

- Norm: Select one of the two available settings (Norm 1, Norm2). Displays calculation results in exponential format when they fall within the ranges below.

  Norm 1: $10^{-2} > |x|, |x| \geq 10^{10}$, Norm 2: $10 - 9 > |x|, |x| \geq 1010$

Example: 1 ÷ 400 SHIFT = (≈) 2.5×10^{-3}

0.0025

Engineer symbols

Specifies whether or not to display calculation results using engineering symbols.

Select	Key press operations
Use Engineer symbols.	SHIFT MENU (SETUP) 4 (Engineer Symbol) 1 (On)
Don't use Engineer symbols.	SHIFT MENU (SETUP) 4 (Engineer Symbol) 2 (Off)

Note

- An indicator (E) is displayed at the top of the screen while 'On' is selected for this setting.

Fraction results

Set results to display as Fractions or Mixed Fraction:

Select	Key press operations
Mixed Fraction	SHIFT MENU (SETUP) ▼ 1 (Fraction Result) 1 (ab/c)
Fraction	SHIFT MENU (SETUP) ▼ 1 (Fraction Result) 2 (d/c)

Complex result

Set the display format for Complex number calculation results in rectangular coordinates or polar coordinates.

Select	Key press operations
Rectangular coordinates	SHIFT MENU (SETUP) ▼ 2 (Complex) 1 ($a+bi$)
Polar coordinates	SHIFT MENU (SETUP) ▼ 2 (Complex) 2 ($r\angle\theta$)

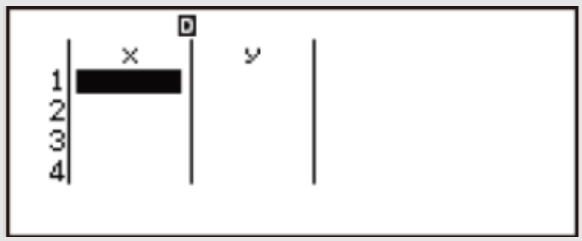
Note

- An "***i***" indicator is displayed at the top of the screen while ($a+bi$) is selected for the Complex Result setting. ∠ is displayed while ($r\angle\theta$) is selected.

Statistical

Set the frequency column On/Off in the statistics table.

Select	Key press operations
Displays the frequency column	SHIFT MENU (SETUP) ▼ 3 (Statistics) 1 (On)

	
Hide the frequency column	SHIFT MENU (SETUP) ▼ 3 (Statistics) 2 (Off) 

Equation/Func (Equation/system of equations)

Set to use complex number results/ impossible equation when solving equations/systems of equations.

Select	Key press operations
Use complex numbers	SHIFT MENU (SETUP) ▼ 4 (Equation/Func) 1 (On)
Don't use complex numbers	SHIFT MENU (SETUP) ▼ 4 (Equation/Func) 1 (On)

Value table

Set to use only $f(x)$ function or use both $f(x)$ and $g(x)$ function in Table mode.

Select	Key press operations
Use only the $f(x)$ function	SHIFT MENU (SETUP) ▼ ▼ 1 (Table) 1 (f(x))
Use both $f(x)$ and $g(x)$ functions.	SHIFT MENU (SETUP) ▼ ▼ 1 (Table) 2 (f(x), g(x))

Recurring decimal

Set use recurring decimal numbers in calculation results.

Select	Keys press operations

Use repeating decimal format	SHIFT MENU (SETUP) ▼ ▼ 2 (Recurring Dec) 1 (On)
Don't use recurring decimals format	SHIFT MENU (SETUP) ▼ ▼ 2 (Recurring Dec) 2 (Off)

Decimal mark

Set whether to use periods or commas for decimal point in calculation results.

Select	Key press operations
Dots (.)	SHIFT MENU (SETUP) ▼ ▼ 3 (Decimal Mark) 1 (Dot)
Comma (,)	SHIFT MENU (SETUP) ▼ ▼ 3 (Decimal Mark) 2 (Comma)

Note

- When the dot is selected as the decimal mark. The separator for multiple results is a comma (**,**). When comma is selected, the separator will be a semi-colon (**;**).

Digit separator

Set to use three-digit separator marks in calculation results.

Select	Key press operations
Use a three-digit separator	SHIFT MENU (SETUP) ▼ ▼ 4 (Digit separator) 1 (On)
Don't use three-digit separator	SHIFT MENU (SETUP) ▼ ▼ 4 (Digit separator) 2 (Off)

Auto-close bracket

Select	Key press operations
Use the auto-close bracket function	SHIFT MENU (SETUP) ▲ 3 (Close bracket) 1 (On)
Don't use the auto-close bracket function.	SHIFT MENU (SETUP) ▲ 3 (Close bracket) 2 (Off)

Set calculation and display methods

To restore the format default settings (except screen contrast and language), do the following: SHIFT 9 (RESET) 1 (Setup Data) = (Yes)

Formats	Default settings
Calculation method	Calculate
Input/output	MathI/MathO
Angle unit	Degree
Number Format	Norm 1
Engineer Symbol	Off
Fraction Result	D/c
Complex	$(a + bi)$
Statistics	Off
Equation/Func	On
Table	$f(x), g(x)$
Recurring Dec	On
Decimal mark	Dot
Digit Separator	Off
Close bracket	Off

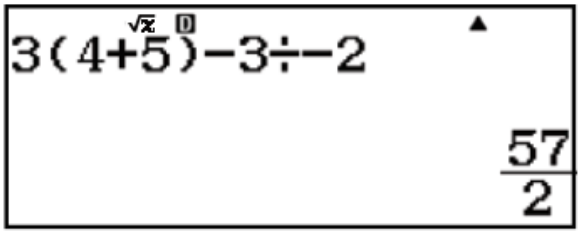
🕮 INPUT EXPRESSIONS AND VALUES

Input calculation expression

The calculator allows inputting expressions in a form similar to a text-book.

For example: $3(4 + 5) - 3 \div (-2) =$

[3] [(] [4] [+] [5] [)] [−] [3] [÷] [−] [2] [=]



Note

- Normally, the cursor shape is a straight **(I)** or horizontal line **(-)** that flashes on the display screen.
- When you run out of character input, the cursor will change shape to (■) to let you know. If a cursor (■) appears, end the expression at an appropriate position and calculate the result.

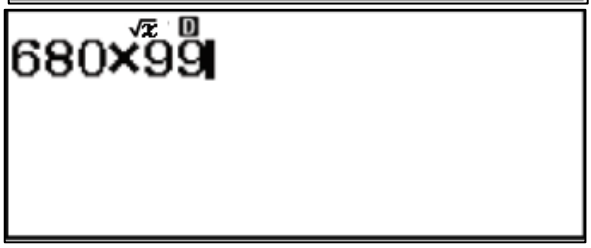
For example:

+ To change the expression 680x98 to 680x99:

[6] [8] [0] [×] [9] [8]

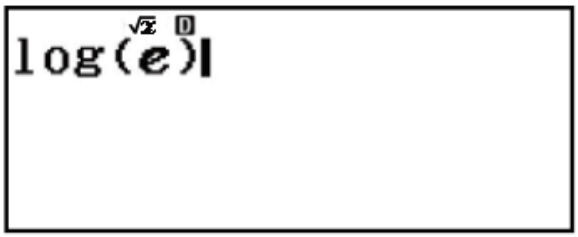
[DEL]

[9]

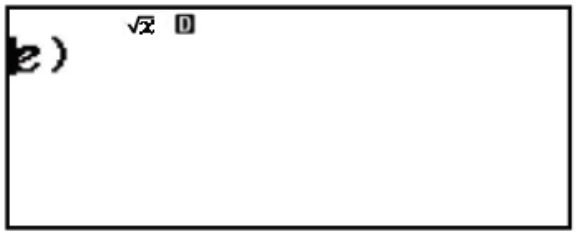


+ To change the expression log(e) to ln(e).

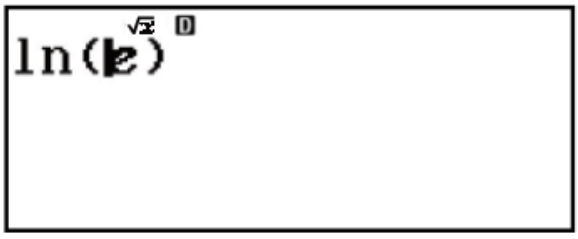
[SHIFT] [(−)] [ALPHA] [×10^x] [)]



[◀] [◀] [DEL]



[ln]



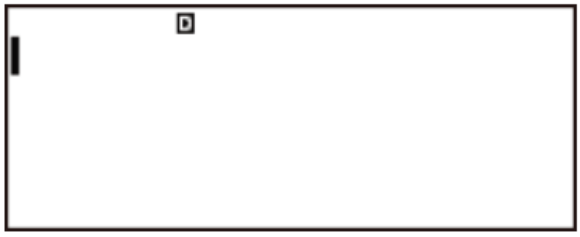
Delete all currently imported calculations

Press [AC]

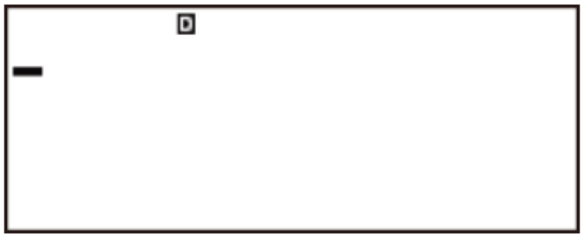
Insert/Overwrite

This function allows us to insert or overwrite part of the content of an input expression.

To use this functions we do the following: SHIFT DEL(INS). The cursor will appear in the shape **(I)**. In the insert method and in the cursor will appear in the shape **(-)** the Overwrite method. (Linel/LineO or Linel/DecimalO).

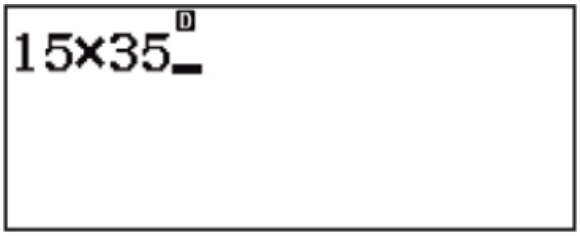


ALPHA DEL(INS)

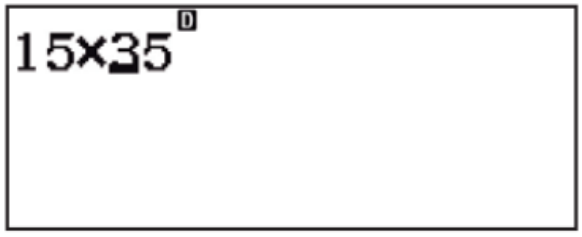


Example 1: To change the expression 15 x 35 to 15 x 5.

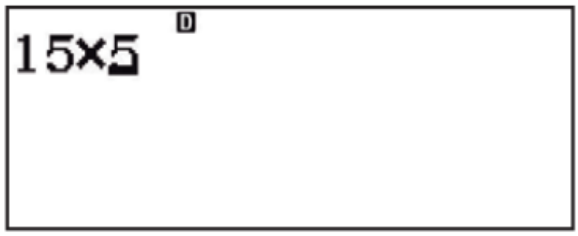
1 5 × 3 5



◀◀

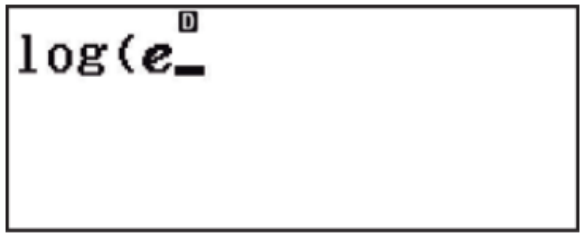


DEL

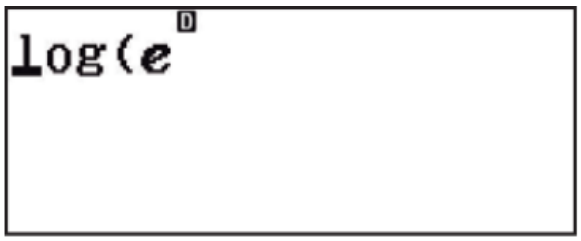


Example: Change the expression log(e) to ln(e).

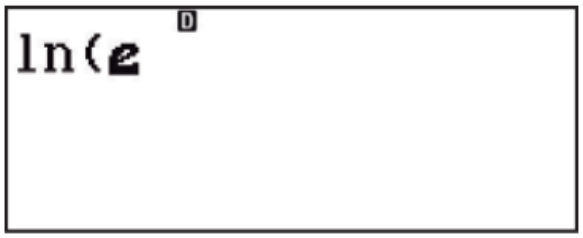
log ALPHA ×10^x



◀◀



ln



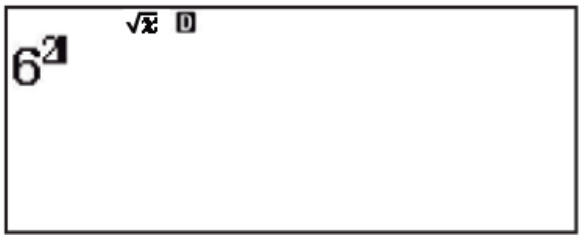
🕮 ENTER THE CALCULATION EXPRESSION IN TEXTBOOK FORMAT

In Mathl/MathO modes and Mathl/DecimalO expressions containing have √, fractions and simple functions can be input in a presentation format similar to a textbook.

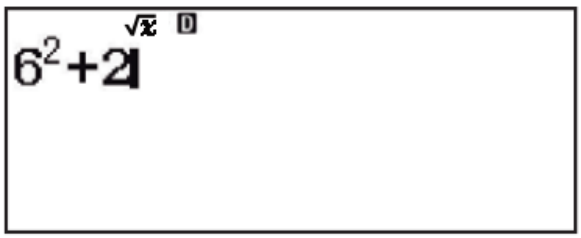
For example:

+ Input $6^2 + 2$.

6 $x^{\blacksquare}$ 2

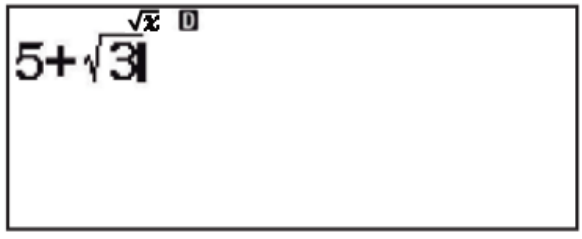


▶ + 2

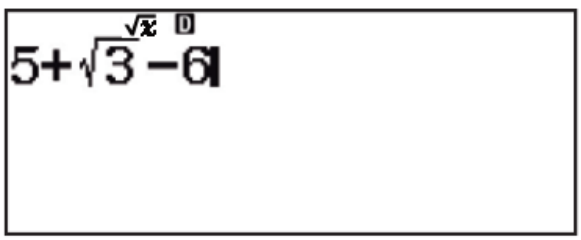


+ Input $5 + \sqrt{3} - 6$

5 + √ 3

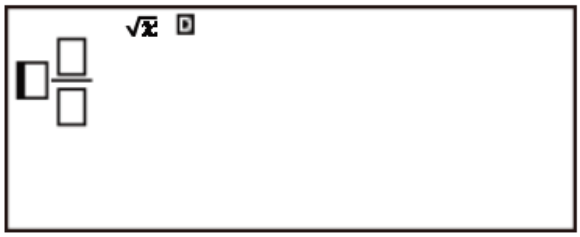


▶ − 6

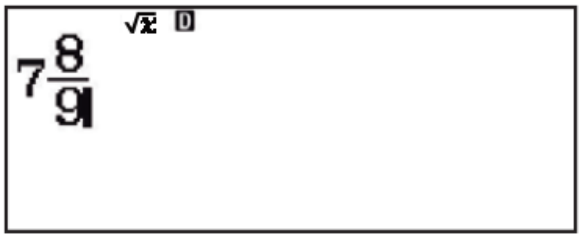


+ Input $7\frac{8}{9}+1\frac{2}{3}$

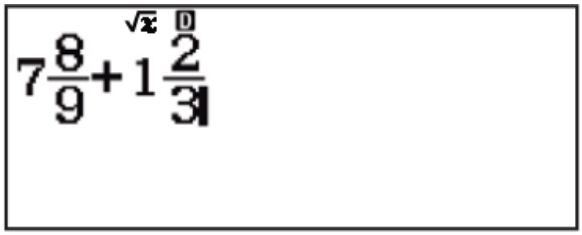
[SHIFT] [▤]



[7] [▶] [8] [▶] [9]

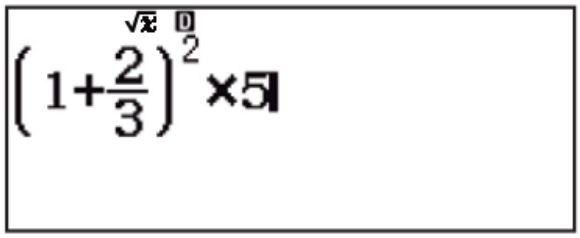


[▶] [+] [SHIFT] [▤] [1] [▶] [2] [▶] [3]



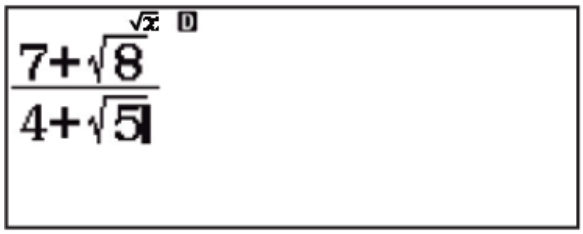
+ Input $\left(1+\frac{2}{3}\right)^2\times 5$

[(] [1] [+] [▤] [2] [▼] [3] [▶] [)] [x^2]
[2] [×] [5]



+ Input $\frac{7+\sqrt{8}}{4+\sqrt{5}}$

[▤] [7] [+] [√] [8] [▼] [4] [+] [√] [5]



UNDO

To Undo the last key action, press [ALPHA] [DEL] (UNDO). To undo a key action you just undone, press [ALPHA] [DEL] (UNDO) once again.

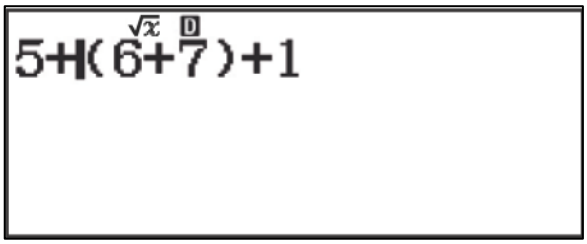
Combine the value into the function

When using textbook format, we can insert part of expression (value, expression in parentheses, etc.) into the function.

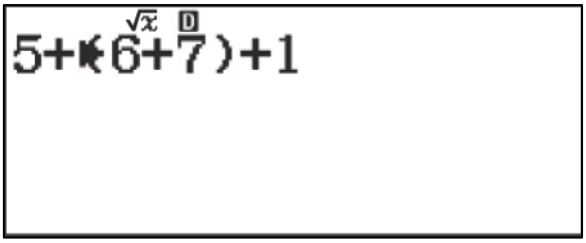
For example: To insert an expression in parentheses of the calculation $5 + (6 + 7) + 1$ into the function $\sqrt{}$.

5 + (6 + 7) + 1

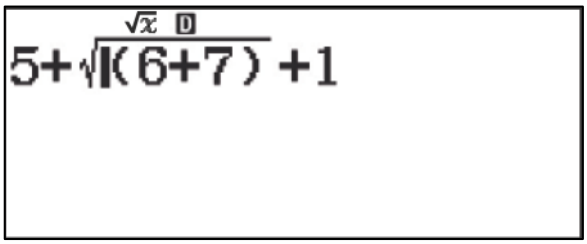
▶ ▶ ▶



SHIFT DEL



√



🕮 DISPLAY RESULTS AS IRRATIONAL NUMBERS

The Calculator will display the results as irrational numbers in Mathl/MathO mode.

Press = after inputting a calculation displays the result as an irrational number.

Press SHIFT = (≈) after inputting a calculation that displays the result as a decimal value.

Note

In Mathl/DecimalO and Linel/DecimalO modes the result is always in decimal format regardless of whether you press = or SHIFT = (≈) ·

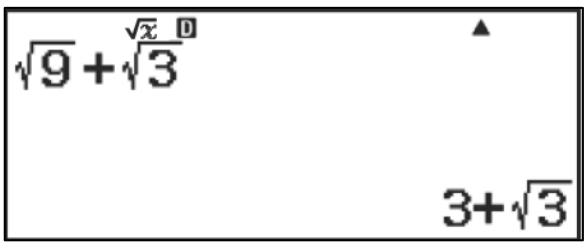
Below is the π format supported by the calculator:

- $n\pi$ (n is an integer).
- $\frac{d}{c}\pi$ or $a\frac{db}{c}\pi$ (depending on the fraction display format setting)

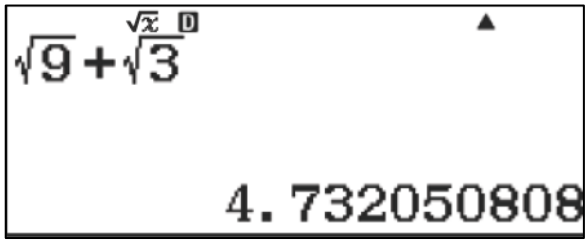
For example:

Example 1: $\sqrt{9} + \sqrt{3} = 3 + \sqrt{3}$ (Mathl/MathO)

√ 9 ▶ + √ 3 =

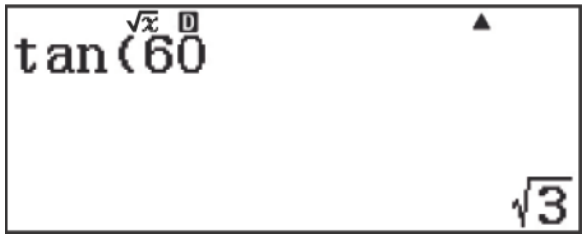


√ 9 ▶ + √ 3 = SHIFT =



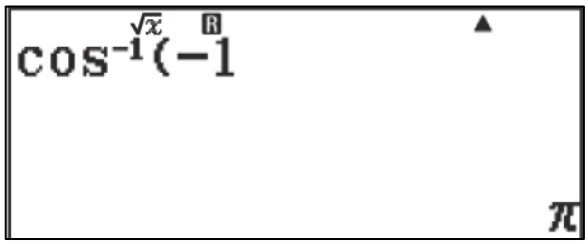
Example 2: $\tan(60) = \sqrt{3}$ (Mathl/mathO) (Angle Unit: Degree)

tan 6 0 =



Example 3: $\cos^{-1}(1) = \pi$ (Mathl/mathO) (Angle Unit: Radian)

SHIFT cos (−) 1 =



Quickly move the cursor

To use this function, we do the following:

Function	Key press operations
Move to the beginning of the expression	SHIFT ▶
Move to the end of the expression	SHIFT ◀
Move to the top of the expression	SHIFT ▲
Move down to the bottom of the expression	SHIFT ▼

Note:

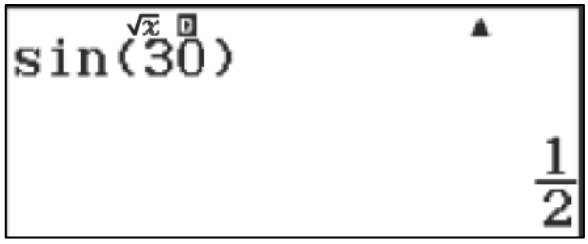
- To move the cursor quickly up or down to an expression, the cursor must be middle of the expression.
- This function is only used in Mathl/MathO, Mathl/DevimalO of Calculate mode.

Auto-Close brackets.

When this feature is enabled, the Calculator will automatically close parentheses for all functions that use opening parentheses.

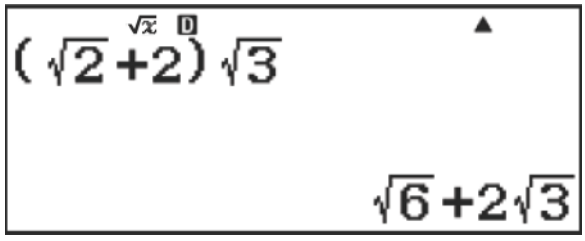
Example 1: $\sin(30) = \frac{1}{2}$ (Angle unit: Degree)

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



Example 2: $(\sqrt{2}+2)\sqrt{3} = \sqrt{6}+2\sqrt{3}$ (Angle unit: Degree)

[(] [√] [2] [▶] [+] [2] [√] [3] [=]



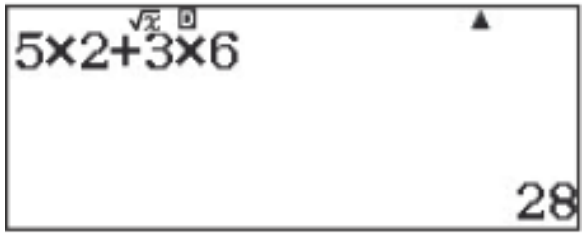
🕮 BASIC CALCULATIONS

Arithmetic calculations

Use the [+] [−] [×] [÷] keys to perform Arithmetic calculations:

For example: Result of calculation $5 \times 2 + 3 \times 6 = 28$

[5] [×] [2] [+] [3] [×] [6] [=]

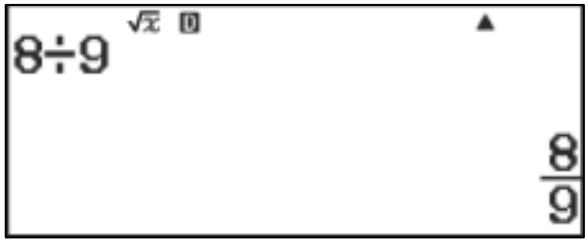


The calculator will automatically prioritize calculations.

You can specify the decimal places (Fix) and number of significant digits (Sci) for calculation results.

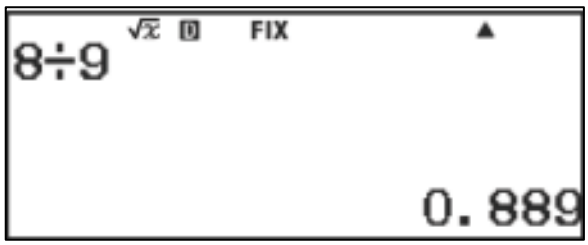
Example: 8 ÷ 9
+ Norm 1

[8] [×] [9] [=]



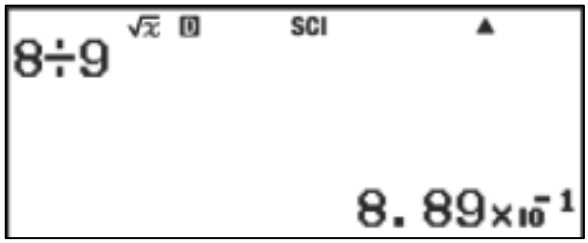
+ 3 number of decimal places (Fix 3)

[8] [÷] [9] [SHIFT] [=]



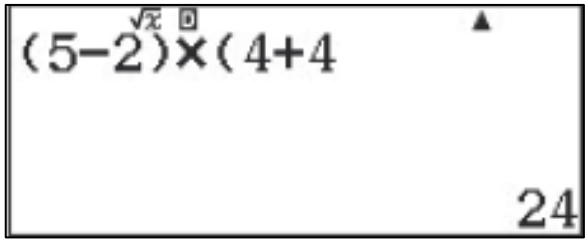
+ 3 number of significant digits (Sci 3)

[8] [÷] [9] [SHIFT] [=]



Example: $(5-2)\times(4+4)=24$

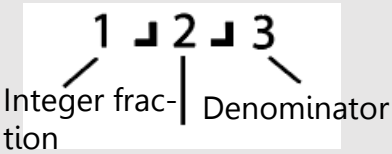
[(] [5] [−] [2] [)] [×] [(] [4] [+] [4] [=]



Fractional format

You can convert the currently displayed fraction or decimal value (decimal value that is convertible to a fraction by this calculator) calculation result to a mixed fraction or an improper fraction.

Format	Fraction converted to mixed fraction	Mixed fraction
Mathl/MathO Mathl/DecimalO	$\frac{5}{3}$ ([▤] [5] [▼] [3] or [▤] [5] [▶] [3] or [5] [▤] [3])	$1\frac{2}{3}$ ([SHIFT] [▤] [1] [▶] [2] [▼] [3] or [SHIFT] [▤] [1] [▶] [2] [▶] [3])

Linel/LineO Linel/Decimalo	 Numerator Denominator	 Integer fraction Denominator Numerator

Note

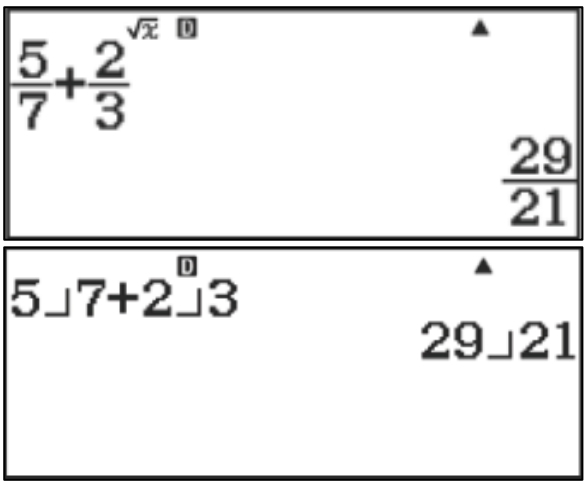
- In initial setup. Numbers displayed as fractions can be converted to Mixed fraction.
- Arithmetic calculations involving Mixed fraction and decimals will result in decimal values while mode other than Mathl/MathO is selected.
- In calculations, when the result is reduced to the simplest fraction format, it will be displayed as a fraction.

Example: $\frac{5}{7}+\frac{2}{3}=\frac{29}{21}$
(Mathl/MathO)

[5] [▼] [7] [▶] [+] [2] [▼] [3] [=]

(Linel/LineO)

[5] [7] [+] [2] [3] [=]



Infinite repeating decimal number

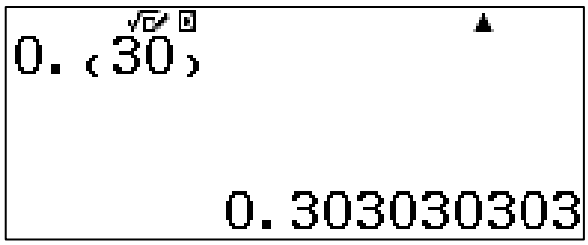
The calculator will display the number as an infinite repeating decimal while you enter the initial infinite repeating decimal value, or the result of the calculation will also display an infinite repeating decimal when available.

Input an infinite repeating decimal number.

Input an infinite repeating decimal, press [ALPHA] [√■] ((■)) to add a space (period), then input the repeating decimal in the separator (period).

Example: To input the infinite repeating decimal 0.303030...(0.(30)).

[0] [•] [ALPHA] [√■] ((■)) [3] [0] [=]



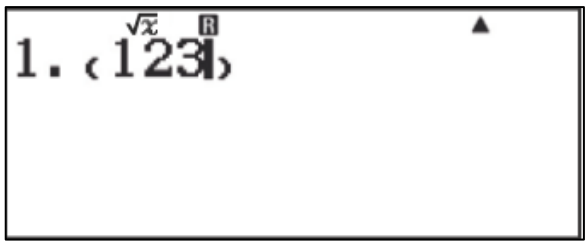
Note

- If the value starts with an integer (Example: 25.21521521…) don't include integer part when adding separators (25.(215)).
- Infinite repeating decimal numbers can only be inputted while Mathl/MathO is selected or Mathl/DecimalO is selected in setting for Input/Output.

Example: Input 1.123123123…(1.(123)).

[1] [•] [ALPHA] [√■] [(] ((■))

[1] [2] [3]

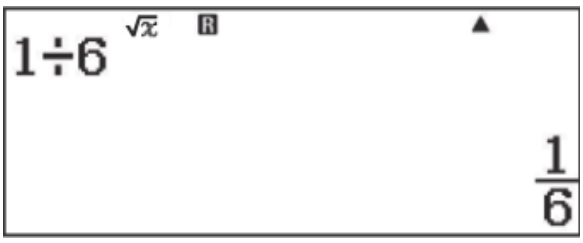


Displays the calculation result as an infinite repeating decimal number.

Calculation results can be displayed as infinitely recurring decimals when selecting "On" in the settings for Recurring Dec or pressing the [S⇔D] key to convert available calculation results to infinitely recurring decimals when available.

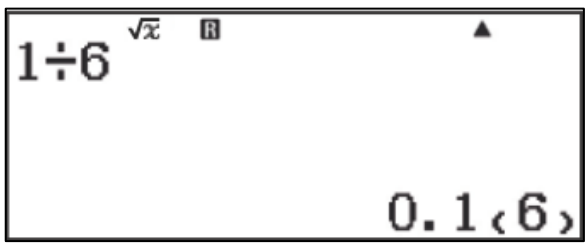
Example: $\frac{1}{6} = 0.1(6) = 0.16666666667$ (Number Format: Norm 1)

[1] [▤] [6] [=]



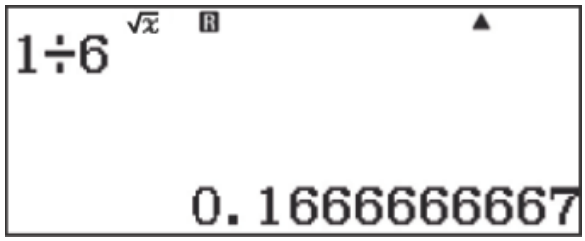
Displays in infinitely recurring decimal format.

[S⇔D]



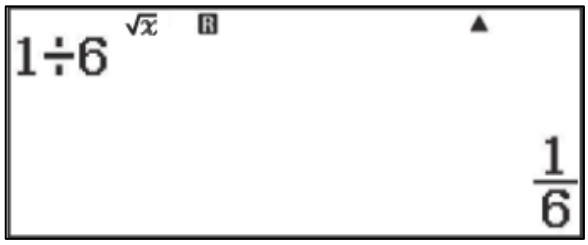
Decimal value according to Norm 1 setting.

S⇔D



Undo to original display format (Fraction).

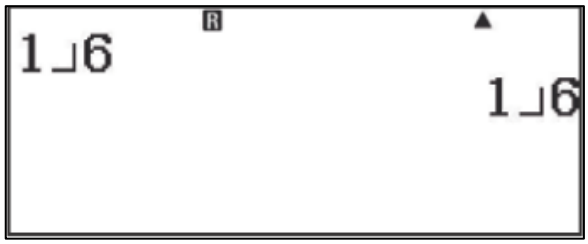
S⇔D



Example: $\frac{1}{6} = 0.1(6) = 0.1666666667$ (Norm 1)

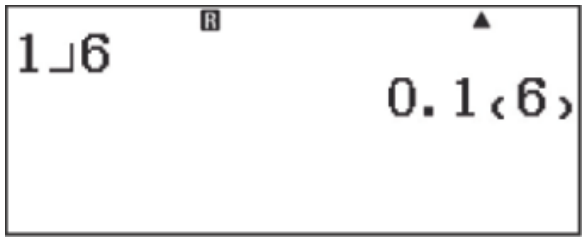
(Linel/LineO)

1 ▤ 6 =



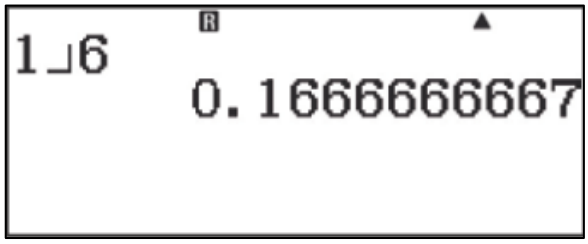
Displays in infinitely recurring decimal format.

S⇔D



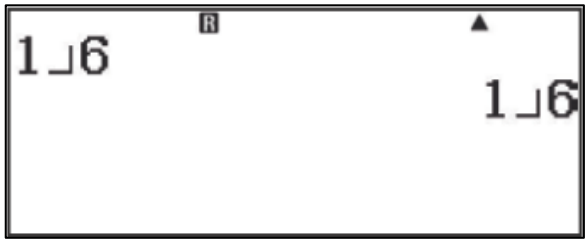
Decimal value according to Norm1 setting.

S⇔D



Undo the original display format (fraction).

S⇔D

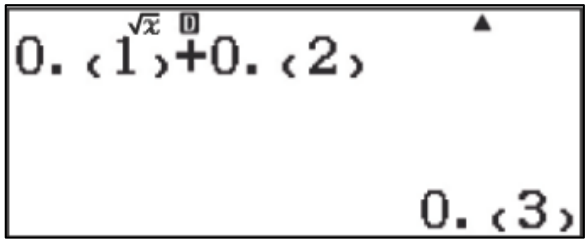


The calculation result must satisfy the following conditions to be displayed as an infinite recurring decimal after pressing the S⇔D key.

❖ The result is in the format of a fraction or mixed fraction, the total number of digits in the mixed fraction (including the integer part, numerator, denominator, and separator symbol) must not be greater than 10.

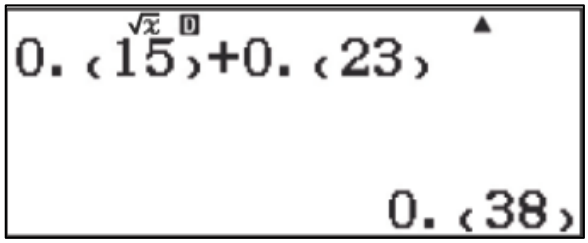
Example: $0,(1) + 0,(2) = 0,(3)$

[ALPHA] [√■] ((■)) [1] [▶] [+] [0] [•]
[ALPHA] [√■] ((■)) [2] [=]



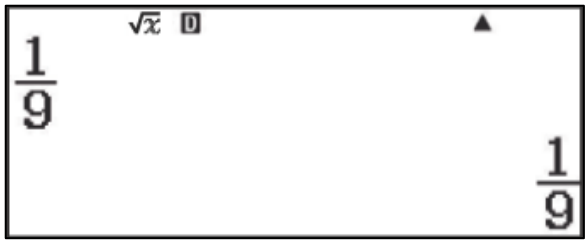
Example: $0,(15) + 0,(23) = 0,(38)$

[0] [•] [ALPHA] [√■] [1] [5] [▶] [+] [0] [•]
[ALPHA] [√■] [2] [3] [=] [S⇔D]

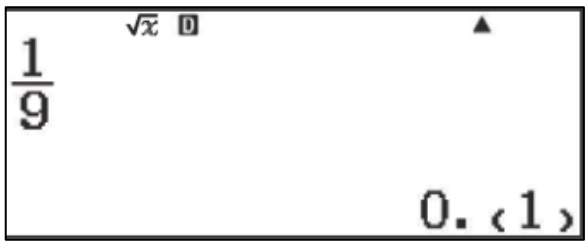


Example: $0,(1) = \frac{1}{9}$

[1] [▤] [9] [=]



[S⇔D]

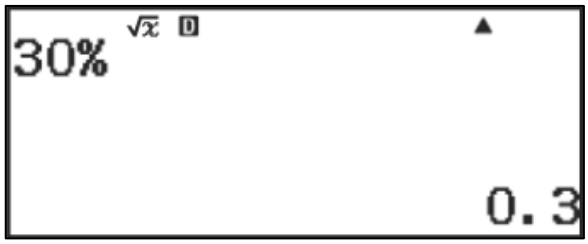


Percentage calculation

To calculate the percentage of the input value, enter a value and press [SHIFT] [Ans] (%) keys.

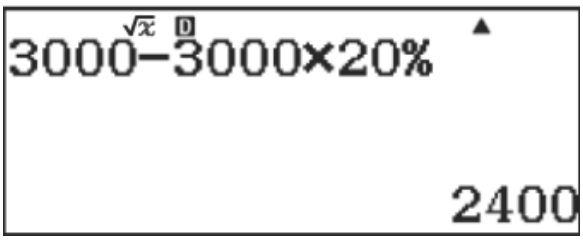
Example: $30\% = 0{,}3(\frac{30}{100})$

[3] [0] [SHIFT] [Ans] (%) [SHIFT] [=]



Example: Find the result when 3000 reduced 20% (2400)

[3] [0] [0] [0] [−] [3] [0] [0] [0] [×]
[2] [0] [SHIFT] [Ans] (%) [=]



Calculation of Degrees, Minutes, Seconds (hexadecimal system)

You can perform calculations using values in the hexadecimal system and convert values back and forth between the hexadecimal and decimal systems.

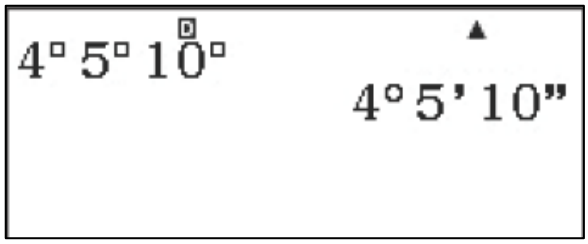
Input the hexadecimal value

The steps input a value in hexadecimal is as follows: {Degree}[°’’’] {minute}[°’’’]{second}

> **Note**
> That we must always input values for degrees and minutes, even if the value is 0

Example: Input 4°5’10’’

[4] [°’’’] [5] [°’’’] [1] [0] [°’’’] [=]



Calculation in hexadecimal system.

To get calculation results in hexadecimal system, we need to perform the following calculations:

- Addition or Subtraction hexadecimal values
- Multiplication or Division hexadecimal values and decimal values.

Change the result display format

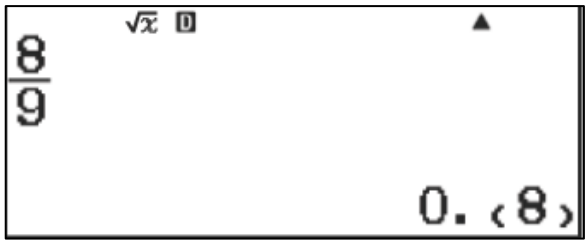
When selected Mathl/MathO or Mathl/DecimalO for Input/Output on the settings menu, each press [S⇔D] will change the calculation result being displayed between fraction and decimal format, $\sqrt{}$ and decimal format, π and decimal format.

Example: Fractions → Decimals (Mathl/MathO) (Recurring Dec: Off)

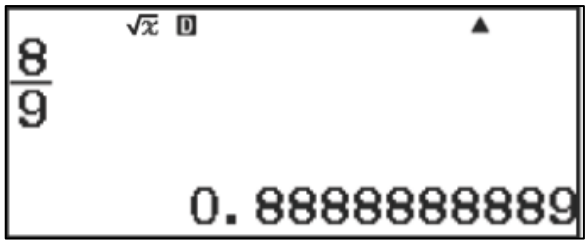
[⚙] [8] [▼] [9] [=]

Each press of the S⇔D key will change the calculation result between the two formats.

S⇔D



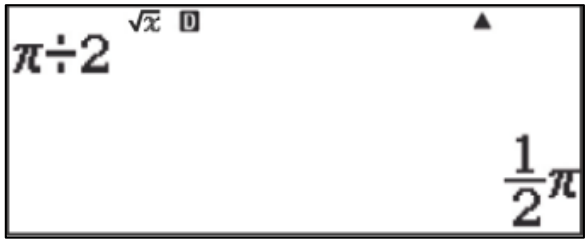
S⇔D



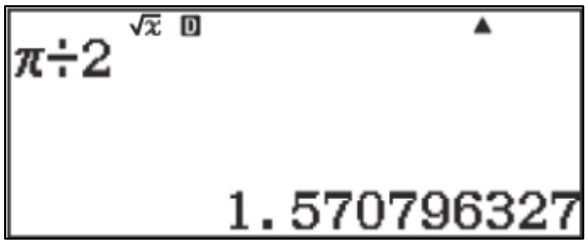
Depending on the setting selected for Fraction Result, the format of the fraction will be displayed differently (the fraction format can be converted to mixed fraction.

Example: $\pi \div 2 = \frac{1}{2}\pi = 1.570796327$ (Mathl/MathO)

SHIFT ×10^x ÷ 2 =



S⇔D

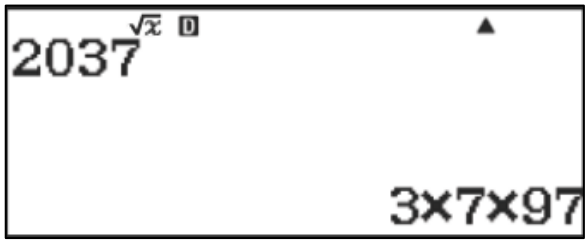


Prime Factorization

In Calculator mode, positive integers shorter than or with 10 digits can be factored into prime factors:

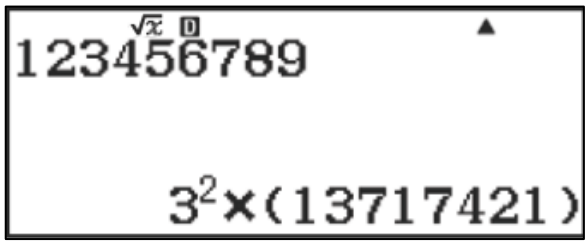
Example: Analysis 2037 into prime factors.

2 0 3 7 = SHIFT °,,, (FACT)



Example: Analysis 123456789 into prime factors.

[1] [2] [3] [4] [5] [6] [7] [8] [9]
[=] [SHIFT] [,,,] (FACT)



To exit the prime factors results display screen, perform the following operations:

+ Press [SHIFT] [,,,] (FACT) or [=]
+ Press any of the following keys: [ENG] or [,,,]

Note

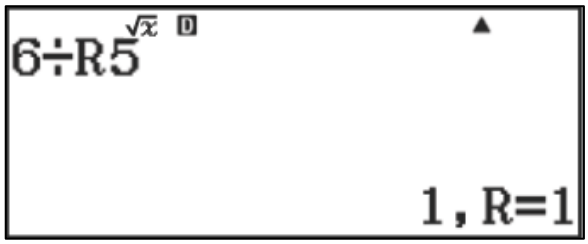
- For the values described below, can't analysis into prime factors even if this has 10 digits or less:
  + One of the prime factors with a value of 1018081 or less.
  + Two or more of the prime factors of a value have three or more digits.
- Fractions that can't be analysis into prime factors will appear in parentheses () on the result display screen.

Find the quotient and remainder of division

To calculate the quotient and remainder, we can use the ÷R function.

Example: Find the quotient and remainder of division $6 \div 5$ (quotient = 1, remainder = 1). (MathI/MathO)

[6] [ALPHA] [▥] [5] [=]



Note

- When performing division with remainder, the quotient is stored in the memory variable Ans.
- If the calculation a ÷R is part of a calculation with many steps, only the quotient is transitioned to the next calculation.

Example: [8] [−] [1] [2] [ALPHA] [▥] (÷R) [5] [=] → 8 − 2

- The [S⇔D] and [,,,] keys will have no effect when the remainder of the division is displayed on the screen.
- Division with data becomes division without remainder and is performed as normal division in the following cases:
  + When the divisor or dividend has a value that is too large.

Example: 30000000000 [ALPHA] [▤] 13 [=]

→ calculated as: 30000000000 ÷ 13

- When division has a quotient that isn't a positive integer or a remainder that isn't a positive integer or a remainder that has a positive fractional value.

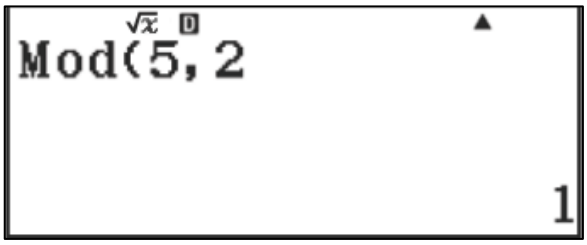
  Example: [(−)] [7] [ALPHA] [▤] [3] [=] → calculated as: $-7 \div 3$

Find the remainder of the division.

You can use the Mod function to find the remainder in division.

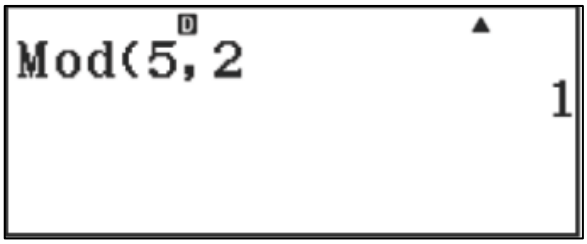
(Mathl/MathO)

[ALPHA] [6] [5] [SHIFT] [)] [2] [=]



(Linel/LineO)

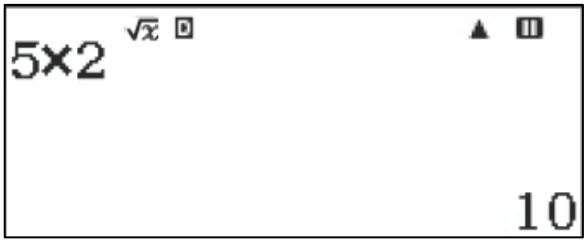
[ALPHA] [6] [5] [SHIFT] [)] [2] [=]



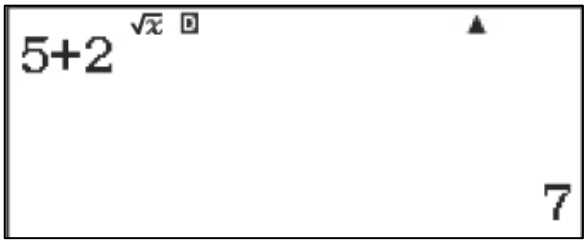
Combine multiple calculation expressions

You can use the colon character (:) to combine two or more expressions. Then the calculator will perform calculations in sequence from left to left to right when pressing the [=] key.

Example: Create a combined expression that performs the following two calculations: 5×2 *và* $5 + 2$ (Mathl/MathO)



▮▮ is the symbol representing the intermediate result of the expression.

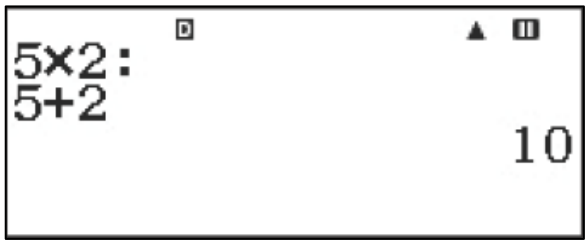


Note

- When selecting Linel/LineO or Linel/DecimalO for Input/Output on the settings menu enter a colon character (:) in the expression, a line break operation will appear.

Example: 5x2 and 5+2

[5] [×] [2] [ALPHA] [(:)] [5] [+] [2] [=]



▮▮ is the symbol representing the intermediate result of the expression.

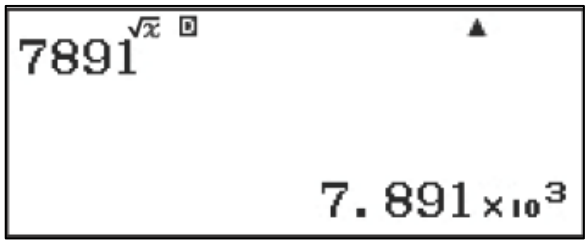
Convert numbers to powers of 10

To convert the exponential fraction of the displayed calculation result value to the power of 10 and a multiple of 3, simply press the [ENG] or [SHIFT] [ENG] key.

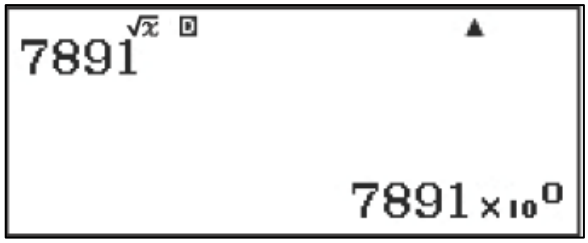
Example 1: Convert the value 7891 to a power of 10, move the decimal mark to the right.

[7] [8] [9] [1] [=]

[ENG]

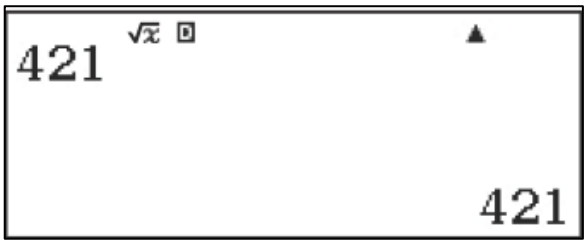


[ENG]

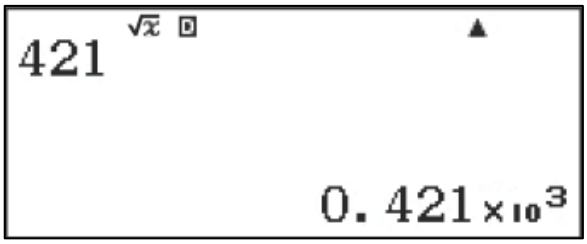


Example 2: Convert the value 421 to a power of 10, move the decimal mark to the left.

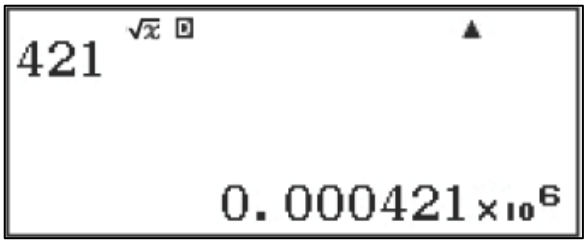
[4] [2] [1] [=]



[SHIFT] [ENG] (←)



[SHIFT] [ENG] (←)



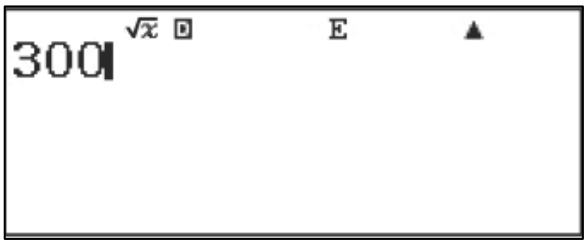
Engineer symbol

The calculator supports 11 technical symbols (m, μ, n, p, f, k, M, G, T, P, E) used to enter values or display calculation results.

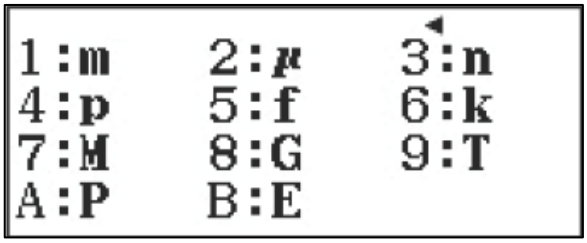
To have the engineering symbols included in the calculation results displayed, select "On" when setting for Engineer Symbol.

Example: input 300p

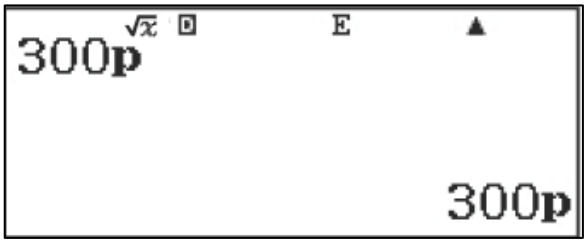
[3] [0] [0]



[OPTN] [S⇔D] (Engineer Symbol)

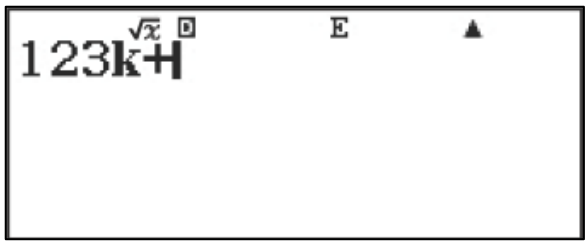


[4] (p) [=]

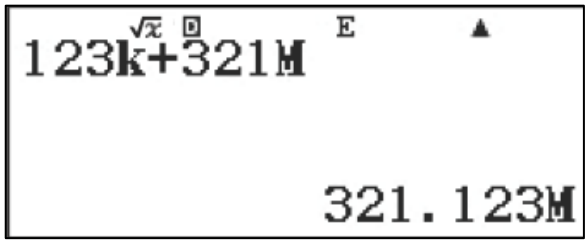


Example 2: Calculate 123k (kilo) + 321M (Mega) = 321.123M (Mega) = 321123k (kilo) = 321123000

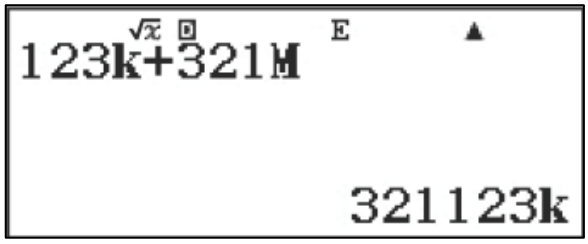
[1] [2] [3] [OPTN] [S⇔D] (Engineer Symbol) [6] (k) [+]



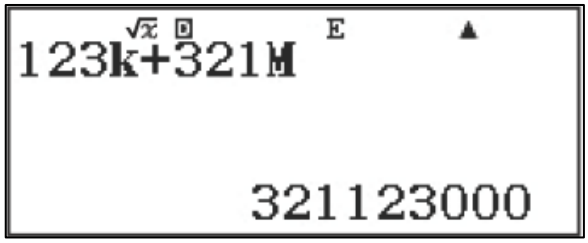
[3] [2] [1] [OPTN] [S⇔D] (Engineer Symbol) [7] (M) [=]



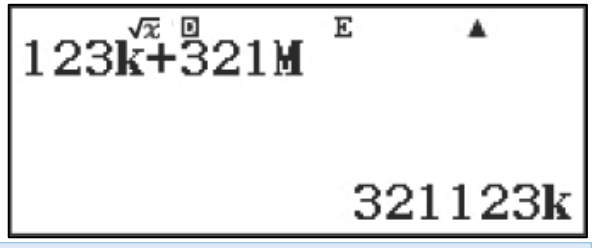
[ENG]



[ENG]



[SHIFT] [ENG] (←)



Note

- If "Off" is selected for Engineer Symbol when installing, the calculation results will display the value without technical symbols.

Memory and memory variables

Result memory (Ans)/Previous result memory (PreAns)

The final calculation result will be stored in Ans (Result) memory. The calculation results obtained previous the result will be stored in PreAns memory (Previous results). When the result of a new calculation is obtained, the current calculation result in the Ans memory will be transferred to the PreAns memory

and the new calculation result will be saved in the Ans memory.

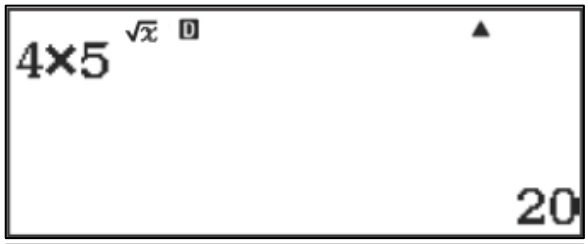
Note

- When performing calculations, use one of the following keys (=, SHIFT =(≈), M+, SHIFT M+(M-), SHIFT STO(RECALL), STO) then the calculation result in Ans memory will be update.
- The calculation result of Ans memory will not change if an error occurs during the current calculation.
- When performing calculations in Complex mode and the result is a Complex, both the real and imaginary parts will be saved in Ans memory. However, when transferring to another calculation mode, the imaginary part will be deleted from Ans memory.
- PreAns memory can only be used in Calculate mode.
- When transfer Calculate mode to another calculation mode, the PreAns memory will be cleared.

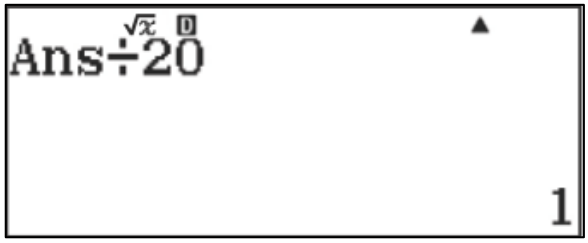
Using Result memory (Ans)

Example: Division the result of 4x5 by 20

4 × 5 =



Continue ÷ 2 0 =



(*) Press ÷ key. The result will automatically enter the command "Ans".

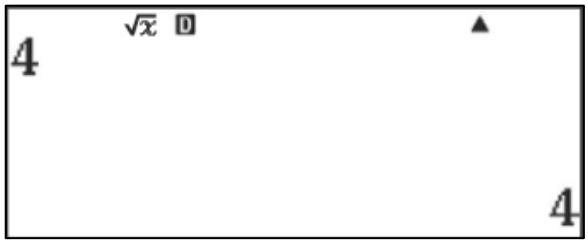
Using Previous result memory (PreAns)

Example:

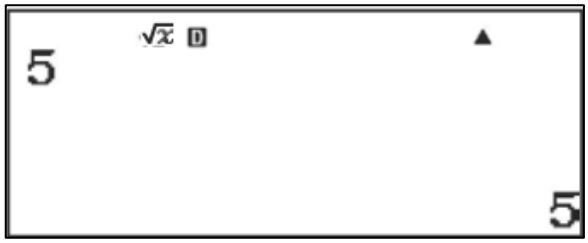
t_1=4

4 =

(Ans = t_1 = 4)

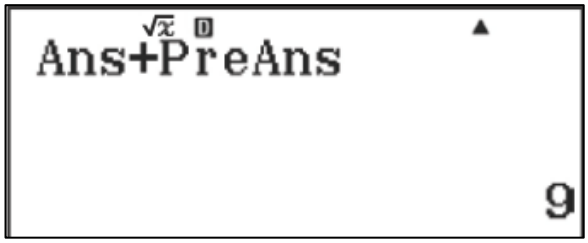


[5] [=]
(Ans = t_2 = 5, PreAns = t_1 = 4)



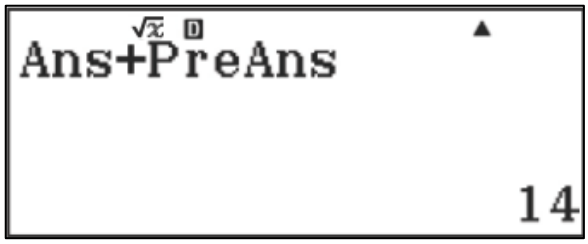
$t_3 = t_2 + t_1 = 5 + 4$

[Ans] [+] [ALPHA] [Ans](PreAns) [=]
(Ans = t_3 = 9, PreAns = t_2 = 5)



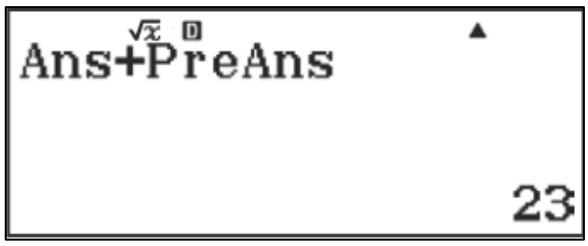
$t_4 = t_3 + t_2 = 9 + 5$

[+] [ALPHA] [Ans](PreAns) [=]
(Ans = t_4 = 14, PreAns = t_3 = 9)



$t_5 = t_4 + t_3 = 14 + 9$

[+] [ALPHA] [Ans](PreAns) [=]
(Ans = t_5 = 23, PreAns = t_4 = 14)



VARIABLES (A, B, C, D, E, F, X, Y, Z)

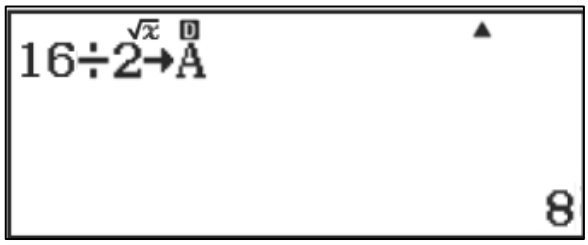
The calculator has 10 preinstalled variables and is named A, B, C, D, E, F, x, y and z.

You can assign values to variables and use variables in calculation.

You can assign a specific value or calculation result to a variable.

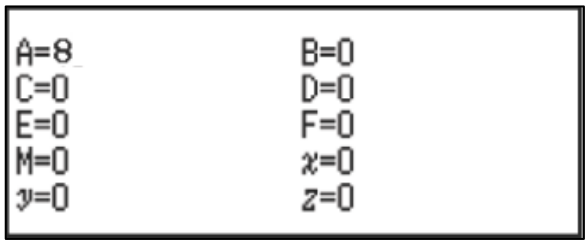
Example 1: Assign the result of operation 16 ÷ 2 to variable A.

[1] [6] [÷] [2] [STO] [(−)] (variable A)



Example 2: Review the value of variable A

SHIFT STO (RECALL)(*)



(−) (variable A) =

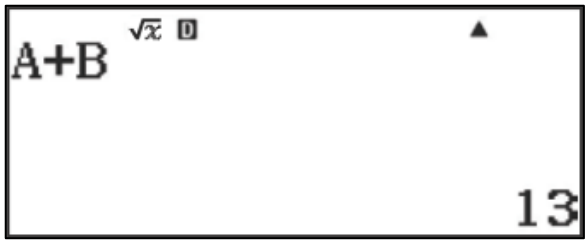
(*) Press SHIFT STO to see the screen displaying the display values being assigned to the A, B, C, D, E, F, x, y, z variables. On this screen, values are always displayed using the Number Format is Norm 1. Press AC to exit the display of variable values.

Example: Adding the values of variable A to the values of variable B

(Continue)

4 + 1 STO ,,, (variable B)

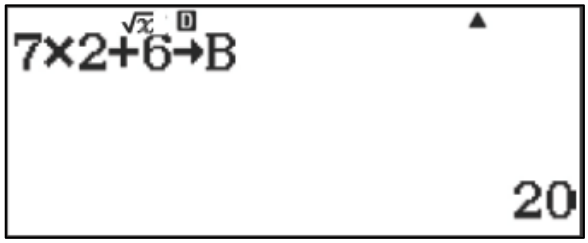
ALPHA (−) (A) + ALPHA ,,, (B) = **



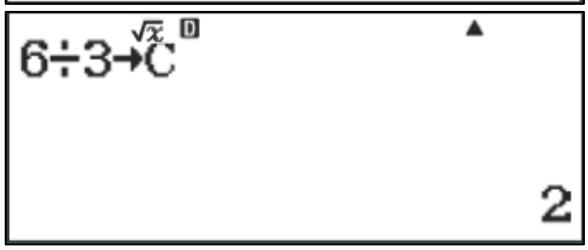
(**) Enter a variable is as follows: Press ALPHA, then press the key corresponding to the variable name you want to enter. To enter x as the variable name, you can press (x) or ALPHA ((x).

Example: $\frac{7\times2+6}{6\div3} = 10$

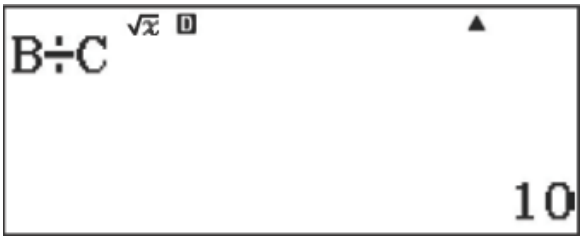
7 × 2 + 6 STO ,,, (variable B)



6 ÷ 3 STO x^{-1} (variable C)



[ALPHA] [•,,,] (B) [÷] [ALPHA] [x^{-1}] (C) [=]

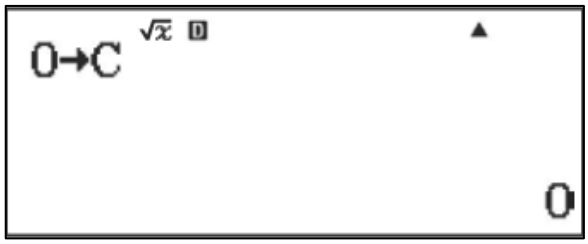


Delete the contents of a specific variable.

Press [0] [STO], then press the key to the variable name whose value you want to delete.

Example: To delete the value of variable C.

[0] [STO] [x^{-1}] (C)



Independent Memory (M)

We can add or subtract calculation results from Independent Memory. When the Independent Memory contains a value, the Icon "M" will display on the screen.

The table below summarizes the operations that can be performed to interact with Independent Memory.

Function	Key press operation
Adds to Independent Memory the display value or result of the expression.	[M+]
Subtracts the display value or result of the expression from independent memory.	[SHIFT] [M+] (M-)
Review the current contents of the independent memory.	[SHIFT] [STO] (RECALL) [M+] (M) [=]

Note

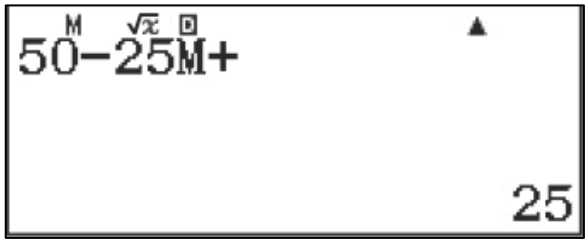
- Variable M is used for independent memory.
- You can also insert the variable M into the calculation, which allows the calculator to use the independent memory contents currently at that position. The following key operation inserts the variable M into calculation. [ALPHA] [M+] (M)
- The "M" Icon will display on the screen when any value different "0" stored in the Independent Memory.

Calculations that use independent memory.

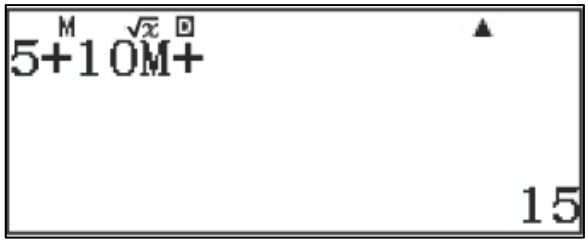
If there is an "M" icon on the display screen, perform the operation in independent memory clearly before executing this example.

Example: $50 - 25 = 25, 5 + 10 = 15, 9 \times 3 = 27, 55 \div 5 = 11$. Result = 24

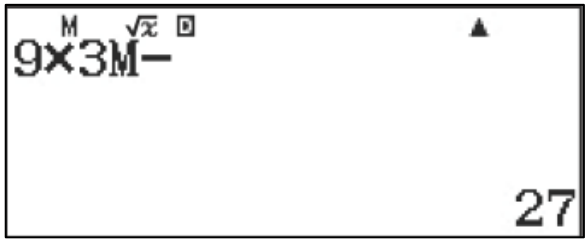
[5] [0] [−] [2] [5] [M+]



[5] [+] [1] [0] [M+]

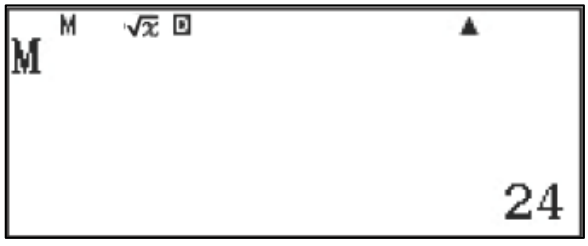


[9] [×] [3] [SHIFT] [M+] (M-)



[5] [5] [÷] [M+]

[SHIFT] [STO] (RECALL) [M+] (M) [=]



Clear memory independently

Press [0] [STO] [M+] this will clear the memory independently and "M" icon disappear from the screen.

Delete the contents of all memory

Ans memory, independent memory and variable contents are still saved even if you press [AC], change the calculation mode or turn off the calculator. PreAns memory contents are still saved even if you press [AC] or turn off the calculator without exiting Calculate mode.

Note

- Perform the following procedure when you want to delete the contents of all memories.

[ALPHA] (RESET) [9] (Memory) [2] [=] (Yes)

- To cancel the delete command without performing any operations, press [AC] instead of [=] [•]

Calculation history

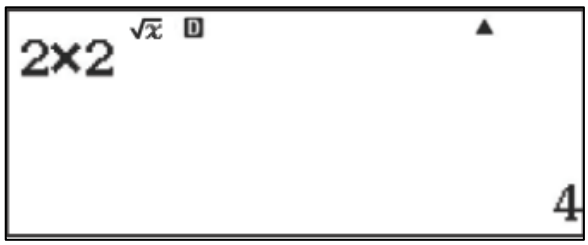
Calculation history

The ▲ and / or ▼ marks at the top of the screen indicate that there is additional calculation history content before and / or after. We can undo the calculation history contents by pressing [▼] and [▲]

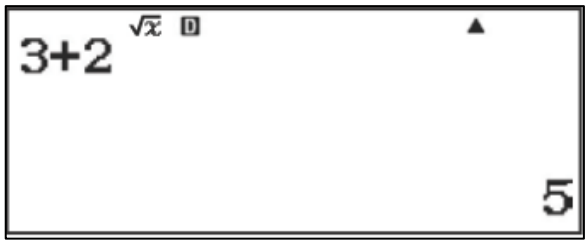
Modes that can support calculation history memory include Calculate, Complex, Base-N, Verify.

Example: (Mathl/MathO).

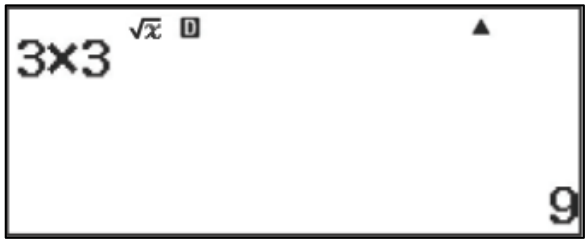
[2] [×] [2] [=]



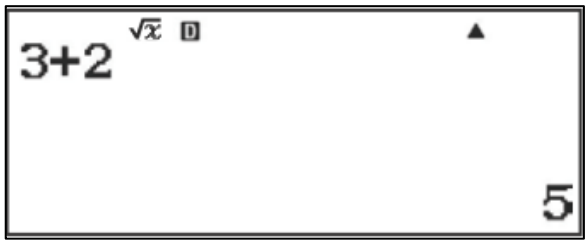
[3] [+] [2] [=]



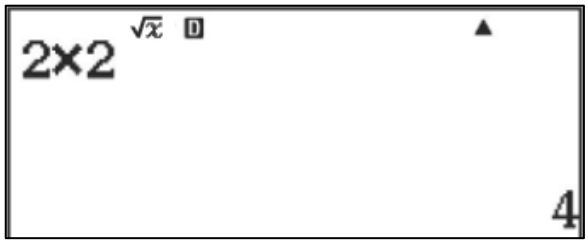
[3] [×] [3] [=]



(Undo) [▲]



(Undo) [▲]



Note

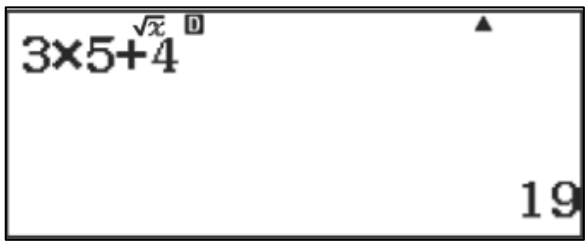
- Every you press [ON], when you change to another calculation mode, change Input/Output settings or press Reset (Initialize All or Setup Data) key then calculation history data will be deleted.
- Because the calculation history memory is limited, when the calculations performed are full in memory, the oldest calculations will be deleted so that new calculations can be saved.

Display the calculation again

When the calculation results are displayed on the screen, you can press [◀] or [▶] to display and edit the content of the previous calculation.

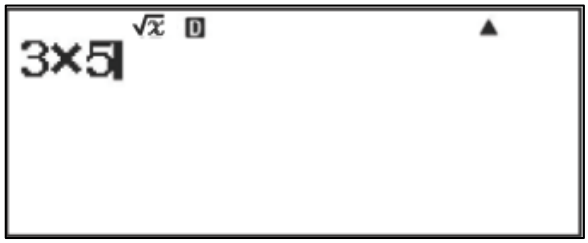
Example: $3 \times 5 + 4 = 19, 3 \times 5 - 5 = 10$

[3] [×] [5] [+] [4] [=]



[◀]

[DEL] [DEL]



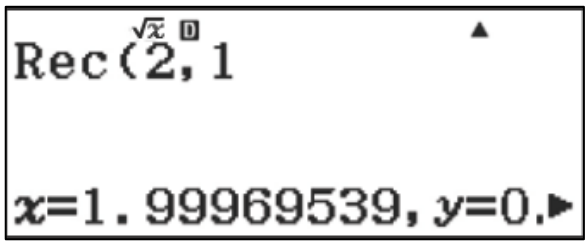
[−] [5]

Note

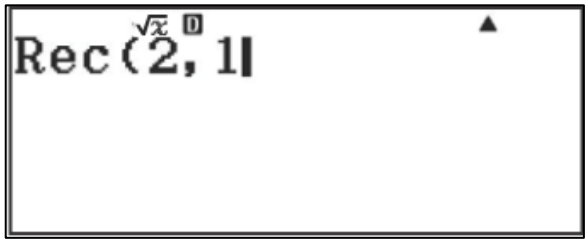
- When the indicator ▲ appears at the top of the display screen the calculation results, if you want to edit the calculation again to press [AC]. After you use ◀ or ▶ to return to the calculation and edit.

Example: Rec(2,1) → Rec(2,2)
(Mathl/MathO)

[SHIFT] [−] [2] [SHIFT] [)] [1] [=]

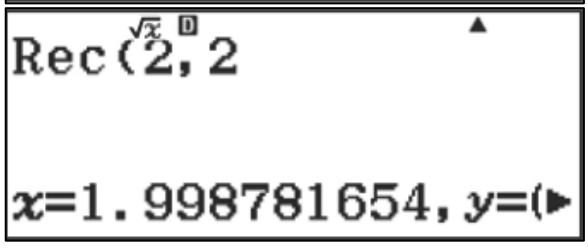


[AC] [◀]



[DEL]

[2] [=]



🕮 CALCULATION MODES

CALC

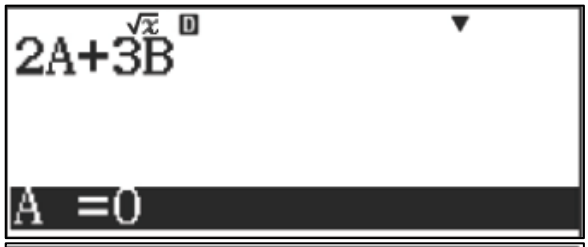
- To consecutive calculation and combine multiple expressions with multiple variables, we can use CALC.
- CALC can only be used in calculation mode and complex numbers.
- Calculation expressions usually have the following 3 format:
  - + Expression with a single variable: Single variable = Expression.
    Example: $y = 3x$
  - + Multivariable expression.
    Example: $x + y, 3Cx + 2Cy, D + E$
  - + Combined expression.
    Example: $A + B, x + y, C + D$
- The expression to the right of the equals mark (inputting by using [ALPHA] [CALC] keys contains variables.

Example of CALC calculation

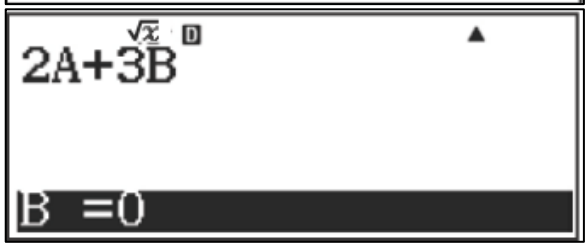
To start CALC calculation after entering an expression, press the key [AC]
Example: To save $2A + 3B$ and then substitute the following values to perform the calculation: $(A, B) = (2,4), (5,10)$

[ALPHA] [(−)] (A) [+] [3] [ALPHA] [,,,] (B)

[CALC]

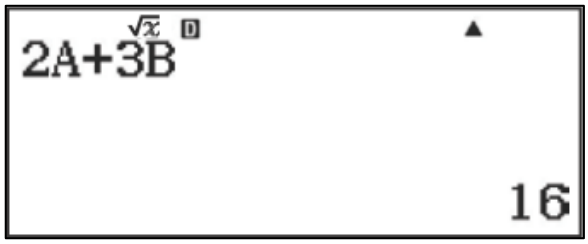


[2] [=]



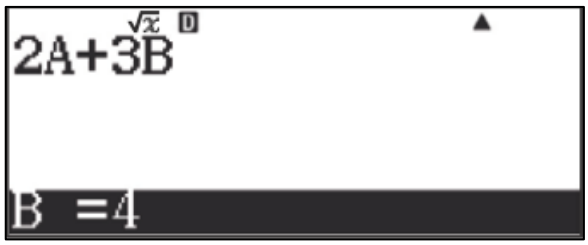
[4] [=]

[=]



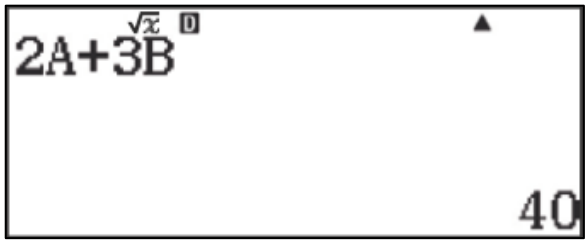
[CALC] (or [=])

[4] [=]



[1] [0] [=]

[=]

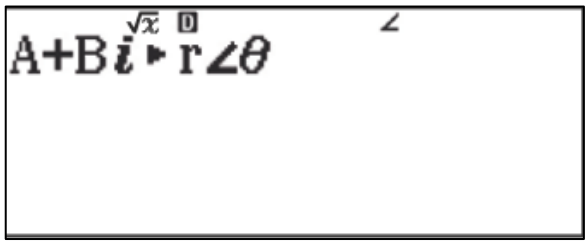


(Press [AC] key to exit CALC)

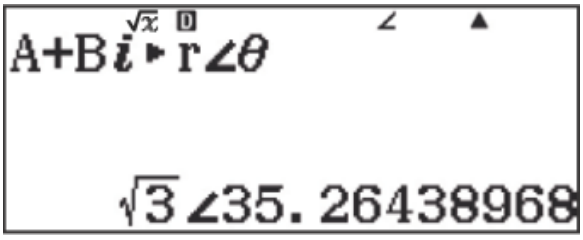
Example: To store $A + Bi$ then define $\sqrt{2} + i, 1 + \sqrt{2}i$

(Angle Unit: Degree, Complex: $a + bi$)

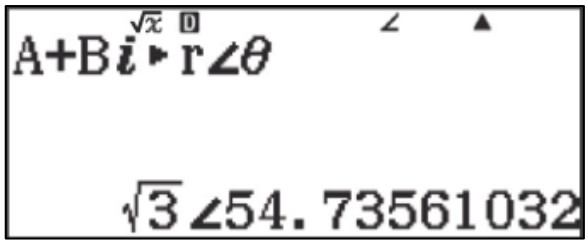
[MENU] [2] [ALPHA] [(−)] [+] [ALPHA] [,] [ENG] [OPTN] [5]



[▼] [√] [2] [)] [=] [1] [=] [=]



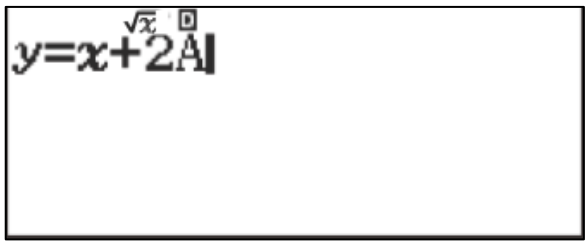
CALC (or =) 1 = √■ 2)
= =



(Press AC key to exit CALC)

Example 3: Calculate $a_{n+1}=a_n+2n$ ($a_1=1$) with the value of a_n changing from a_2 to a_5 (Result: $a_2 = 3$, $a_3 = 7$, $a_4 = 13$, $a_5 = 21$).

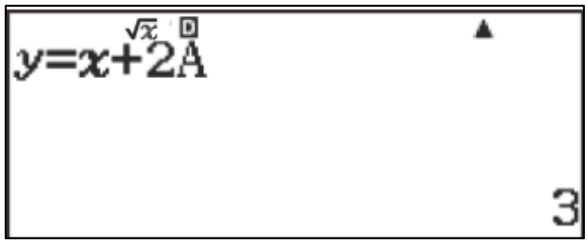
ALPHA) (y) ALPHA CALC (=)
x + 2 ALPHA (−) (A)



CALC

Assign 1 to a_1:
1 =

Assign 1 to n:
1 = =

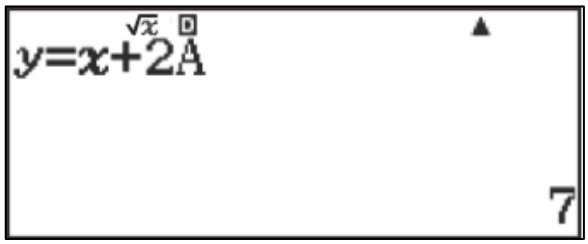


CALC (or =)

Assign value to a_2:
Ans =

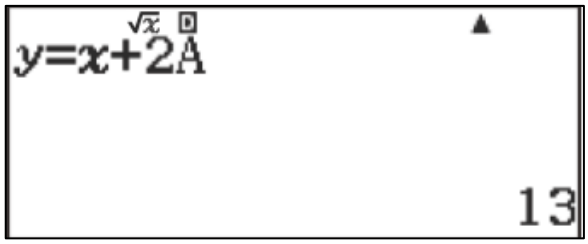
Assign 2 to n:

2 = =



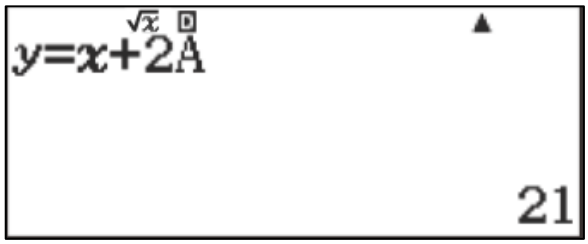
(The value of a_3)

CALC (or) =) Ans = 3 = =



(The value of a_4)

CALC (or) =) Ans = 4 = =



(The value of a_5)

(Press AC key to exit CALC)

Note

- During the time from pressing CALC until exiting CALC calculation mode by pressing AC, we should use a linear input method for input.

SOLVE

SOLVE is the method used to search the solution of the equation.
SOLVE is only used in Calculate mode.
SOLVE supports inputting the equation of the following expression.

Example: $x = Sin(D), y = x + 2, x + 5 = A + B, xy + A(xy + A = 0)$

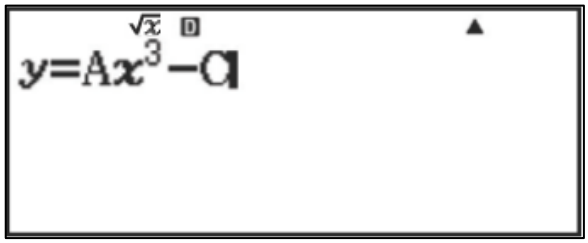
- For equations that has function $\sum(, \prod(, \mathrm{Pol}(, \mathrm{Rec}(, \div R$ or multiple statements then SOLVE can't be solved.
- When the solution value isn't in the equation to be solved, the error (Variable ERROR) will appear.

Note

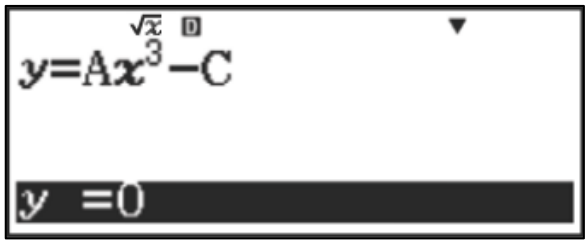
- For equation types that contain functions with opening parentheses (such as function log, sin, cos, ...), you must always close the parentheses after inputting a value for the function.
- During the time from pressing (SOLVE) until exiting SOLVE by pressing [AC] we should use a linear input method to input.

Example: Find the value of x with $y = Ax^3 - C \; and \; y = 1, a = 1, b = -3$

[ALPHA] [)] [ALPHA] [CALC] [ALPHA] [(−)] [x]
[SHIFT] [x^2] [+] [ALPHA] [x^{-1}]



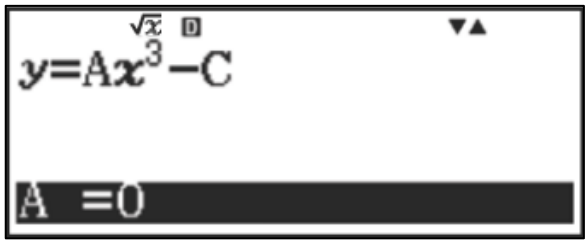
[SHIFT] [CALC]



(The value of y)

Input value $y = 1$

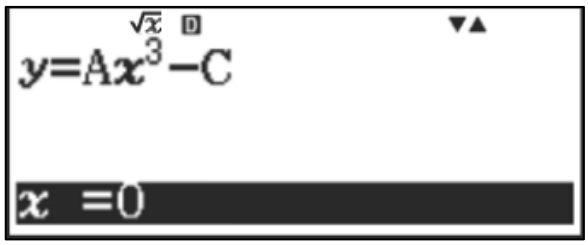
[1] [=]



(The value of A)

Input value $A = 1$

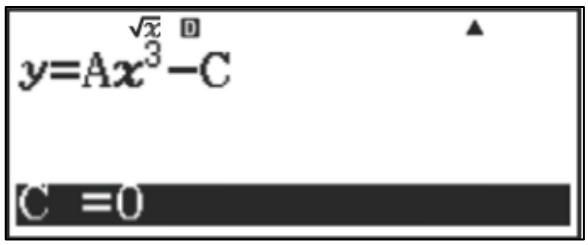
[1] [=]



(The value of x)

Input the start value for x=0

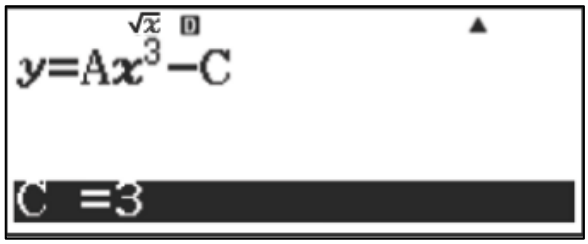
[0] [=]



(The value of B)

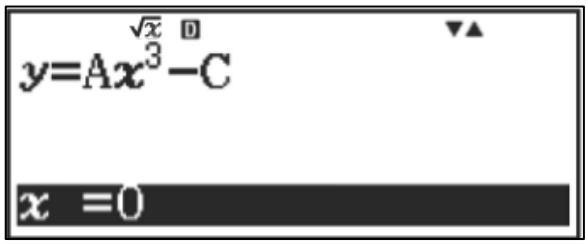
Input value $C = 3$

3 =



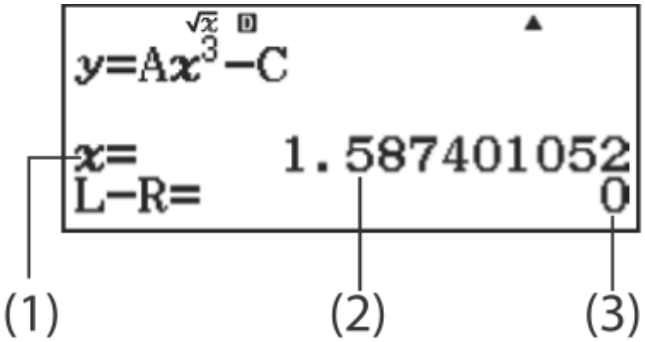
Choose the variable you want to find by moving to the screen that assigns that variable's value. Here you find the value of variable x.

▲



Find variable x.

=



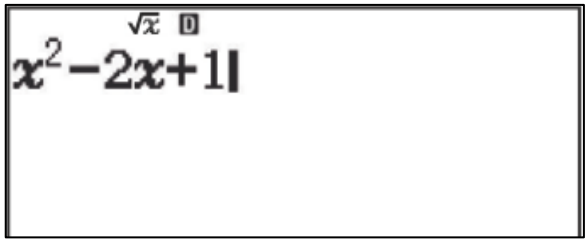
(1) Variable to be solved.
(2) Solution.
(3) Result (left)- (right).

(Press AC key to exit SOLVE)

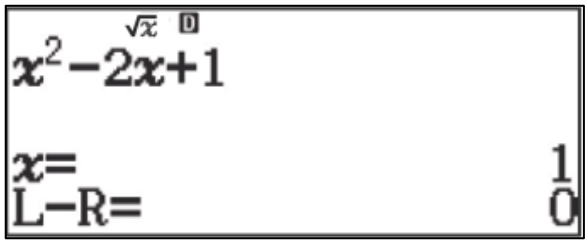
- The solution is always displayed as a decimal.
- If the value of (L-R) is closer to 0, the value of solution is more accurate.

Example: Find x when $y = 1$ and $y = 5$ of equation $y = x^2 - 2x + 1$

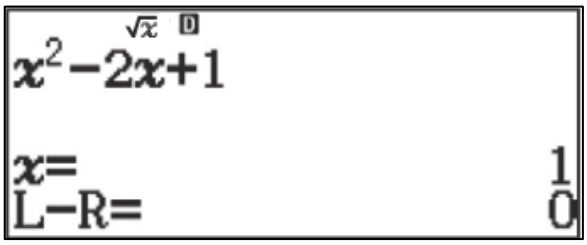
ALPHA) (Y) ALPHA CALC (=) x x^2
− 2 x + 1



ALPHA CALC (SOLVE)

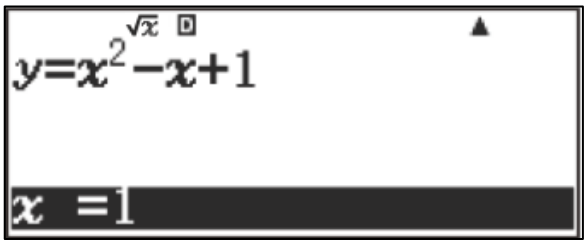


[3] [=]

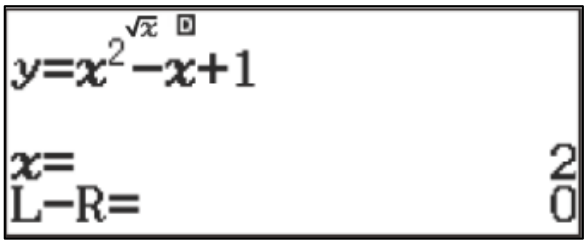


Input the start value for x (input 1)

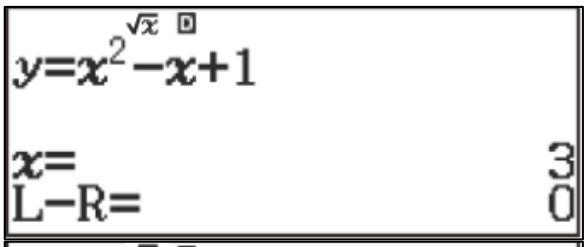
[1] [=]



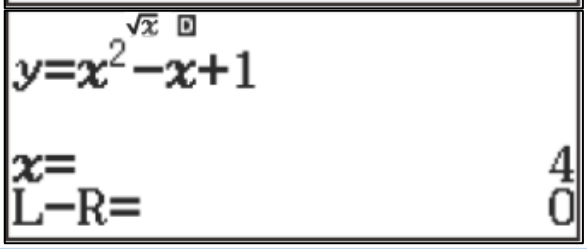
[=]



[=] [▲] [7] [=] [=]



[=] [▲] [1] [3] [=] [=]



Note

- SOLVE performs solution search a preset number of times. In case the solution cannot be search, the calculator screen will display "Continue: =" to confirm whether to continue searching or not. If you want to continue, press [=], if you don't want to continue, press [AC] to exit SOLVE.
- Depending on the start value assigned to the solution variable, SOLVE may not be able to search the solution then reassign the starting value closer to the solution.
- In some cases, SOLVE may not be able to search the exact solution even when a solution exists.

Differential

How to input differential

- In Mathl mode. $\frac{d}{dx}(f(x))|x = a$
- In Linel mode. $\frac{d}{dx}(f(x), a, tol)$

  $f(x)$: Function with variable x (all variables other than x are constants).
  a: Input a value to determine the derivative point (differential point).
  tol: Tolerance range (Linel/LineO or Linel/DecimalO).
- If the tol tolerance value is not inputted, then value of tol default are 1×10^{-10}.

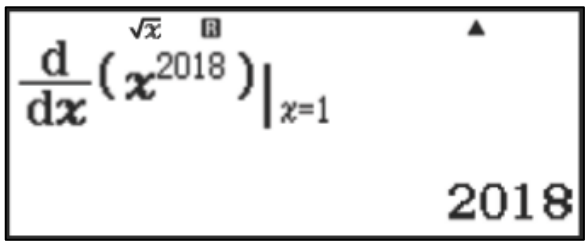
Note

- The functions below will not use as $f(x), a, b$ or tol in the differential function:
  + $(,\ d/dx(,\ \sum(,\ \prod(\ \text{in}\ f(x), a, b\ or\ tol)$
  + The functions Pol (, Rec(and $\div R$ can't be used as $f(x)$ in a differential function.
- Radian must be chosen as the angle unit when calculating differentials.
- The screen will display the message "Time out" when the calculation takes too long without giving a result.
- The smaller the Tol, the more exactly the calculation results are. The value of tol must be greater than 1×10^{-14}.
- Tol can only be entered in Linel mode.
- Calculation results may not be accurate, and errors may appear due to the following factors:
  + The Points are discontinuous in the x values.
  + Sudden change in the x values.
  + Include the maximum and minimum points in the x values.
  + Include the inflection point in the x values.
  + Includes non-differentiable points in the x values.
  + The result of the differential calculation is close to 0.
- To stop the integral calculation, press [AC]

Example of differential calculate

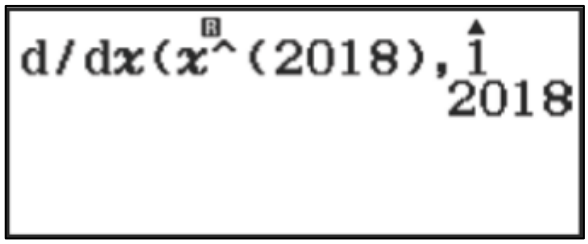
Example: Determine $f(1)$ when $f(x) = x^{2018}$
(Mathl/MathO)

[SHIFT] [∫] [x] [x^▪] [2] [0] [1] [8]
[▶] [▶] [1] [=]



(Linel/lineO)

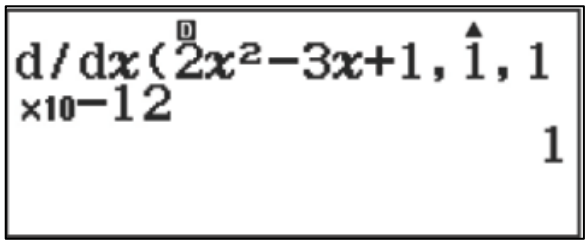
SHIFT $\int_{\square}^{\square}$ x $x^{\square}$ 2 0 1 8)
SHIFT) 1 =



Example: $\frac{d}{dx}(2x^2 - 3x + 1, 1, 1 \times 10^{-12}) = 1$

(Linel/LineO)

SHIFT $\int_{\square}^{\square}$ 2 x x^2 − 3 x +
1 SHIFT) 1 SHIFT)
1 $\times 10^x$ (−) 1 2 =



Integral

Instructions for entering expressions

(1) In Mathl mode.

$$\int_{a}^{b} f(x)dx$$

(2) In Linel mode

$$\int f(x), a, b, tol)$$

- $f(x)$: Function with variable x (all variables other than x are constants).
- a: Lower limit.
- b: Upper limit.
- tol: Tolerance range (Linel/LineO or Linel/DecimalO).

Note

- The functions below can't be used as $f(x), a, b$ *or* tol in integral calculation mode:
  + (, $d/dx($, $\sum($, $\prod($
  + The functions Pol (, Rec(and $\div R$ will not be used as function $f(x)$
- The integration result will be negative when $f(x) < 0$ is within the integration range corresponding to $a \leq x \geq b$.

Example:

$$\int_{2}^{1} (x^2 + 2)dx = \frac{7}{2}$$

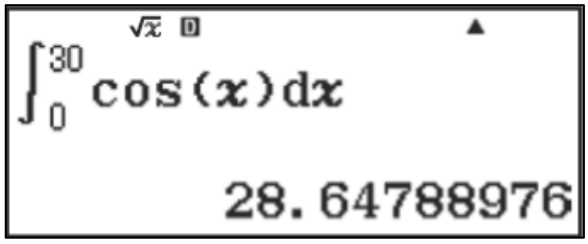
- The screen will display a message "Time out" when the calculation takes too long without giving a result.
- Select Radian as the angle unit when calculating integration.

- The smaller the tol, the more accurate the calculation results. The value of tol must be greater than 1×10^{-14}.
- tol can only be entered at Line mode.
- To stop the Integral calculation process, press [AC]

Example of Integral calculation.

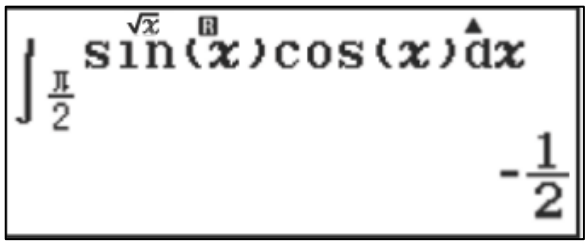
Example 1: Calculate the integral $\int_0^{30} \cos(x)\, dx$.
(Mathl/MathO) (Angle Unit: Radian)

[∫] [cos] [x] [)] [▶] [0] [▶] [3] [0] [=]



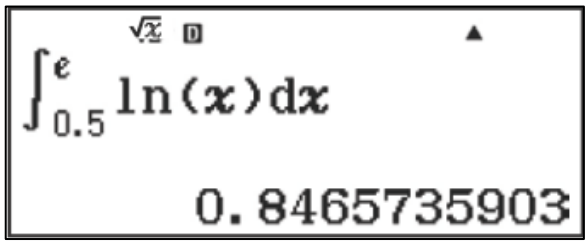
Example 2: Calculate the integral $\int_{\pi \div 2}^{\pi} \sin(x)\cos(x)dx$
(Mathl/MathO) (Angle Unit: Radian)

[∫] [sin] [x] [)] [cos] [x] [)]
[SHIFT] [×10^x] [▤] [2] [▲] [▲] [SHIFT] [×10^x] [=]



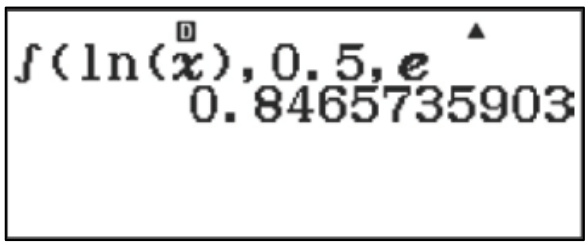
Example 3: Calculate the integral $\int(\ln(x), 0.5, e = 0.8465735903$
(Mathl/MathO) (Angle Unit: Degree)

[∫] [ln] [x] [)] [▶] [0] [•] [5]
[▶] [ALPHA] [×10^x] (e) [=]



(Mathl/MathO) (Angle Unit: Degree)

[∫] [ln] [x] [)] [SHIFT] [)] (,) [0] [•] [5]
[SHIFT] [)] (,) [ALPHA] [×10^x] (e) [)] [=]



Summation(Σ).

With Σ you can calculate the sum of a function $f(x)$ in a specific range.

Input Syntax

(1) In Mathl mode.

$$\sum_{a}^{b}(f(x))$$

(2) In Linel mode.

$$\sum(f(x),a,b)$$

$f(x)$: Function with variable x (all variables other than x are constants).

a: Start point of the calculation range.

b: End point of the calculation range.

- a and b are integers in the range $-1\times10^{10} < a \le b < 1\times10^{10}$
- The calculation step is fixed at 1.

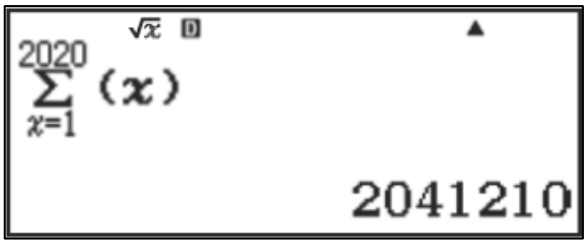
Note

- In the addition calculation, the following functions can't be used as functions $f(x)$, lower limit a and upper limit b.
- (, d/dx(, Σ(, $\prod$(
- The functions Pol (, Rec(and $\div R$ will not be used as function $f(x)$.
- To stop the addition calculation process, press [AC]

Example: Calculate the addition $\sum(x,1,2020)$

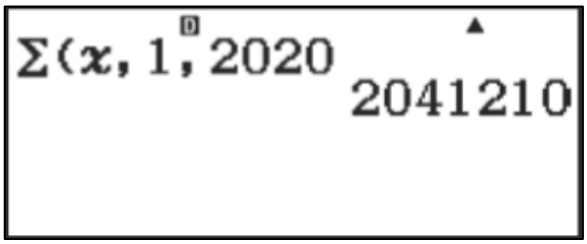
(Mathl/MathO) (Angle Unit: Degree)

[SHIFT] [x] [x] [▶] [1] [▶]
[2] [0] [2] [0] [=]



(Linel/LineO) (Angle Unit: Degree)

[SHIFT] [x] [x] [SHIFT] [)] (,) [1] [SHIFT] [)] (,)
[2] [0] [2] [0] [=]



Product calculation (Π)

With Π you can calculate the product of a function $f(x)$ in a specific range.

Instructions for entering expressions.

(1) In Mathl mode

$$\prod_{a}^{b}(f(x))$$

(2) In Linel mode

$$\prod(f(x)a,b)$$

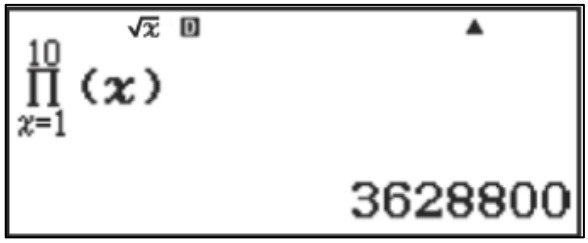
- $f(x)$: Function with variable x (all variables other than x are constants)
- a: Start point of the calculation range.
- b: End point of the calculation range.
- a and b are integers in the range $a < 1 \times 1010,\ b < 1 \times 1010, a \leq b$.
- The calculation step is fixed at 1.

Note

- In the products calculation, the following functions can't be used as functions $f(x)$, lower limit a and upper limit b.
- (, $d/dx($, $\Sigma($, $\prod($
- The functions Pol (, Rec(and $\div R$ will not be used as function $f(x)$.
- To stop the products calculation process, press C

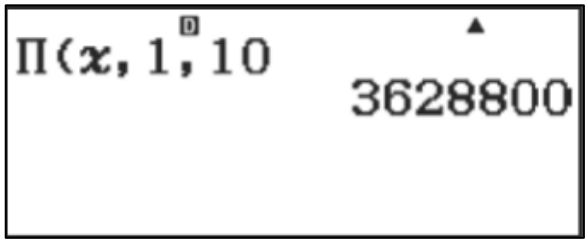
Example: Calculate $\prod(x, 1, 10)$
(Mathl/MathO) (Angel Unit: Degree)

ALPHA x x ▶ 1 ▶ 1 0 =



(Linel/LineO) (Angel Unit: Degree)

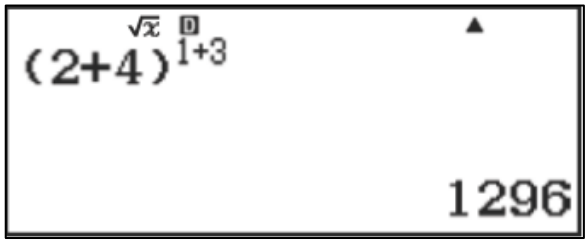
ALPHA x x SHIFT) (,) 1 SHIFT) (,) 1 0 =



Exponents and Radicals

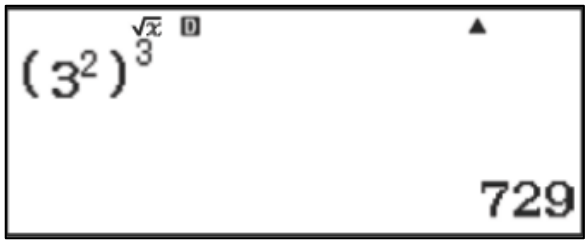
Exponent functions and radical exponential functions can be used in calculation Calculate, Statistics, Distribution, Equation/Func, Inequality, Matrix, table, Vector, Verify, Ratio and Complex mode.
Example: $(2+4)^{1+3}$

(2 + 4) $x^{\square}$ 1 + 3 =



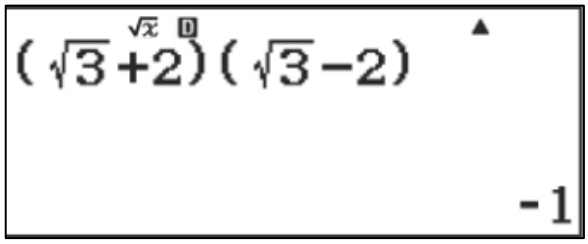
Example: $(3^2)^3$

(3 x^2) SHIFT x^2 =



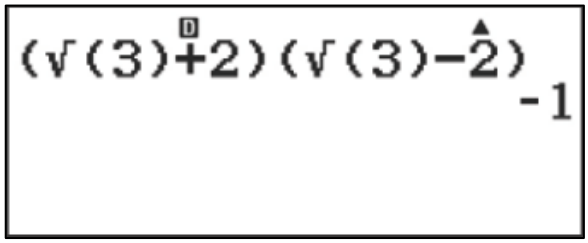
Example: $(\sqrt{3}+2)(\sqrt{3}-2)=-1$
(Mathl/MathO)

(√■ 3 ▶ + 2) (√■ 3 ▶ − 2) =



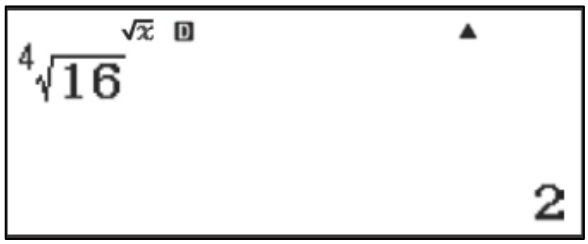
(Linel/LineO)

(√■ 3) + 2) (√■ 3) − 2) =



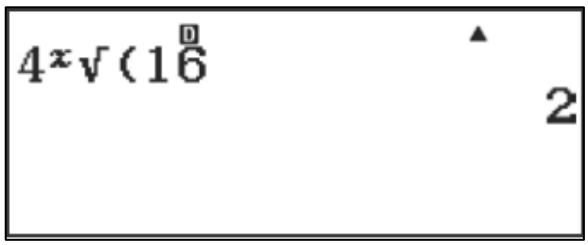
Example: $\sqrt[4]{16}=2$
(Mathl/MathO)

SHIFT $x^{\blacksquare}$ 4 ▶ 1 6 =



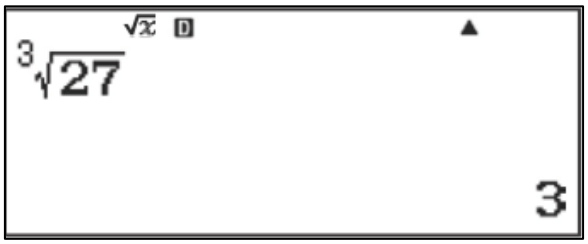
(Linel/LineO)

4 SHIFT $x^{\blacksquare}$ 1 6 =



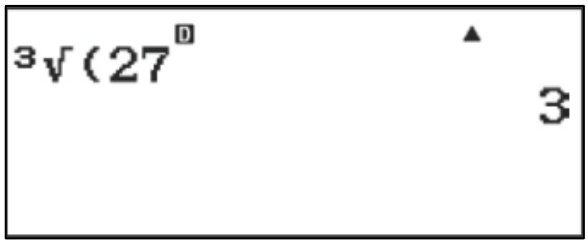
Example: $\sqrt[3]{27}=3$
(Mathl/MathO)

SHIFT √■ 2 7 =



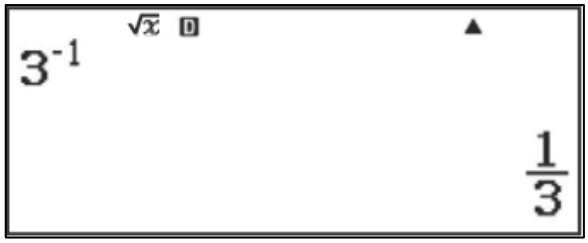
(Linel/LineO)

SHIFT √■ 2 7 =



Example: $3^{-1} = \frac{1}{3}$
(Mathl/MathO)

3 x^{-1} =



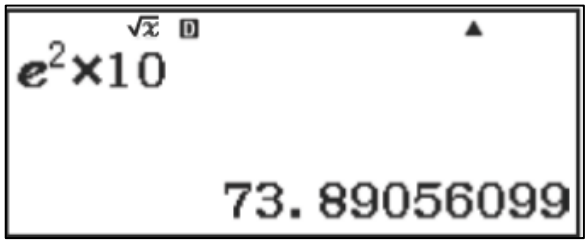
Exponential function/Logarithmic (log) function

Exponential function

Exponential functions can be used in calculation Calculate, Statistics, Distribution, Equation/Func, Inequality, Matrix, table, Vector, Verify, Ratio and Complex mode.

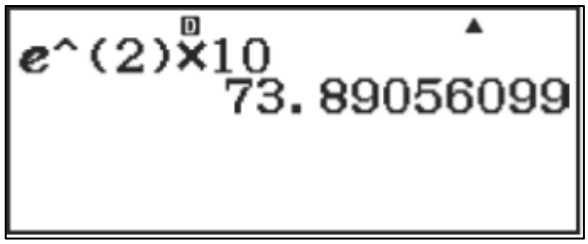
Example: $e^2 \times 10 = 73.89056099$
(Mathl/MathO)

SHIFT ln 2 ▶ × 1 0 =



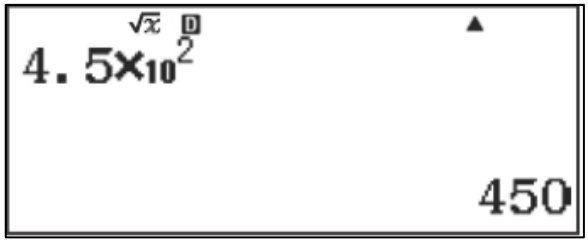
(Linel/LineO)

SHIFT ln 2) × 1 0 =



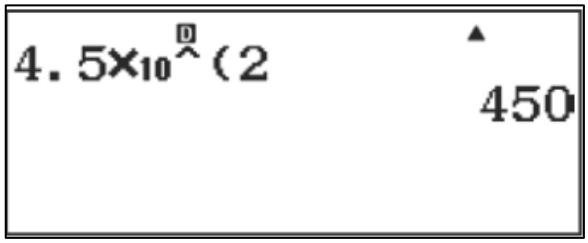
Example: $4.5 \times 10^2 = 450$
(Mathl/MathO)

4 • 5 × SHIFT log■ 2 =



(Linel/LineO)

4 • 5 × SHIFT log 2 =



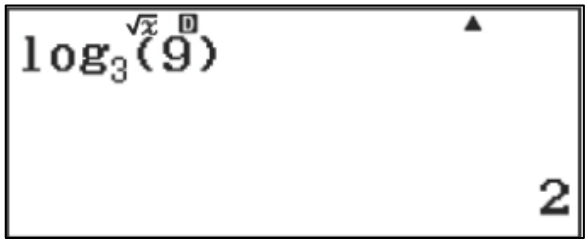
Logarithmic (log) function

- Logarithmic functions can be used in calculation Calculate, Statistics, Distribution, Equation/Func, Inequality, Matrix, Table, Vector, Verify, Ratio and Complex mode.
- For the logarithm function "$log($" you can determine the base m using the expression "$log\ (m,n)$"
- If you input only one value, base 10 will be used for the calculation.
- "In(" is a natural logarithm function with base e.
- You can also use the log key when entering an expression "$log\ (m,n)$" while using MathI/MathO or LineI/LineO mode.

Example: $\log_3 9 = 2$

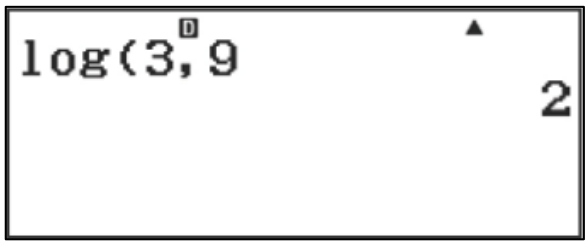
(MathI/MathO)

log 3 ▶ 9 =



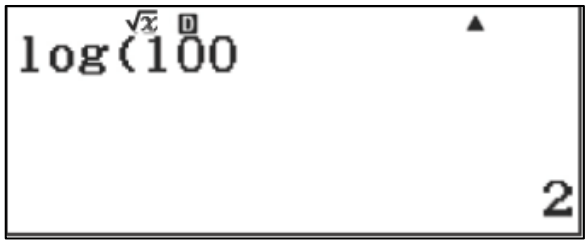
(LineI/LineO)

ALPHA (−) (or log) 3 SHIFT) 9 =



Example: $\log 100 = 2$

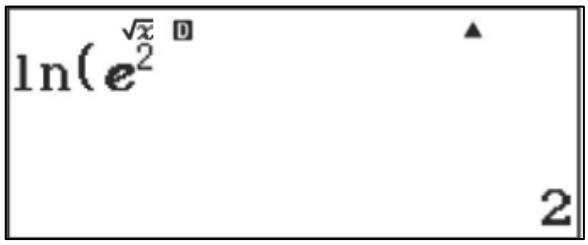
SHIFT (−) 1 0 0 =



If you don't input a base value, the function will default to base 10.

Example: $\ln e^2 = 2$

[ln] [ALPHA] [×10^x] [x²] [=]

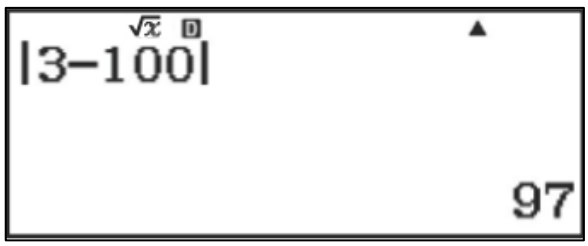


Absolute Value (ABS)

Example: $\text{Abs}(3-100) = |3-100| = 97$

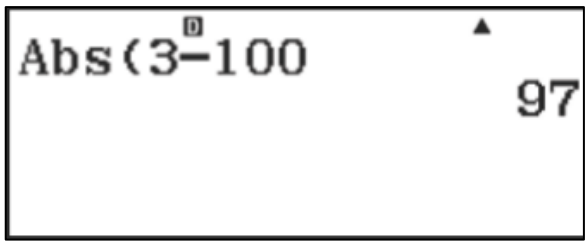
(Mathl/MathO)

[SHIFT] [(] [3] [−] [1] [0] [0] [=]



(Linel/LineO)

[SHIFT] [(] [3] [−] [1] [0] [0] [=]



Factorial (FAC)

Example: $(2+6)! = 40320$

[(] [2] [+] [6] [)] [SHIFT] [x⁻¹] [=]

Pi (π) number and Base e

Pi (π) number

To input π we do the following: [SHIFT] [×10^x]

Value of $\pi = 3.14159265358980$

Note

- Display value of $\pi = 3.141592654$
- Calculated value of $\pi = 3.14159265358980$
- You can use π in any calculation mode except Base-N.

Base e

To input the base natural logarithm e, we operate as follows: [ALPHA] [×10^x]
The value of base $e = 2.71881828459042$

Note

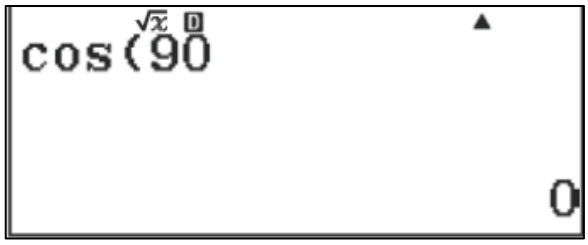
- Display value of base $e = 2.71881828$
- Calculated value of base $e = 2.71881828459042$
- You can use base e in any calculation mode except Base-N.

Trigonometry and Inverse Trigonometry

Trigonometric

Trigonometric functions can be used in calculation Calculate, Statistics, Distribution, Equation/Func, Inequality, Matrix, Table, Vector, Verify, Ratio and Complex mode.
Example: $Cos(90) = 0$
(Angle Unit: Degree)

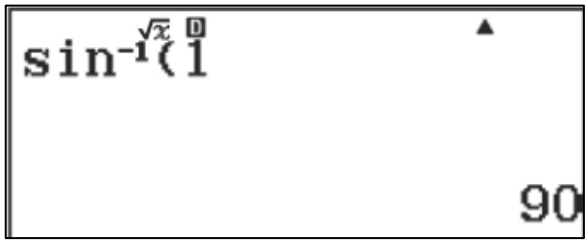
[cos] [9] [0] [=]



Inverse trigonometry

Inverse trigonometric functions can be used in calculation Calculate, Statistics, Distribution, Equation/Func, Inequality, Matrix, Table, Vector, Verify, Ratio and Complex mode.
Example: $\mathrm{Sin}^{-1}(1) = 90$
(Angle Unit: Degree)

[SHIFT] [sin] [1] [=]



Hyperbolic and Inverse Hyperbolic

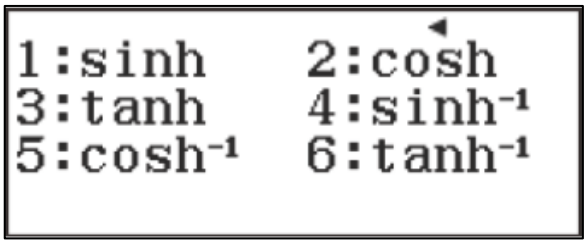
Hyperbolic Func

Hyperbolic functions can be used in calculation Calculate, Statistics, Distribution, Equation/Func, Inequality, Matrix, table, Vector, Verify, Ratio and Complex mode.

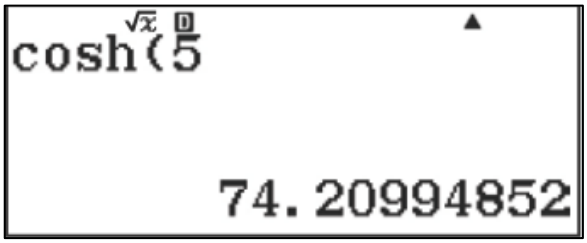
To use the Hyperbolic function, you can press [OPTN] [x] (Hyperbolic Func)

Example: $\mathrm{Cosh}(5) = 74.20994852$

[OPTN] [x] (Hyperbolic Func)



[2] (cosh) [=]



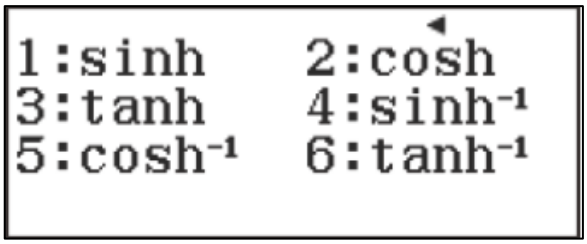
Inverse Hyperbolic Func

Inverse Hyperbolic functions can be used in calculation: Calculate, Statistics, Distribution, Equation/Func, Inequality, Matrix, Table, Vector, Verify, Ratio and Complex mode.

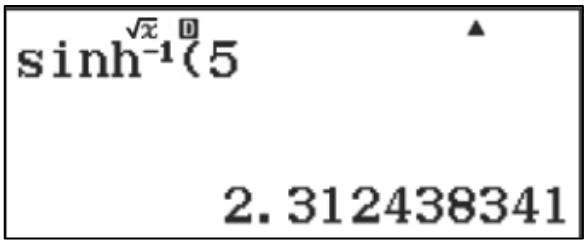
To use the Inverse Hyperbolic function, you can press [OPTN] [x] (Hyperbolic Func)

Example: $\mathrm{Sinh}^{-1}(5) = 2.312438341$

[OPTN] [x] (Hyperbolic Func)



[4] (Sinh^{-1}) [5] [=]



Scientific constants

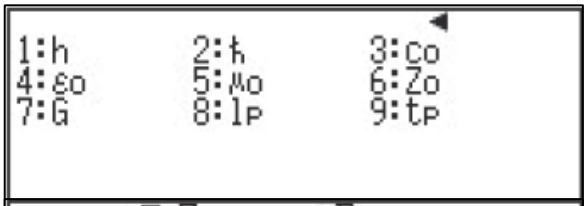
The calculator integrates up to 47 scientific constants that can be used in any mode besides BASE-N. Each scientific constant can be used in calculation operations as a unique symbol (such as "e"), which can be used inside of calculations.

To enter a scientific constant into the calculation, you can do as follows:

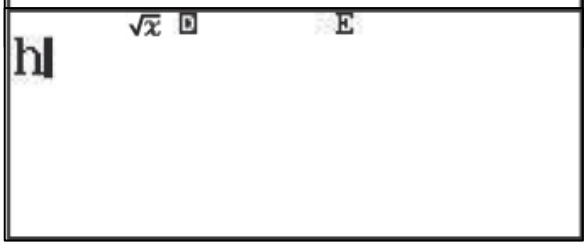
Example: To enter the scientific constant h (Planck's constant) and display its value.

SHIFT 7 (to display the list of scientific constants)

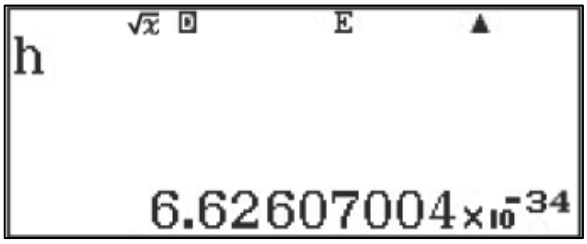
1 (Universal) (to display the list scientific constants of category Universal)



1 (h: Planck's constant)

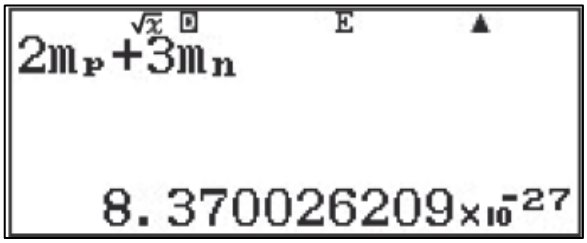


=

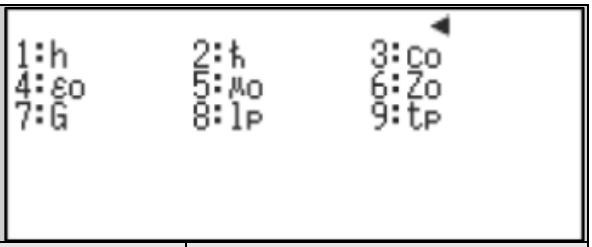


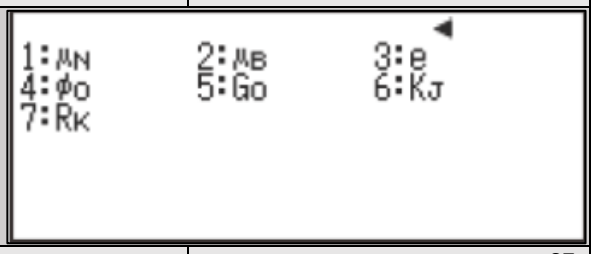
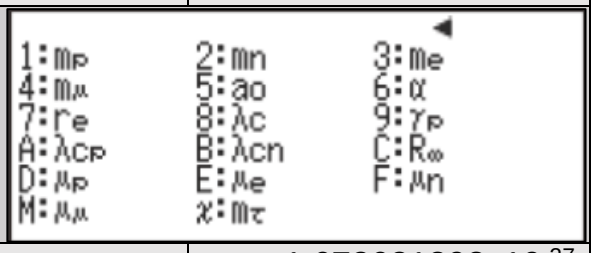
Example 2: Calculate $2m_p+3m_n$

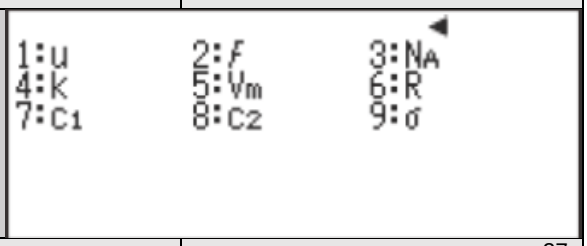
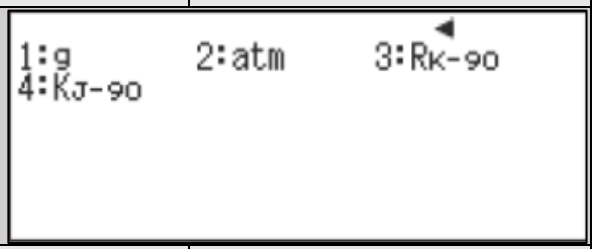
2 SHIFT 7 3 1 +
3 SHIFT 7 3 2 =

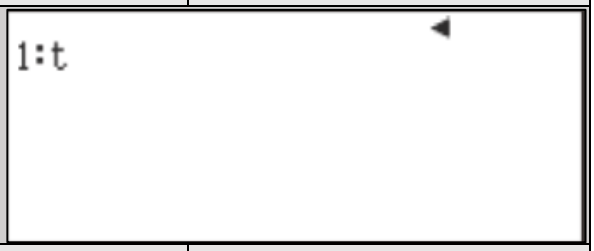


The table below shows the scientific constants included in each category:

SHIFT 7 (CONST) 1 (Universal)		
1 h	Planck constant	6,62607004x10^{-34}
2 ħ,	Reduced Planck constant	1,0545718x10^{-34}
3 c	Speed of light in vacuum	299792458
4 ε_0	Vacuum electric permittivity	8,854187817x10^{-12}

5 μ_0	Vacuum magnetic permeability	$1{,}256637061 \times 10^{-6}$
6 Z_0	Impedance of free space	376,7303135
7 G	Newtonian constant of gravitation	$6{,}616229 \times 10^{-11}$
8 l_P	Length Planck	$1{,}616229 \times 10^{-35}$
9 t_P	Time Planck	$5{,}39116 \times 10^{-44}$
SHIFT 7 (CONST) 2 (Electromagnetic)		
1 μ_N	Nuclear magneton ratio	$5{,}050783699 \times 10^{-27}$
2 μ_B	Bohr magneton ratio	$9{,}274009994 \times 10^{-24}$
3 e	The elementary charge	$1{,}602176621 \times 10^{-19}$
4 Φ_0	Magnetic flux quantum	$2{,}067833831 \times 10^{-15}$
5 G_0	Magnetic flux quantum	$7{,}748091732 \times 10^{-5}$
6 K_J	Josephson constant	$4{,}835978525 \times 10^{14}$
7 R_K	Von Klitzing constant	25812,80746
SHIFT 7 (CONST) 3 (Atomic & Nuclear)		
1 m_p	Proton mass	$1{,}672621898 \times 10^{-27}$
2 m_n	Neutron mass	$1{,}674927471 \times 10^{-27}$
3 m_e	Electron mass	$9{,}10938356 \times 10^{-31}$
4 m_μ	Muon mass	$1{,}883531594 \times 10^{-28}$
5 a_0	Bohr radius	$5{,}291772107 \times 10^{-11}$
6 α	fine-structure constant	$7{,}297352566 \times 10^{-3}$
7 r_e	Classical electron radius	$2{,}817940323 \times 10^{-15}$
8 λ_C	Compton wavelength	$2{,}426310237 \times 10^{-12}$
9 γ_p	Proton gyromagnetic ratio	267522190
A λ_{Cp}	Proton Compton wavelength	$1{,}321409854 \times 10^{-15}$
B λ_{Cn}	Neutron Compton wavelength	$1{,}319590905 \times 10^{-15}$

C R_∞	Rydberg constant	10973731,57
D μ_p	Proton magnetic moment	$1,410606787x10^{-26}$
E μ_e	Electron magnetic moment	$-9,28476462x10^{-24}$
F μ_n	Neutron magnetic moment	$-9,662365x10^{-27}$
M μ_μ	Muon magnetic moment	$-4,49044826x10^{-26}$
x m_τ	Tauon mass	$3,16747x10^{-27}$
SHIFT 7 (CONST) 4 (Physio-Chem)		
1 u	Atomic mass constant	$1,66053904x10^{-27}$
2 *F*	Faraday constant	96485,33289
3 N_A	Molar volume of ideal gas	$6,022140857x10^{23}$
4 K	Boltzmann constant	$1,38064852x10^{-23}$
5 V_m	Molar volume of ideal gas	0,022710947
6 R	Molar Gas constant	8,3144598
7 c_1	First radiation constant	$3,74177179x10^{-16}$
8 c_2	Second radiation constant	0,0143877736
9 σ	Stefan-Boltzmann constant	5,670367
SHIFT 7 (CONST) 5 (Adopted Values)		
1 g	Standard acceleration of gravity	9,80665
2 atm	Magnetic flux quantum	101325
4 R_{K-90}	The value converts of	25812,807

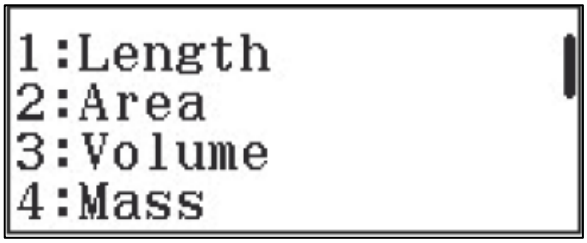
	the von Klitzing constant	
5 $K_{J\text{-}90}$	The value converts of the Josephson constant	$4{,}835979 \times 10^{14}$
SHIFT 7 (CONST) 6 (Other)		
1 t	Celsius temperature	273,15

Unit Conversion

The calculator's built-in metric conversion commands make it simple 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.

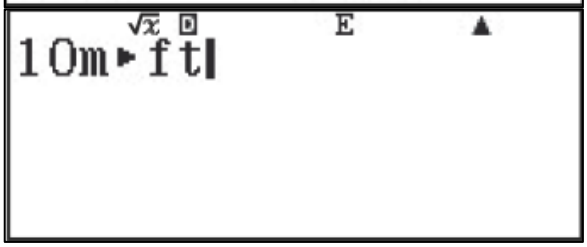
Example 1: To convert 10m to feet.

SHIFT 8 (to display the metric conversion menu)

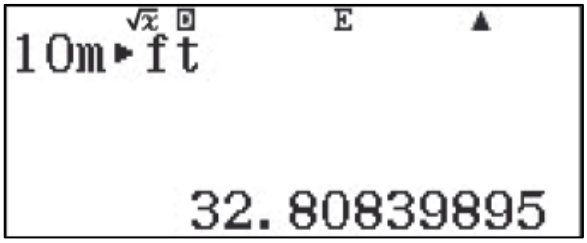


1 (to display the Length list)

1 0 4 (m ▶ ft)

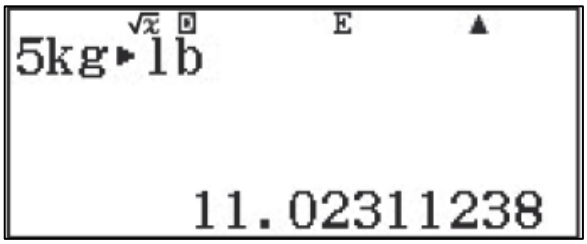


=

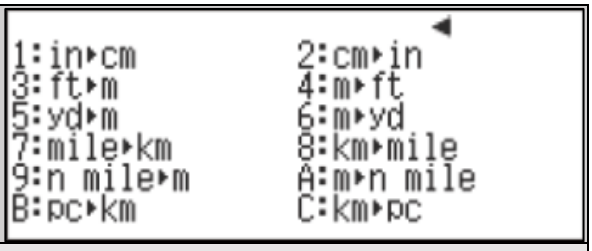
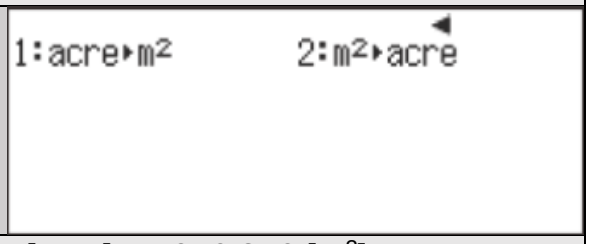
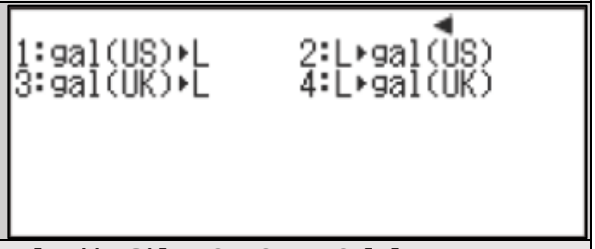


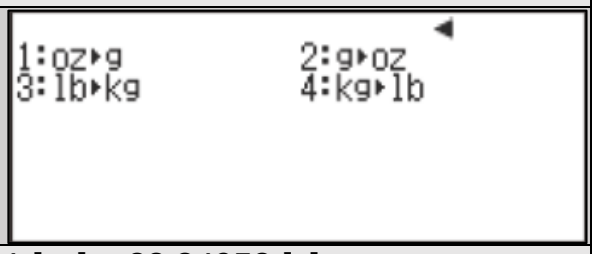
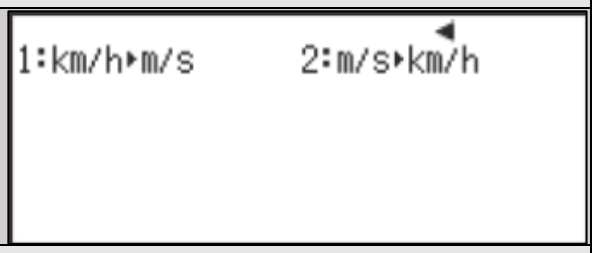
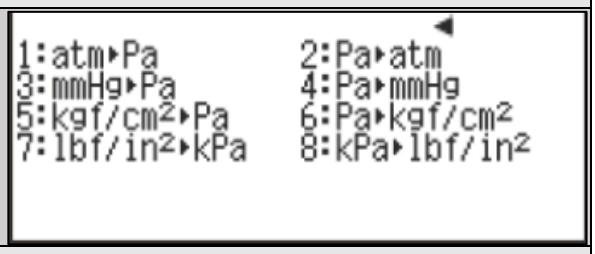
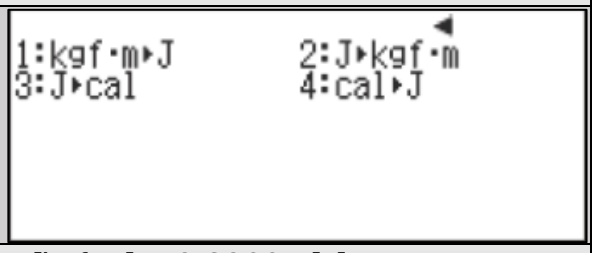
Example 2: To convert 5kg to Pound.

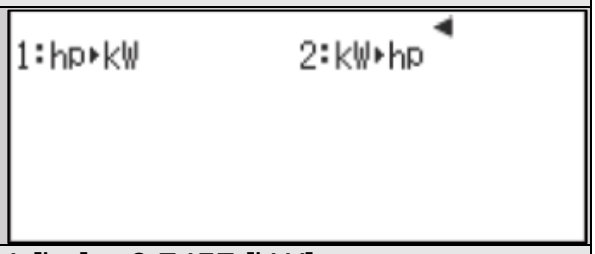
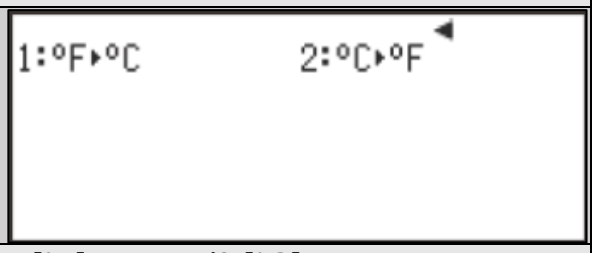
5 SHIFT 8 (CONV) 4 (Mass) 5 (kg ▶ lb)



* The table below shows the unit conversion commands included in each Category:

ALPHA 8 (CONV) 1 (Length)	
1 in ▶ cm	1 [inch] = 2,54 [cm]
2 cm ▶ in	1 [cm] = 50/127 [inch]
3 ft▶m	1 [ft] = 0,3048 [m]
4 m ▶ ft	1 [m] = 1250/381 [m]
5 yd ▶ m	1 [yd] = 0,9144 [m]
6 m ▶ yd	1 [m] = 1250/1143 [yd]
7 mile ▶ km	1 [mile] = 1,609344 [km]
8 km ▶ mile	1 [km] = 0,6213711922 [mile]
9 n mile ▶ m	1 [n mile] = 1852 [m]
A m ▶ n mile	1 [m] = 1/1852 [n mile]
B Pc ▶km	1 [pc] = $3{,}085678 \times 10^{13}$
C km▶pc	1 [km] = $3{,}24077885 \times 10^{-14}$ [pc]
ALPHA 8 (CONV) 2 (Area)	
1 acre ▶m^2	1 [acre] = 4046,856 [m^2]
2 m^2 ▶acre	1 [m^2] = 125/505857 [acre]
ALPHA 8 (CONV) 3 (Volume)	
1 gal (US) ▶L	1 [gal(US)] = 3,785412 [L]

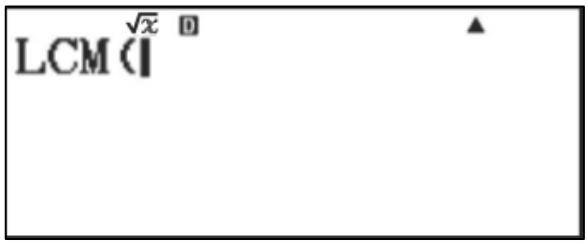
2 L▶ gal (US)	1 [L] = 0,26417203373 [gal(US)]
3 gal (UK) ▶R	1 [gal(UK)] = 4,54609 [L]
4 R▶ gal (UK)	1 [L] = 0,2199692483 [gal(UK)]
ALPHA 8 (CONV) 4 (Mass)	
1 oz ▶g	1 [oz] = 28,34952 [g]
2 g ▶oz	1 [g] = 0,03527396584 [oz]
3 lb ▶kg	1 [lb] = 0,4535924 [kg]
4 kg ▶lb	1 [kg] = 2,204622476 [lb]
ALPHA 8 (CONV) 5 (Velocity),	
1 km/h ▶m/s	1 [km/h] = 5/18 [m/s]
2 m/s ▶km/h	1 [m/s] = 18/5 [km/h]
ALPHA 8 (CONV) 6 (Pressure)	
1 atm ▶Pa	1 [atm] = 101325 [Pa]
2 Pa ▶atm	1 [Pa]= 1/101325 [atm]
3 mmHg ▶Pa	1 [mmHg] = 133,3224 [Pa]
4 Pa ▶mmHg	1 [Pa] = 7,50061505x10^{-3} [mmHg]
5 kgf/cm^2 ▶Pa	1 [kgf/cm^2] = 196133/2 [Pa]
6 Pa ▶kgf/cm^2	1 [Pa] = 2/196133 [kgf/cm^2]
7 lbf/in^2 ▶kPa	1 [lbf/in^2] = 6,894757 [kPa]
8 kPa ▶lbf/in^2	1 [kPa] = 0,1450377439 [lbf/in^2]
ALPHA 8 (CONV) 7 (Energy)	
1 kgf • m ▶J	1 [kgf.m] = 9,80665 [J]

2 J ▶ kgf • m	1 [J] = 0,1019716213 [kgf.m]
3 J ▶cal	1 [J] = 5000/20929 [cal]
4 cal ▶J	1 [cal] = 4,1858 [J]
ALPHA 8 (CONV) 8 (Power)	
1 hp ▶kW	1 [hp] = 0,7457 [kW]
2 kW ▶hp	1 [kW] = 1,341021859 [hp]
ALPHA 8 (CONV) 9 (Temperature)	
1 °F ▶°C	1 [°F] = - 155/9 [°C]
2 °C ▶°F	1 [°C] = 169/5 [°F]

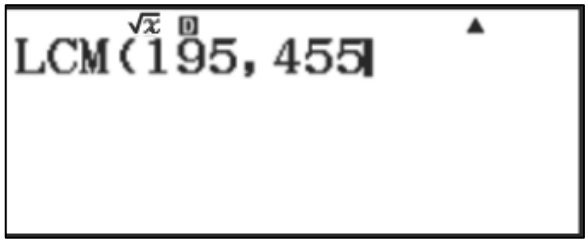
Find the Least Common Multiple (LCM) and the Greatest Common Divisor (GCD)

Example 1: Find the least common multiple (LCM) of 195 and 455.

ALPHA ÷ (LCM)



1 9 5 SHIFT) (,) 4 5 5



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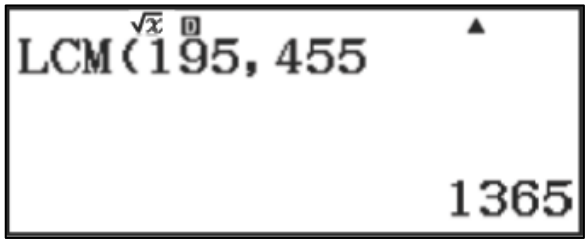
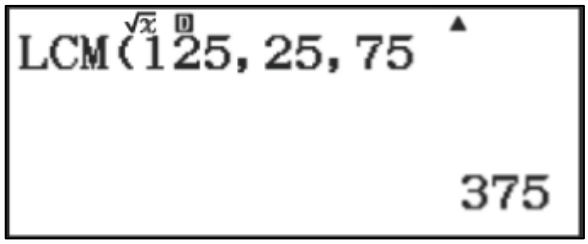
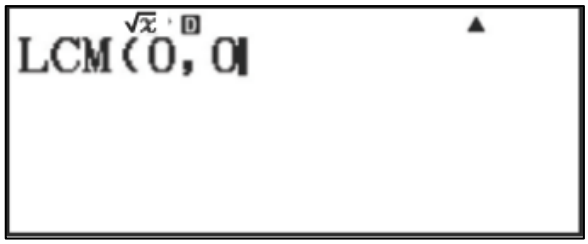


Example 2: Find the least common multiple (LCM) of the 125, 25, 75 and 0, 0 and 0, 2

ALPHA ÷(LCM) 1 2 5 SHIFT) (,) 2 5 SHIFT) (,) 7 5 =



ALPHA ÷(LCM) 0 SHIFT) (,) 0



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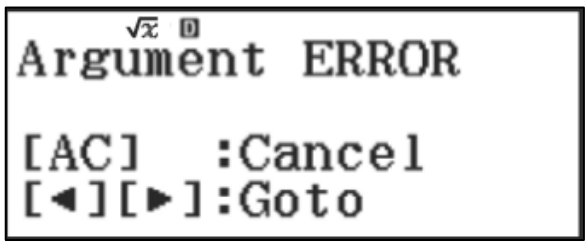
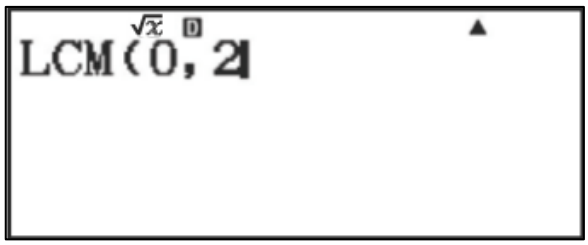


ALPHA ÷(LCM) 0 SHIFT) (,) 2



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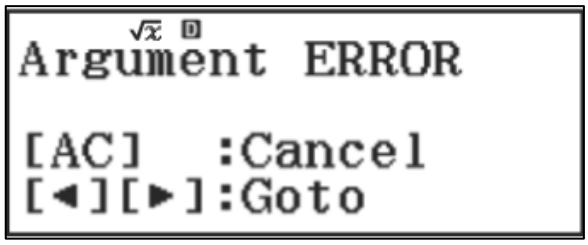
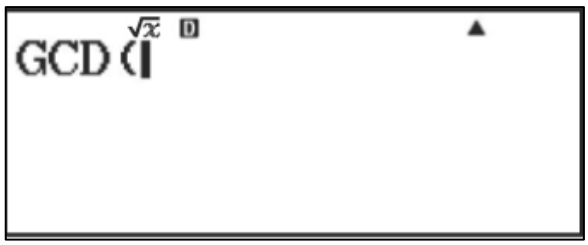
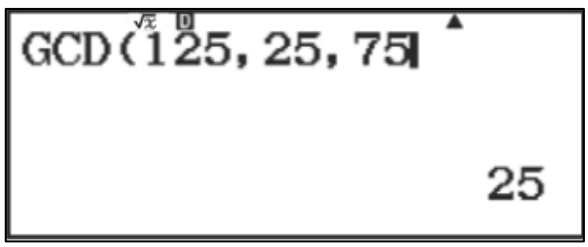


Example 3: Find the greatest common divisor (GCD) of the 125, 25, 75 and 0, 0 and 0, 2

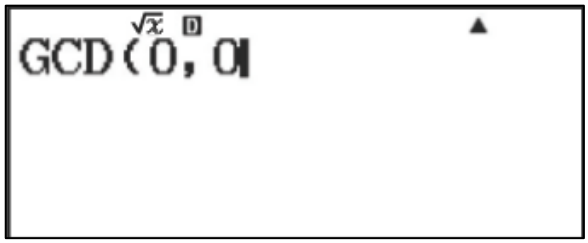
ALPHA ×(GCD)



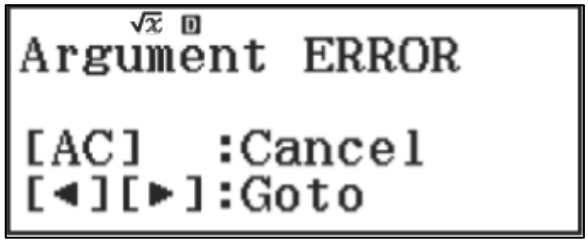
1 2 5 SHIFT) (,) 2 5 SHIFT) (,) 7 5 =



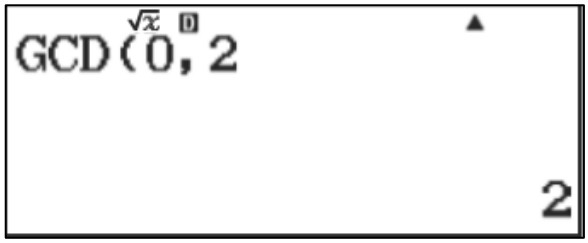
AC ALPHA ✕(GCD) 0 SHIFT) (,) 0



=



AC ALPHA ✕(GCD) 0 SHIFT) (,) 2 =



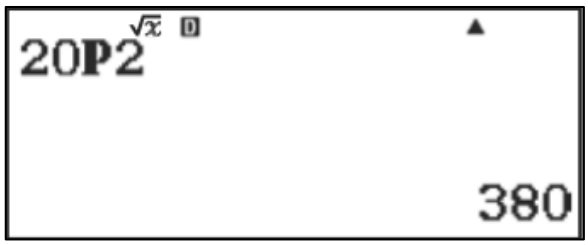
Performance Function (nPr) and Combination Function (nCr)

n and r must be integers in the range $0 \leq r \leq n < 1010$.

Example: To determine the number of permutations and combinations, when selecting 2 people from a group of 20 people.

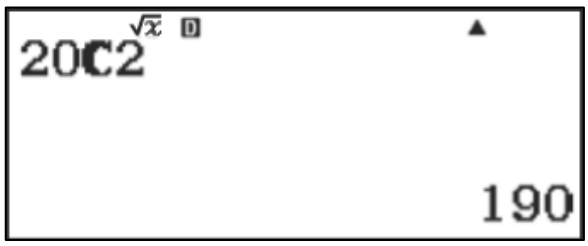
Permutation:

2 0 SHIFT ✕(nPr) 2 =

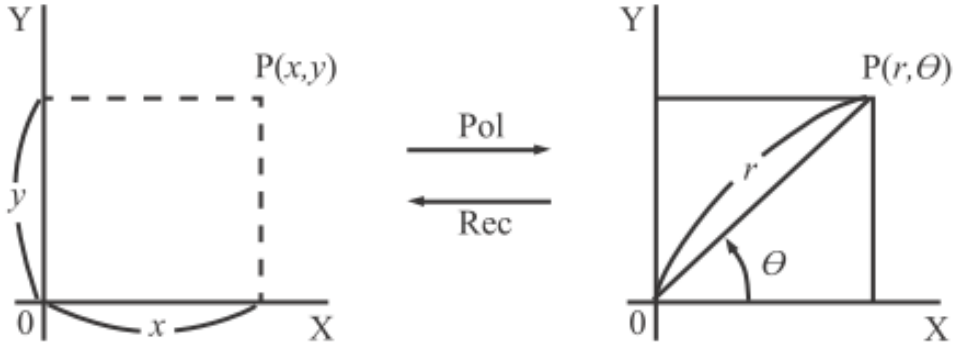


Combination:

2 0 SHIFT ÷(nCr) 2 =



Convert coordinates



Rectangular coordinates (Rec) Polar coordinates (Pol)

- The coordinate conversion function can only be used in the following calculation modes: Calculate, Statistics, Matrix and Vector.
- Pol: Convert rectangular coordinates to polar coordinates.
- Rec: Convert polar coordinates to rectangular coordinates.

Convert to polar coordinates (Pol)

Pol (X, Y) X: X value in rectangular coordinates.
Y: Y value in rectangular coordinates.

- The result of calculation θ is displayed in the range $-180^0 < \theta < 180^0$
- The result of calculating θ depends on the angle unit set.
- The calculation result r is assigned to variable X, and θ is assigned to Y.

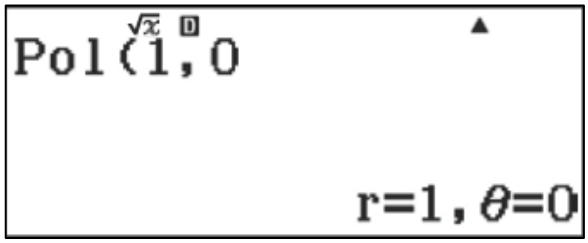
Convert to rectangular coordinates (Rec)

Rec(r, θ) r: Value of r in polar coordinates.
θ: value of θ in polar coordinates.

- The result of calculation x is assigned to variable X, and y is assigned to Y.
- If you perform a coordinate conversion in an expression instead of a single operation, the calculation will be performed using only the first value (or the r value or the X value) produced by the conversion.

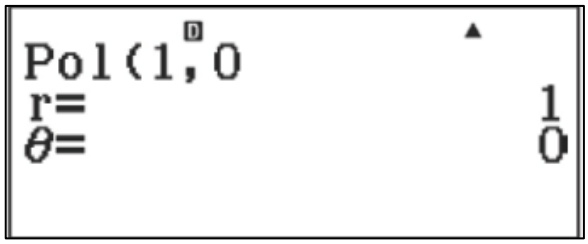
Example: $(X, Y) = (1,0) \rightarrow (r, \theta)$ (Angle Unit: Degree)
(Mathl/MathO)

SHIFT + (Pol) 1 SHIFT) (,) 0 =



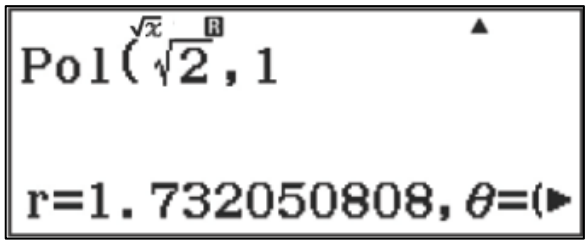
(Linel/LineO)

SHIFT + (Pol) 1 SHIFT) (,) 0 =



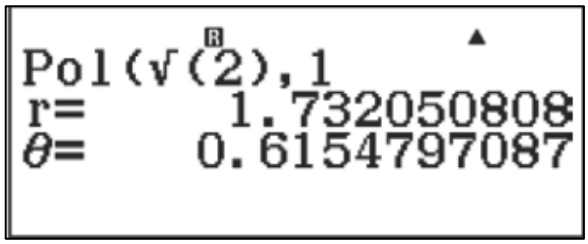
Example: $(\mathrm{X},\mathrm{Y}) = (\sqrt{1}, 1) \rightarrow (r, \theta)$ (Angle Unit: Degree)
(Mathl/MathO)

SHIFT + (Pol) √■ 2 ▶ SHIFT)
(,) 1 =



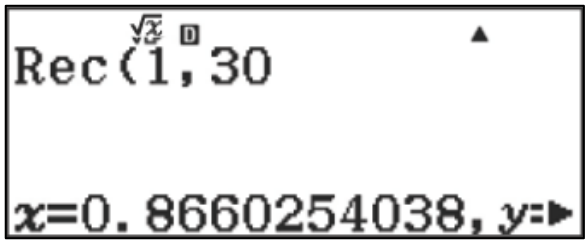
(Linel/LineO)

SHIFT + (Pol) √■ 2) SHIFT)
(,) 1 =



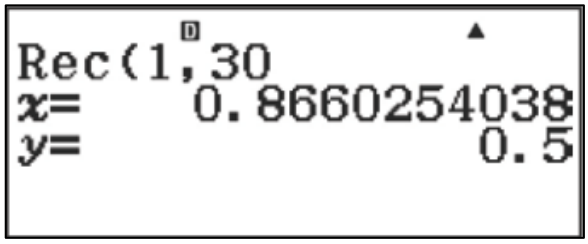
Example: $(r, \theta) = (1, 30) \rightarrow (X, Y)$ (Angle Unit: Degree)
(Mathl/MathO)

SHIFT − (Rec) 1 SHIFT) (,) 3 0 =



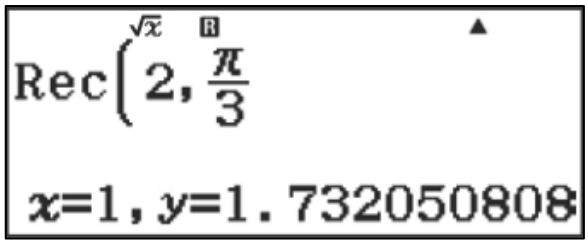
(Linel/LineO)

SHIFT − (Rec) 1 SHIFT) (,) 3 0 =



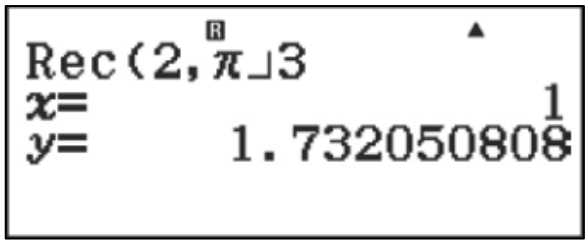
Example: $(r, \theta) = (2, \frac{\pi}{3}) \rightarrow (X, Y)$ (Angle Unit: Radian)
(Mathl/MathO)

SHIFT − (Rec) 2 SHIFT)
(,) SHIFT x10^x 🖶 3 =



(Linel/LineO)

SHIFT (−)(Rec) 2 SHIFT)
(,) SHIFT ×10^x ▤ 3 =

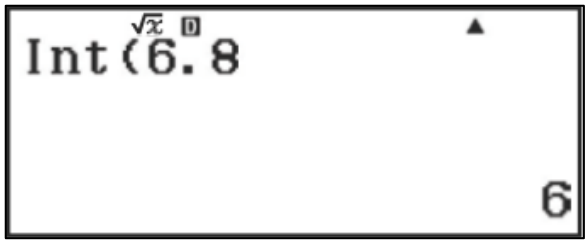


Calculate Integer part of the value (INT). The Largest Integer that does not exceed the value (INTG)

Integer part of value (INT)

Example: Find the integer part of 6.8.

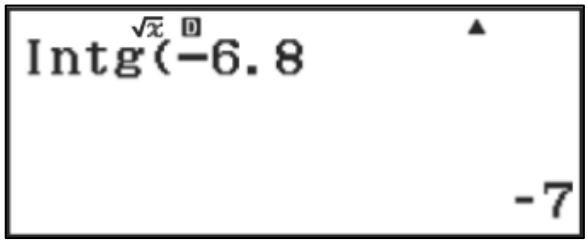
ALPHA +(Int) 6 • 8 =



The largest integer that does not exceed the value (Intg)

Example: Find the largest integer not greater than −6.8

ALPHA −(Intg) (−) 6 • 8 =



Round off function (RND)

Use the Rnd function to format the results according to the current Number Format setting.

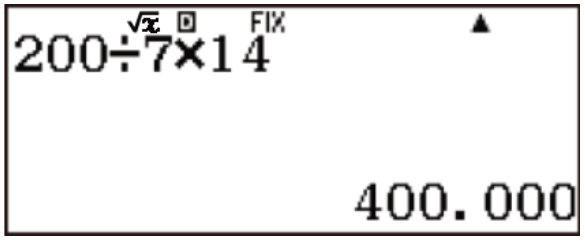
Number Format: Norm 1 or Norm 2

Using the Norm 1 or Norm 2 setting causes the argument to be rounded off at the 10th digit of the mantissa part.

Number Format: Fix or Sci

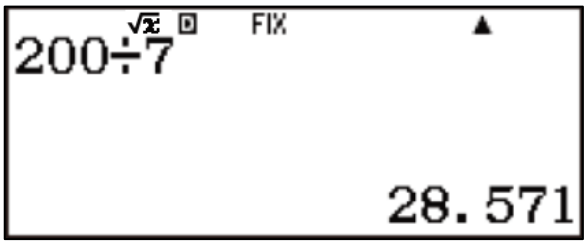
Example: To perform the following calculation when Fix 3 is selected for the number of displayed digits: $200 \div 7 \times 14 = 400$ (Mathl/DecimalO).

2 0 0 ÷ 7 × 1 4 =

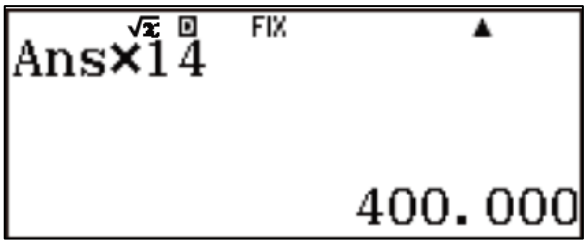


(The calculation is done internally using 15 digits).

2 0 0 ÷ 7 =

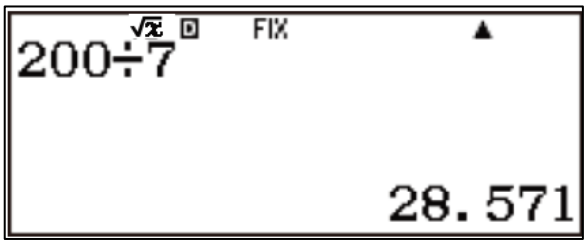


× 1 4 =



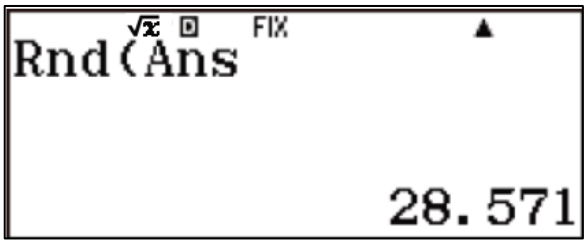
Below does the same calculation and is rounded.

2 0 0 ÷ 7 =



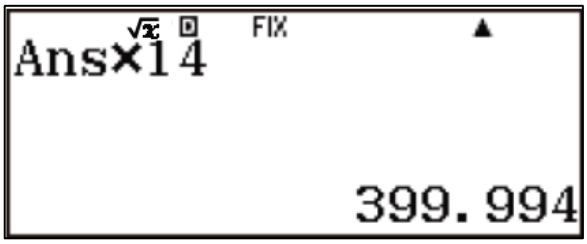
(Round off the value to the specified digits)

SHIFT 0 (Rnd) =



Check round off results.

× 1 4 =



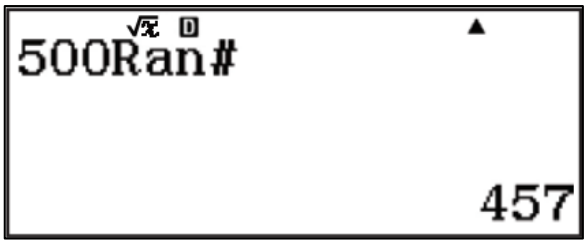
Ran#, RanLnt#, RanABC

Random number (Ran#)

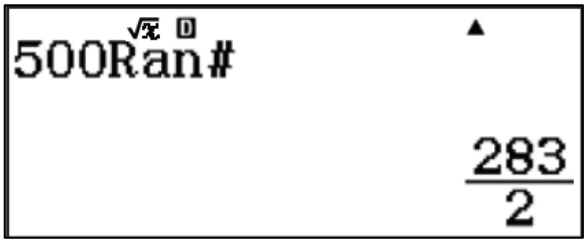
The function creates a random number(Ran#) between 0.000 and 0.999. The result will be displayed as a fraction in Mathl/MathO mode.

Example: Create three 3-digit random numbers less than or equal to 500.

[5] [0] [0] [SHIFT] [•] [=]



[=]



[=]

Note:

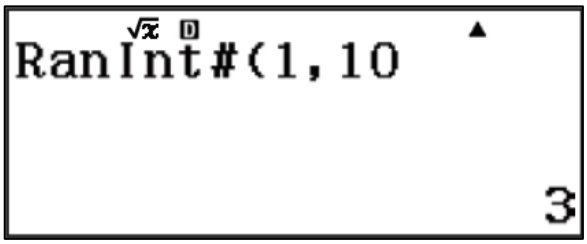
- The calculator may give results different from the results in the image illustration above.

Random Integer (RanInt#)

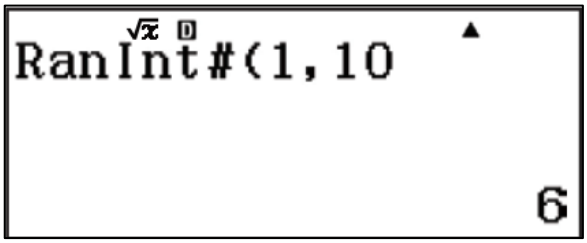
Entering a function of the RanInt#(a,b) will create a random integer between a and b.

For example: To create random integers in the range from 1 to 10.

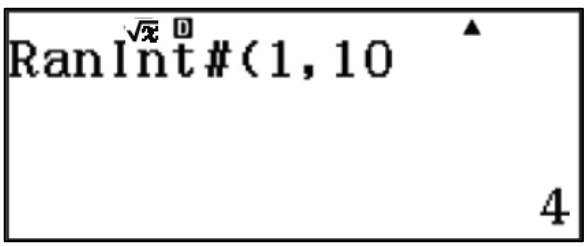
[ALPHA] [•] [1] [SHIFT] [)] [1] [0] [=]



[=]



[=]



Note:

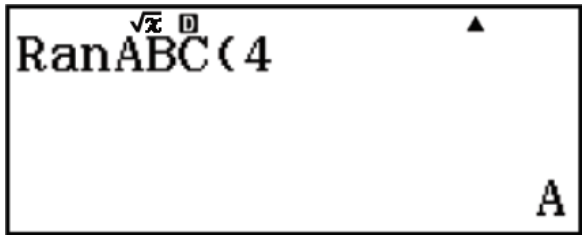
- The calculator may give results different from the results in the image illustration above.

Random letters (RanABC)

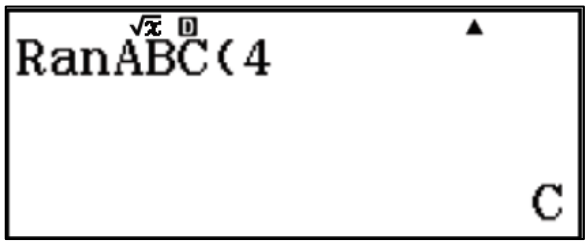
Entering the function RanABC(a) format will create a random letter from A to F the letter with the number a according to the Alphabet.

For example: To create random letters from A to F.

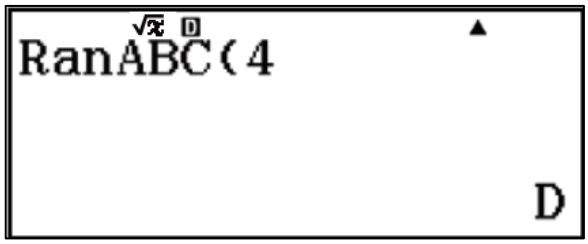
[ALPHA] [0] (RanABC) [4] [=]



[=]



[=]

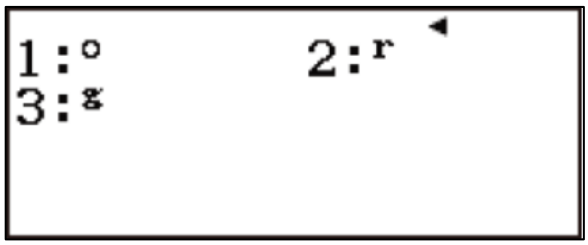


Note:

- The calculator may give results different from the results in the image illustration above.

Angular Unit

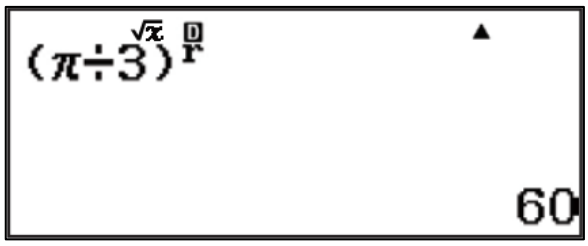
After inputting a value, press [OPTN] [❯] [2] (Angle Unit) to go to the angle unit selection menu screen. Press the key corresponding to the angle unit to use. The calculator will automatically calculate according to the selected angle unit.



^{O}: Degree, ^{r}: Radian, ^{g}: Grad

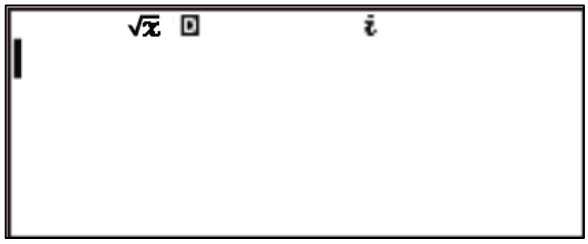
Example: To convert the following values to degrees: $\frac{\pi}{3} radian = 60^o$, $50\ grad = 45^o$

(Angle Unit) 2 =



Complex numbers (CMPLX)

To perform calculation operations related to complex numbers, we enter Complex mode. Press key MENU 2 to enter **COMPLEX** mode.

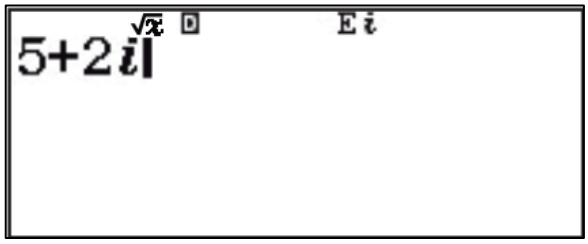


Inputting complex numbers

In Complex mode, the ENG key will be used to input the virtual number $\boldsymbol{i}$. Use the ENG key when inputting rectangular coordinate format $a + bi$.

For example, Input: $5 + 2i$

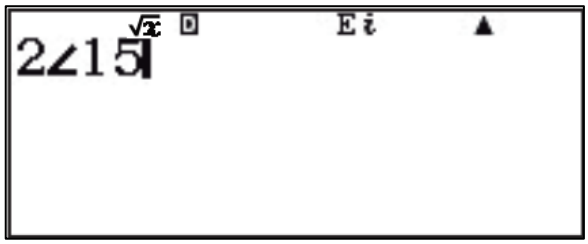
5 + 2 ENG (i)



To input values for complex numbers, we can also use polar coordinate format $(r\angle\theta)$

For example, to Input $2\angle 15$:

2 SHIFT ENG $(\angle)$ 1 5

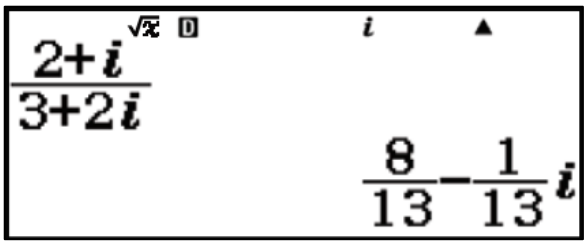


Format the way calculation results are displayed on the calculator screen

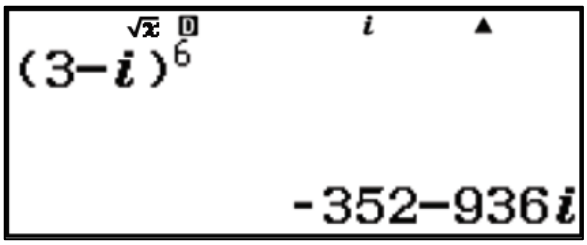
The way complex number calculation results are displayed will depend on the display format that has been set.

For Complex numbers $(a + bi)$ format:

Example 1: Calculate $\frac{(2+i)}{(3+2i)} = \frac{8}{13} - \frac{1}{13}i$



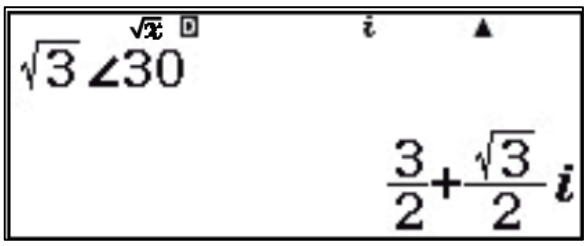
Example 2: Calculate $(3 - i)^6$



Note

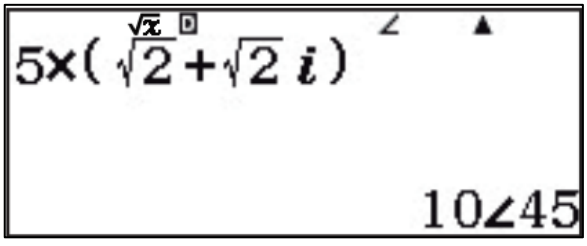
- For Complex numbers $(a + bi)^n$ format, the range of n is $-1010 < n < 1010$

Example 3: $\sqrt{3}\angle 30 = \frac{3}{2} + \frac{\sqrt{3}}{2}i$

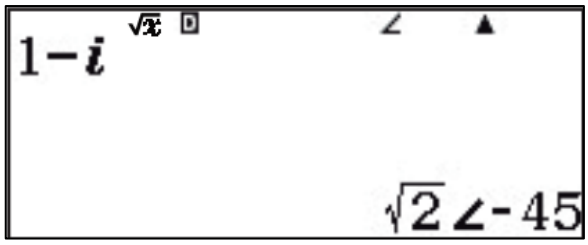


For Complex numbers $(r\angle\theta)$ format:

Example 1: $5 \times (\sqrt{2} + \sqrt{2}i) = 10\angle 45$ (Angle Unit: Gegree)



Example 2: $1 - i = \sqrt{2}\angle -45$(Angle Unit: Gegree)



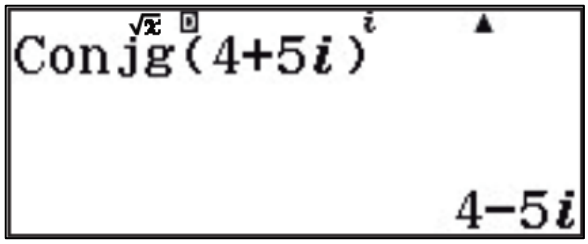
Note:

- Before starting the calculation, you must determine the angle unit.
- The value θ of the calculation result belongs to the range $-180^o < \theta < 180^o$
- In Linel/LineO or Linel/DecimalO calculation mode, the calculation results will display a and bi (or r and θ) on two separate lines.

Conjugated complex numbers (Conjg)

For example: To find the complex conjugate (Conjg) of $4 + 5i$
(Complex: $(a + bi)$)

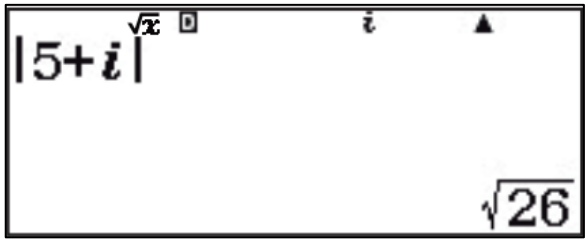
OPTN 2 (Conjugate) 4 + 5
ENG) =



Absolute value (Abs) and argument (Arg).

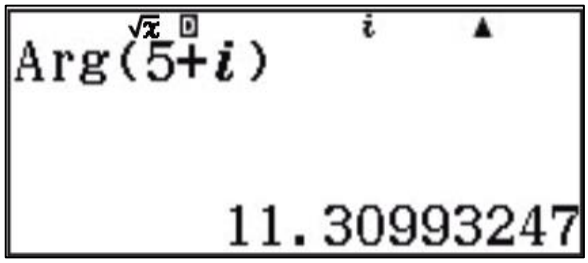
Example: To find the absolute value (Abs) and argument (Arg) of $5 + i$
+ Absolute value (Abs

SHIFT ((Abs) 5 + ENG (i)) =



+ Argument (Arg)

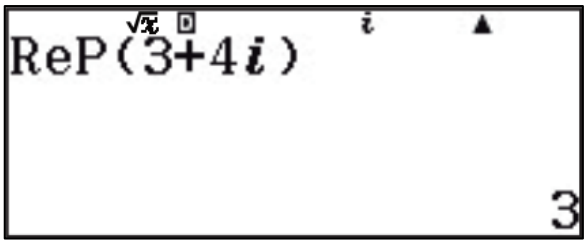
OPTN 1 (Argument) 5 + ENG) =



Real and imaginary parts (Rep, ImP)

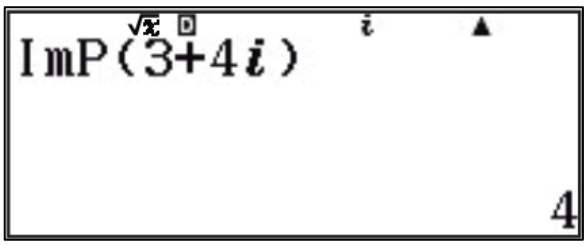
For example, to get the real part (ReP) and imaginary part (ImP) of $3 + 4i$
+ The Real part:

[OPTN] [3] (Real Part) [3] [+] [4] [ENG] [)] [=]



+ The Imaginary part

[OPTN] [4] (Imaginary part) [3] [+] [4] [ENG] [)] [=]

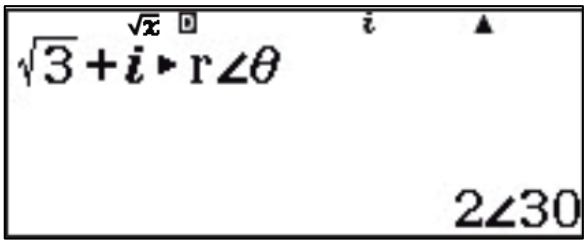


The complex number display format setting and calculation result display specification can be overwritten by performing key operations as below at the end of the calculation.

- To specify the rectangular coordinate format for displaying calculation results, perform the following key press: [OPTN] [▼] [6] (►$a + bi$)
- To specify the polar coordinate format for displaying calculation results, perform the following key press: [OPTN] [▼] [5] (►$r\angle\theta$)

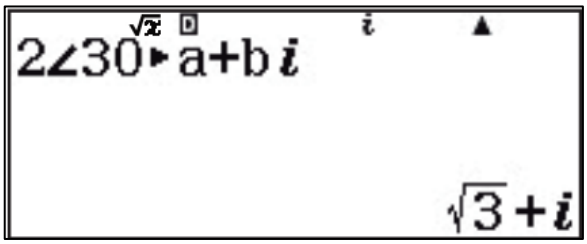
Example 1: $\sqrt{3} + i = 2\angle 30$, (Angle Unit: Degree)

[√] [3] [▶] [+] [ENG] [OPTN] [5] [=]



Example 2: $2\angle 30 = \sqrt{3} + i$, (Angle Unit: Degree)

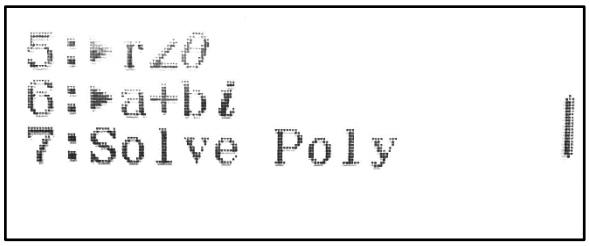
[2] [SHIFT] [ENG] [3] [0] [OPTN] [6] [=]



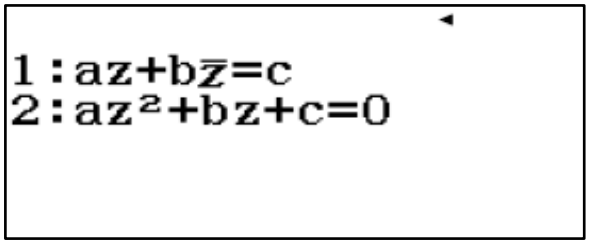
Solve complex equations (New Function)

To solve complex equations containing complex numbers, perform the following operations. In complex number mode (CMPLX).

Press [OPTN] [7] (Solve Poly) The screen appears as follows.

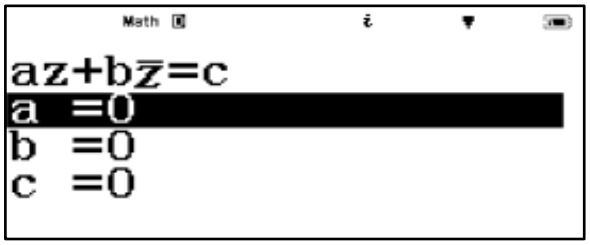


-To select to solve complex equations containing conjugate complex numbers, press [1] ($az + b\bar{z}$=c).
-To select to solve 2nd degree complex equations, press [2] ($az^2 + bz + c$=0).

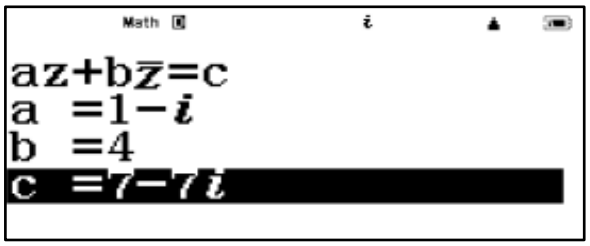


Solve complex equations containing conjugate complex
Example: Find the complex number z with ($(1 - i)z + 4\bar{z}$=7-7i).

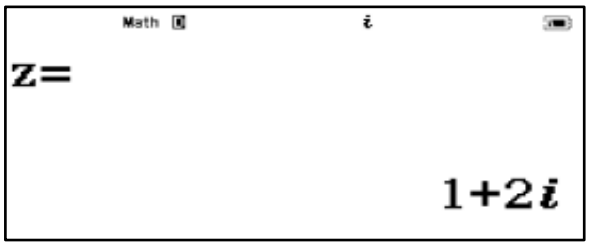
Press [OPTN] [7](Solve Poly) [1] ($az + b\bar{z}$=c).



[1] [−] [ENG] (i) [=] [4] [=] [7] [−] [7] [ENG] (i) [=]



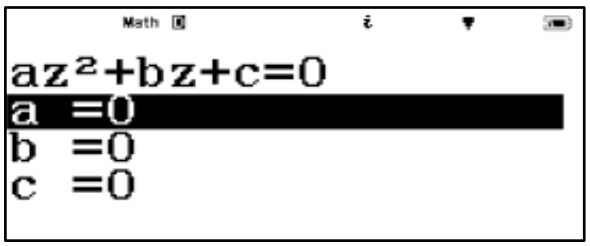
[=]



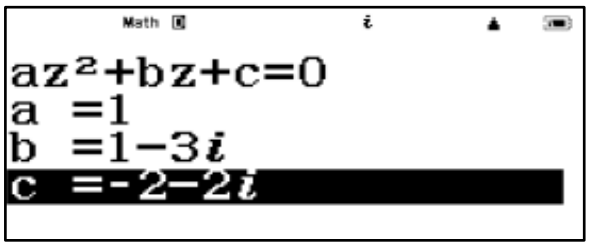
The result $z = 1 + 2i$

Solve 2nd degree complex equations
Example: Find the complex number z with với $z^2 + (1 - 3i)z + (-2 - 2i) = 0$

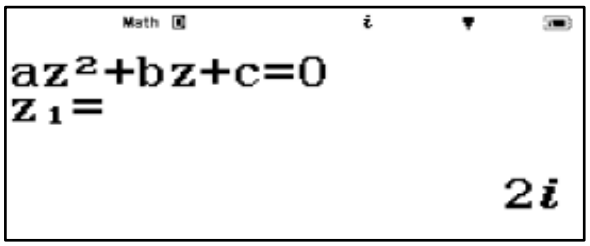
Press [OPTN] [7](Solve Poly) [2] ($az^2 + bz + c$=0).



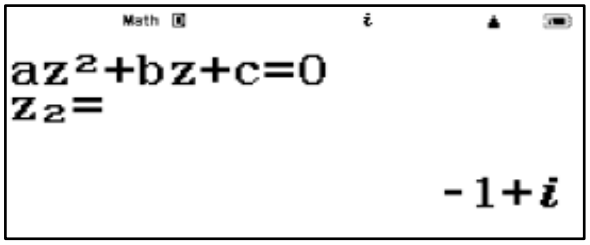
[1] [=] [1] [−] [3] [ENG] (i) [=] [−] [2] [−] [2] [ENG] (i) [=]



[=]



[=]



The result $z1 = 2i \; and \; z2 = -1 + i$

Base number N (BASE-N)

To perform calculations using decimal, hexadecimal, binary, and/or octal values. Press key [MENU] [3] to enter Base-N mode.

Set the Base system and input the value.

Use the keys below to specify the base system used in the calculation.

Keys:

Key	Base system	Symbols on the screen
[x^2] (DEC)	Decimal	[Dec]
[$x^{\blacksquare}$] (HEX)	Hexadecimal	[Hex]
[$\log_{\blacksquare}\square$] (BIN)	Binary	[Bin]
[ln] (OCT)	Octal	[Oct]

Note:

- When selecting Base-N mode, the base number system is initially set to Decimal ([Dec]).

Input value Base-N

- In Base-N mode, we can input values by selecting and using the corresponding base system.
- Error xx will occur if the input value does not match the number system being selected.
- In Base-N mode, we can't input fractional values or exponential functions. If the calculation results in a fractional value, the decimal part will be removed.

Input hexadecimal value Base-N

In hexadecimal system, to input letters (A, B, C, D, E, F) for calculated values, use the keys as below: (−)(A), °’’’(B), x^{-1}(C), sin(D), cos(E), tan(F).

The table below describes in detail the input data range and output data range for the number systems:

Base system	Data range
Binary system	Positive: $00000000000000000000000000000000 \leq x \leq 01111111111111111111111111111111$ Negative: $10000000000000000000000000000000 \leq x \leq 11111111111111111111111111111111$
Octal system	Positive: $00000000000 \leq x \leq 17777777777$ Negative: $20000000000 \leq x \leq 37777777777$
Decimal system	$-2147483648 \leq x \leq 2147483647$
Binary system	Positive: $00000000 \leq x \leq 7FFFFFFF$ Negative: $80000000 \leq x \leq FFFFFFFF$

When the calculation result is outside the data range for the number system being used, a “Math ERROR” will appear.

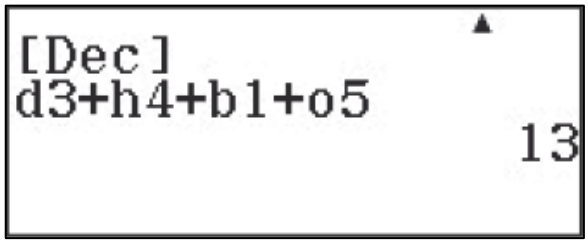
Determines the base of the special input value Base-N

You can also use the commands below to specify the base system for each input value.

Base system	Key press operations
Decimal (Base 10)	OPTN ▼ 7(d)
Hexadecimal (Base 16)	OPTN ▼ 8(h)
Binary (Base 2)	OPTN ▼ 9(b)
Octal (Base 8)	OPTN ▼ (−) [A](o)

Example: To calculate $3_{10} + 4_{16} + 1_2 + 5_8$ and display the result as a decimal value.

AC x^2(DEC) OPTN ▼ 7(d) 3 + OPTN ▼ 8(h) 4 + OPTN ▼ 9(b) 1 + OPTN (−)[A] (o) 5 =

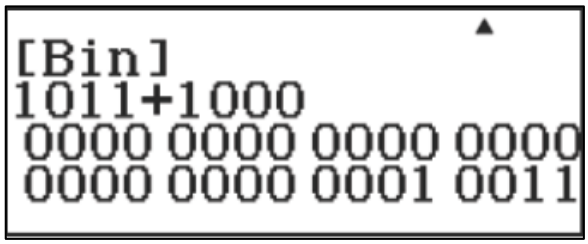


Convert the calculation result to a value of another Base-N system.

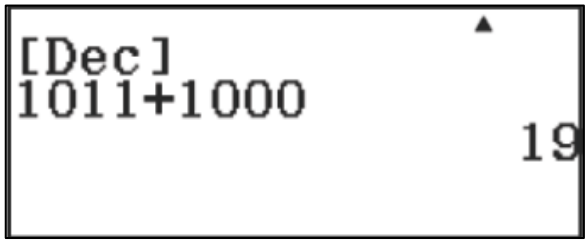
To convert the current calculation result to a value of another base system, perform the following press key: x^2(DEC) Decimal, $x^{\blacksquare}$(HEX) Hexadecimal, log(BIN) Binary, ln(OCT) Octal.

For example: Calculate $1011_2 + 1000_2$ in binary system then convert the result to decimal system.

log(BIN) 1 0 1 1 + 1 0 0 0 =



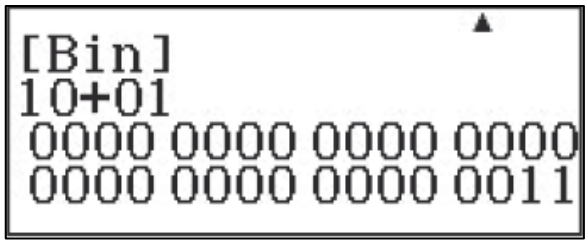
x^2(BIN)



Example of calculating Base N

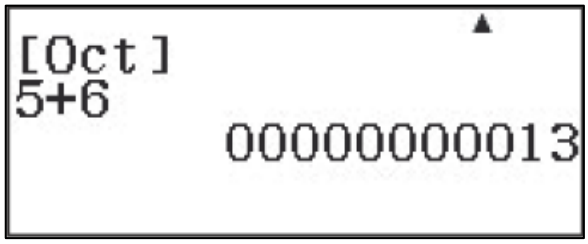
Example 1: To calculate $10_2 + 01_2$ in binary.

AC log(BIN) 1 0 + 0 1 =



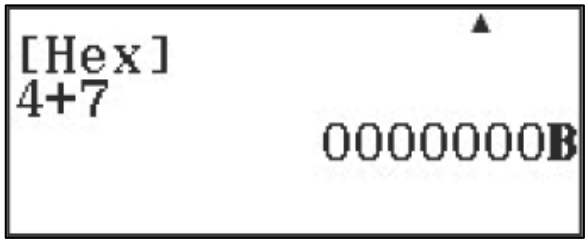
Example 2: To calculate 5+6 in octal

AC ln(OCT) 5 + 6 =



Example 3: To calculate 4+7 in hexadecimal.

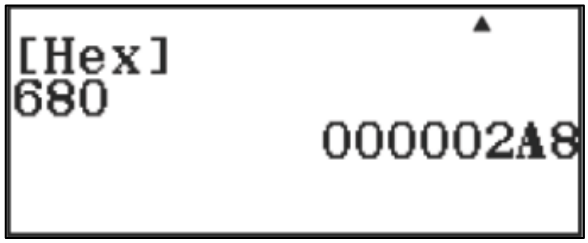
AC $x^{\blacksquare}$ (HEX) 4 + 7 =



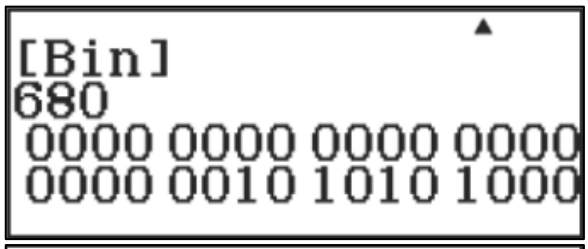
Example 4: Convert the number 680_{10} in decimal system to binary, octal and hexadecimal system.

AC x^{2} (DEC) 6 8 0 =

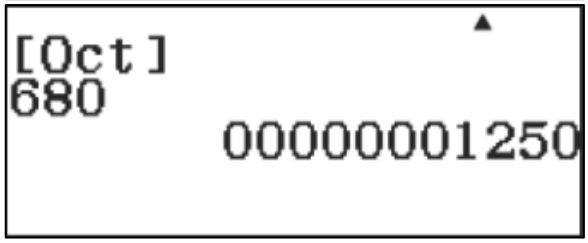
$x^{\blacksquare}$ (HEX)



$\log_{\blacksquare}\square$ (BIN)

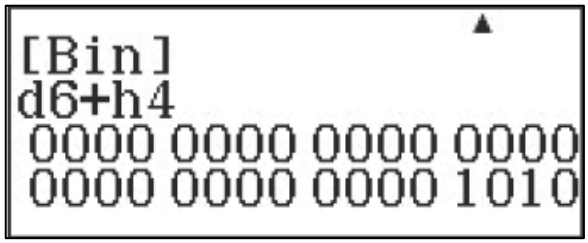


In (OCT)



Example 5: To convert the result of $6_{10} + 4_{16}$ to binary.

AC $\log_{\blacksquare}\square$ (BIN) OPTN ▼ 7 (d) 6 +
OPTN ▼ 8 (h) 4 =



Logical calculation and negation

Perform press key as same in the table below to use logical calculation and negation.

Logical calculation and negation.	Key press operations

Function "Neg(", Returns complement of 2	OPTN 6 (Neg)
Function "Not(". Returns complement result on bit.	OPTN 5 (Not)
The logical calculation "and" (logical product) returns the AND result on bit.	OPTN 1 (and)
The logical calculation "or" (logical sum), returns the OR result on bits	OPTN 2 (or)
The logical calculation "xor" (excluded logical sum), returns the XOR result on bits.	OPTN 3 (xor)
Logical operator "Xnor" (excluded negative Logical Sum). Returns the XNOR result on bit.	OPTN 4 (xnor)

Note:

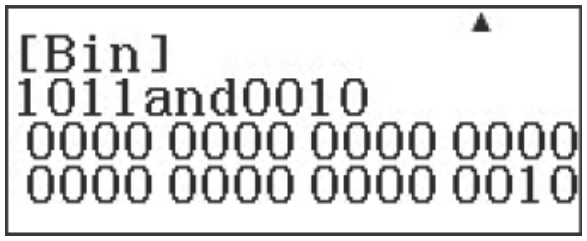
- For negative values in Binary, Hexadecimal or Octal, the calculator converts the value to Binary, takes complement of 2, then converts back to the original base.
- For negative values in the Decimal system, the calculator adds a minus sign in front of the value.

For example

All the following examples are implemented in Binary log (BIN)

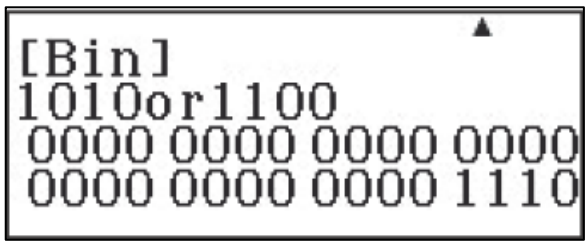
Example 1: To determine the logical AND calculation of 1011_2 and 0010_2

AC 1 0 1 1 OPTN
1 (and) 0 0 1 0 =



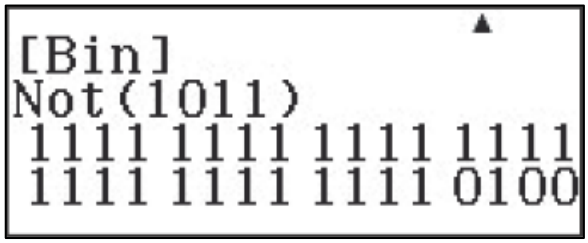
Example 2: To determine the logical OR calculation of 1011_2 and 11010_2

AC 1 0 1 0 OPTN
2 (or) 1 1 0 0 =



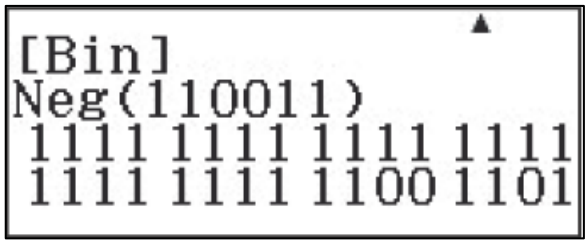
Example 3: To determine the complement on bit of 1011_2 (Not (1011_2))

AC OPTN 5 (Not) 1 0 1 1) =



Example 4: To negate (take complement of 2) of 110011_2 (Neg (11011_2)

AC OPTN 6 (Neg) 1 1 0
0 1 1) =



Matrix (MATRIX)

Matrix mode allows performing calculations with matrices up to 4 rows and 4 columns in size. The matrix variables used for calculation are MatA, MatB, MatC and MatD. Press key MENU 4 to enter Matrix mode.

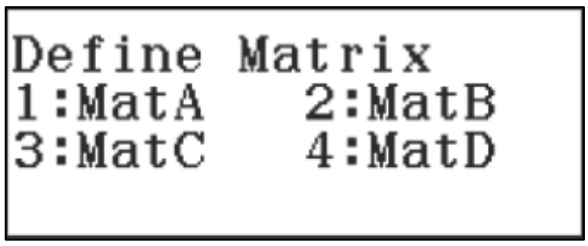
The results of the matrix calculation will be saved in the matrix response memory are "MatAns".

Create and manage Matrix

Create and store a Matrix in the Matrix variable.

In Matrix mode, press OPTN 1 (Define Matrix)

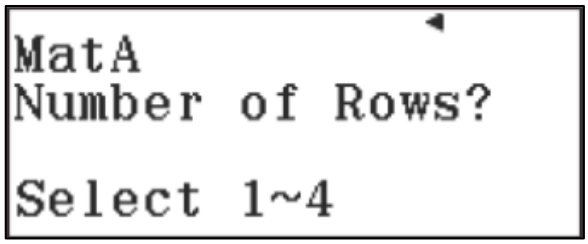
1.This will display the matrix selection screen.



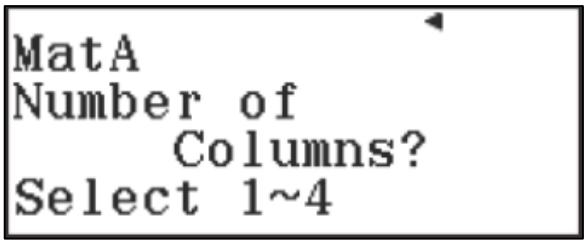
Note

- Every time you select Matrix mode, the matrix selection screen is always displayed first.

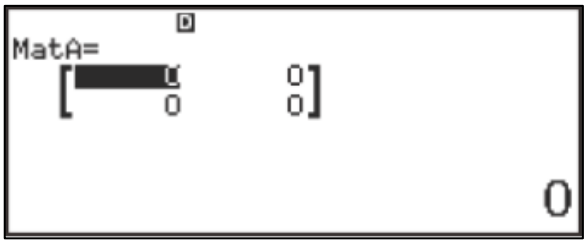
2. Press the number keys (1, 2, 3 or 4) to determine the name of the matrix you want to select.



3. Press the number keys ([1], [2], [3] or [4]) to specify the rows number



4. Press the number keys ([1], [2], [3] or [4]) to specify the column number. After selecting the number of columns, the matrix editor will appear.

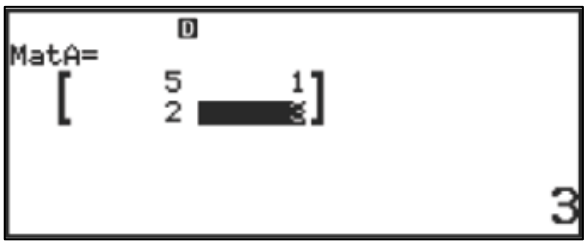


5. Input values for each element of the matrix into the matrix editor.

For example, to assign $\begin{bmatrix} 5 & 1 \\ 2 & 3 \end{bmatrix}$ to MatA.

Press [MENU], select the Matrix mode icon, and then press [=]

[1](MatA) [2](2 rows) [2](2columns)
[5] [=] [1] [=] [2] [=] [3] [=]

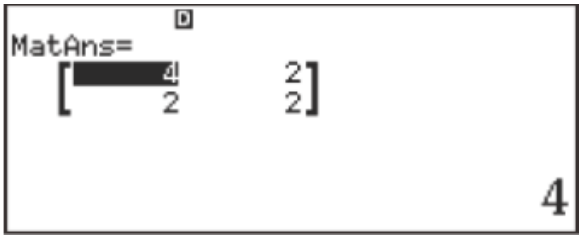


Matrix calculation

When the calculator is displaying the matrix selection screen or the matrix editor and pressing [AC], the calculator will switch to the matrix calculation screen.

Matrix result memory (MatAns)

After completing the matrix calculation, the resulting matrix will be assigned to the variable "MatAns" and will be displayed on the screen as below:



Use the variable "MatAns" to perform matrix calculations as follows:

- Perform the following key operation to insert the MatAns variable into the matrix calculation: [OPTN] [7] (MatAns).

- While the MatAns screen is being displayed, pressing one of the following keys will switch to the calculation screen: [+], [−], [×], [÷], [x^2], [x^{-1}], [SHIFT] [x^2] (x^3).

Note

- The contents of the variable "MatAns" can't be edited.
- Press [AC] to switch to the matrix calculation screen.

Edit data for matrix variables

To edit the content of the matrix variable, perform the following key operations:

1.Press [OPTN] [2] (Edit Matrix), when the menu appears, select the matrix variable you want to edit.

2. In the displayed editing screen, move the cursor to the cell with the value you want to edit, input the new value and press [=]

Want to copy the content of a matrix variable (MatAns). Perform the following press steps:

1. Select the matrix you want to copy in the matrix editing screen.

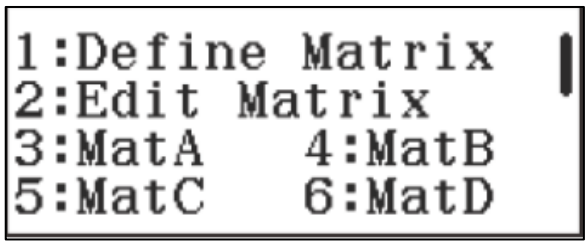
If you want to copy the MatAns matrix, press the following key to select: [OPTN] [7] (MatAns),

2. Press [STO], then press one of the keys below to select the copy position.

The matrix editing screen with the content of the copy will be displayed: [(−)] (MatA), [,] (MatB), [x^{-1}] (MatC), [sin] (MatD),

Categories in Matrix mode

Matrix calculation screen.



The table below depicts the categories in Matrix mode.

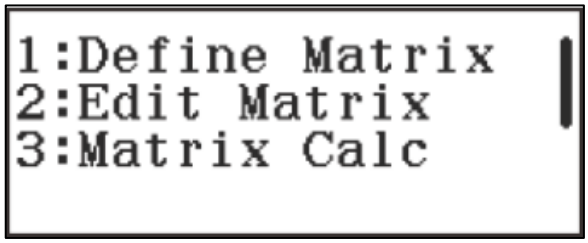
Matrix mode	Key press operations
Select a matrix (MatA, MatB, MatC, MatD) and specify its size.	[OPTN] [1] (Define Matrix)
Select a matrix (MatA, MatB, MatC, MatD) to display and edit the matrix's data.	[OPTN] [2] (Edit Matrix)
Enter "MatA"	[OPTN] [3] (MatA)

Enter "MatB"	OPTN 4 (MatB)
Enter "MatC"	OPTN 5 (MatC)
Enter "MatD"	OPTN 6 (MatD)

Matrix mode	Key press operations
Enter "MatAns"	OPTN 7 (MatAns)
Enter the function "Det(": Function to get the determinant.	OPTN 8 (Determinant)
Enter the function "Trm(" n: Matrix transformational function	OPTN 9 (Transposition)
Enter the function "Identity(": Identity matrix	OPTN (–) (Identity)

Edit Matrix

The table below depicts the categories in the matrix editor. Press key OPTN



Matrix mode	Key press operations
Select an (MatA, MatB, MatC, MatD) matrix and specify its size.	OPTN 1 (Define Matrix)
Select a display (MatA, MatB, MatC, MatD) matrix and edit the matrix data.	OPTN 2 (Edit Matrix)
Displays the matrix calculation screen	OPTN 3 (Matrix Calc)

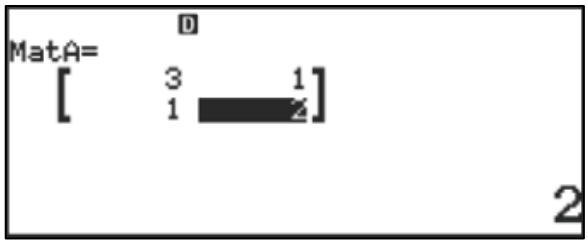
Matrix calculation

Press key MENU 4 to enter the Matrix, and then press AC

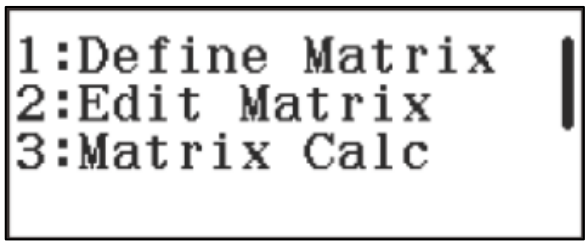
(Matrix Mode screen)

Example 1: $\begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix} \times \begin{bmatrix} -1 & 1 \\ 2 & 3 \end{bmatrix}$

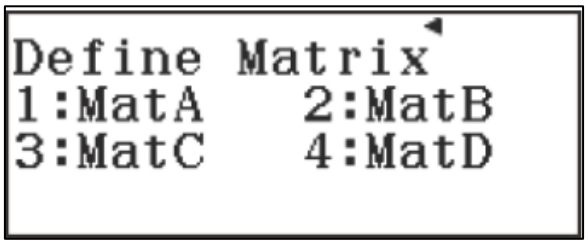
OPTN 1 (Define Matrix) 1 (MatA) 2 (2 rows) 2 (2 columns)
3 = 1 = 1 = 2 =



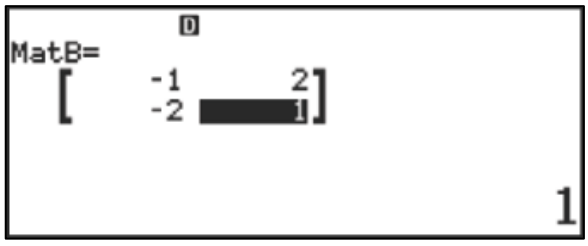
OPTN



1 (Define Matrix)



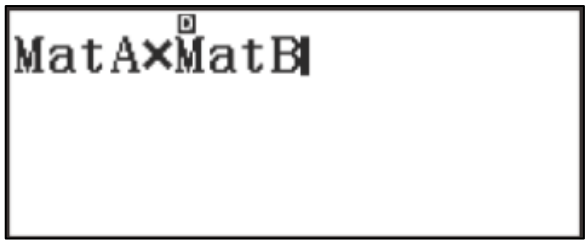
2 (MatB) 2 (2 crows) 2 (2 columns)
(−) 1 = 2 = (−) 2 = 1 =



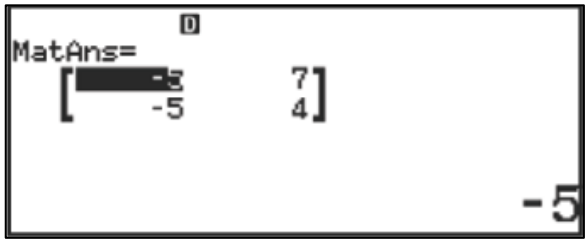
AC

MatA x MatB:

OPTN 3 (MatA) × OPTN 4 (MatB)

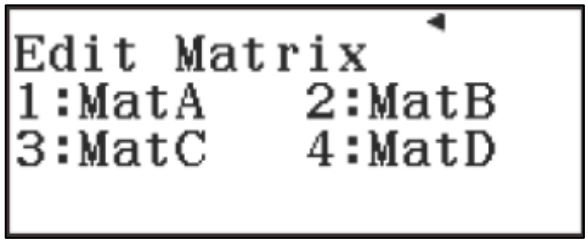


=

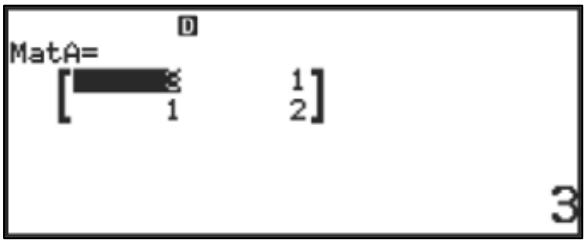


Example 2: To copy MatA = $\begin{bmatrix}3 & 1\\1 & 2\end{bmatrix}$ to MatB and change the content of MatB to MatB = $\begin{bmatrix}-1 & 2\\-2 & 1\end{bmatrix}$

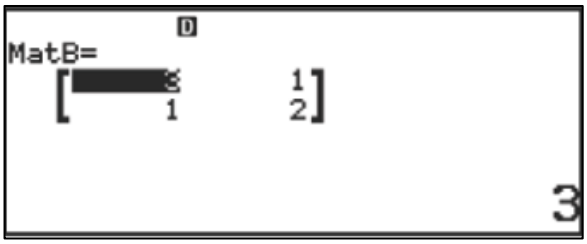
AC OPTN 2 (Edit Matrix)



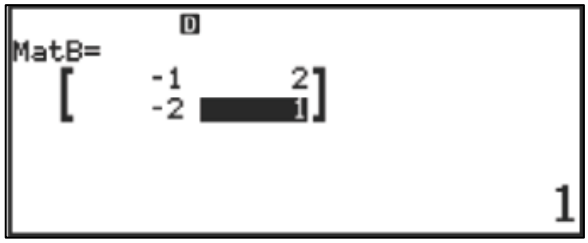
1 (MatA)



STO ,,,, (MatB)



(−) 1 = 2 = (−) 2 = 1 =

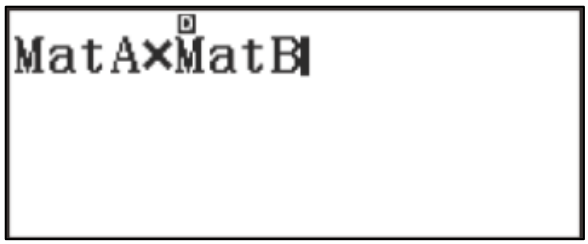


The example below uses $MatA = \begin{bmatrix}3 & 1\\1 & 2\end{bmatrix}$, MatB = $\begin{bmatrix}-1 & 2\\-2 & 1\end{bmatrix}$, MatC = $\begin{bmatrix}-1 & 0 & 1\\1 & -1 & 0\end{bmatrix}$

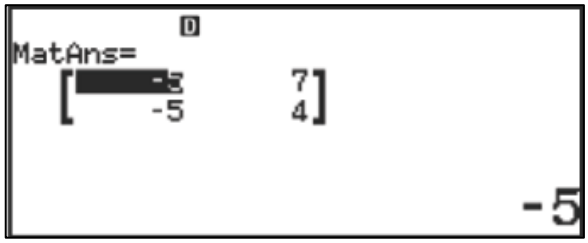
Example 3: MatA × MatB, MatB × MatA – MatA × MatB (multiply two matrices)

MatA × MatB

[OPTN] [3] (MatA) [×] [OPTN] [4] (MatB)

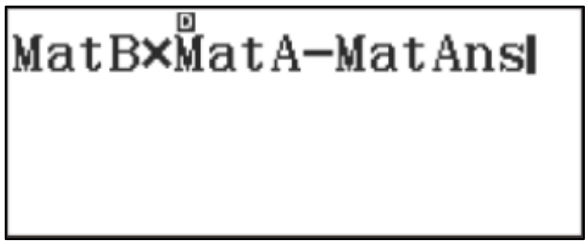


[=]

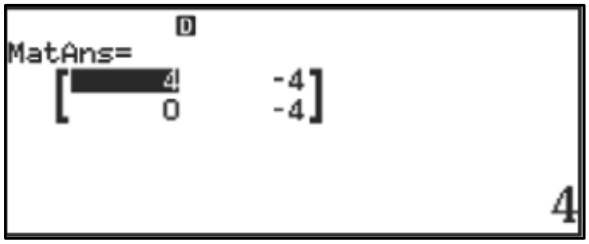


MatB × MatA – MatA × MatB

[OPTN] [4] (MatB) [×] [OPTN] [3] (MatA)
[−] [OPTN] [7] (MatAns)



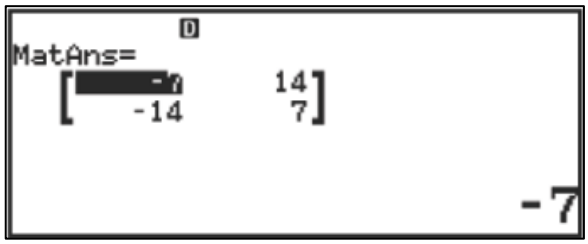
[=]



Example 4: 7 x MatB (Multiply scalars with matrices)

[AC] [7] [×] [OPTN] [4] (MatB)

[=]



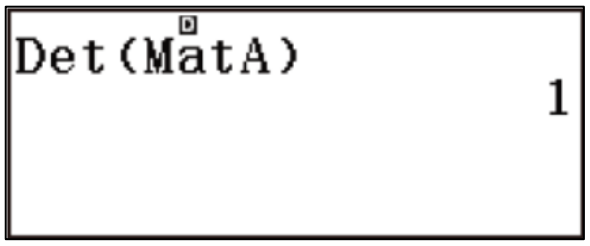
Example 5: To get the determinant of MatA (Det(MatA)

$\text{Det}[a_{11}] = a_{11}$

$\text{Det}\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} = a_{11}a_{22} - a_{12}a_{21}$

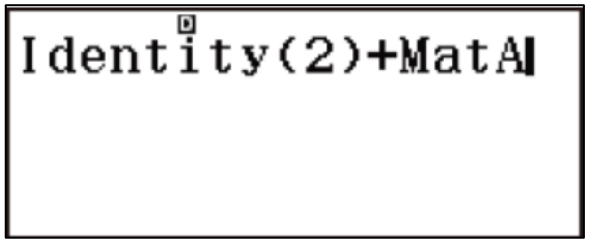
$$\text{Det}\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$
$$= a_{11}a_{22}a_{33} + a_{12}a_{23}a_{31} + a_{13}a_{21}a_{32} - a_{13}a_{22}a_{31} - a_{12}a_{21}a_{33} - a_{11}a_{23}a_{32}$$

AC OPTN 8 (determinant) OPTN 3 (MatA)) =

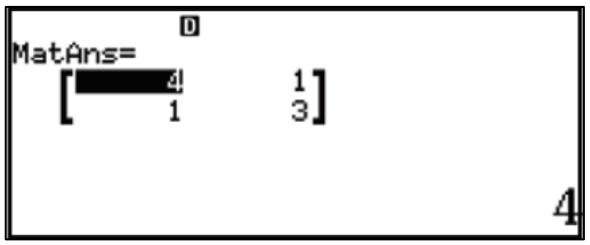


Example 6: To create a 2 x 2 identity matrix and add it to MatA (Identity (2) + MatA)

AC OPTN (−) (Identity) 2) + OPTN 3 =



=

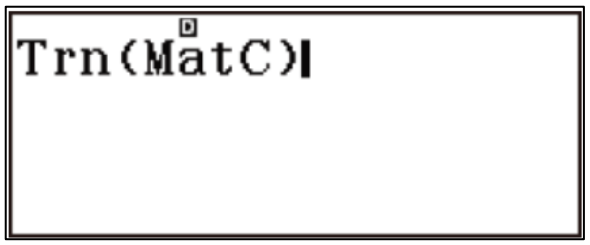


Note:

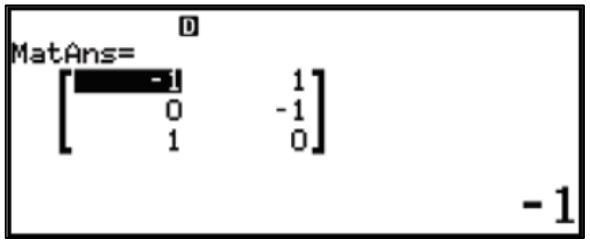
- You can select a value from 1 to 4 as an argument to the Identify command (size of the identity matrix).

Example 7: To transformation calculation of MatC (Trn(MatC))

AC OPTN 9 (transformation) OPTN 5 (MatC))



=



Example 8: To reverse the square of MatA(MatA^{-1})

Note:

- You can't use $x^{\blacksquare}$ to enter "$^{-1}$" for this enter time.

$$[a_{11}]^{-1} = \left[\frac{1}{a_{11}}\right]$$

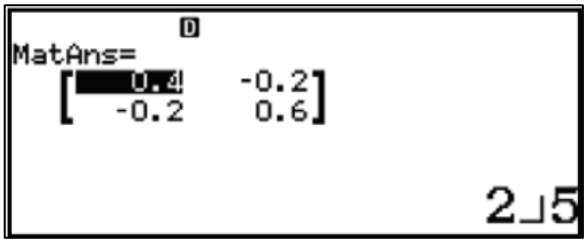
$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}^{-1} = \frac{\begin{bmatrix} a_{22} & -a_{12} \\ -a_{21} & a_{11} \end{bmatrix}}{a_{11}a_{22}\ \ a_{12}a_{21}}$$

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}^{-1}$$

$$= \frac{\begin{bmatrix} a_{22}a_{33} - a_{23}a_{32} & -a_{12}a_{33} + a_{13}a_{32} & a_{12}a_{23} - a_{13}a_{22} \\ -a_{21}a_{33} + a_{23}a_{31} & a_{11}a_{33} - a_{13}a_{31} & -a_{11}a_{23} + a_{13}a_{21} \\ a_{21}a_{32} + a_{22}a_{31} & -a_{11}a_{32} + a_{12}a_{31} & a_{11}a_{22} - a_{12}a_{21} \end{bmatrix}}{det \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}}$$

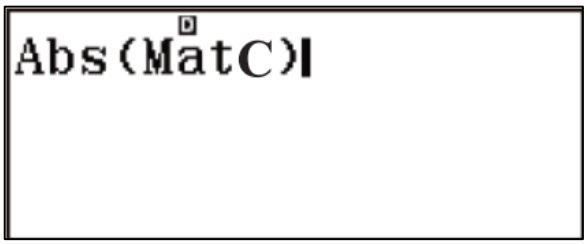
AC OPTN 3 x^{-1}

=

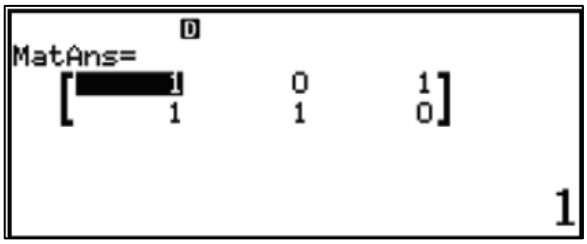


Example 9: To get the absolute value of each element of MatC (Abs(MatC).

AC SHIFT ((Abs) OPTN 5 (MatC))



=



Vector

Vector mode is used to perform 2-dimensional and 3-dimensional vector calculations. Press key [MENU] [5] to enter VECTOR mode.

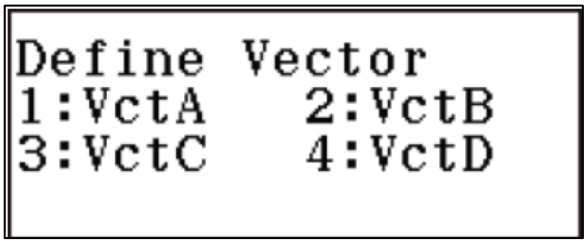
The vector variables used in vector calculations are VctA, VctB, VctC, VctD.

The result of vector calculation will be stored in the vector response memory as "VctAns"

Create and manage Vectors

Create and stores a vector in a vector variable.

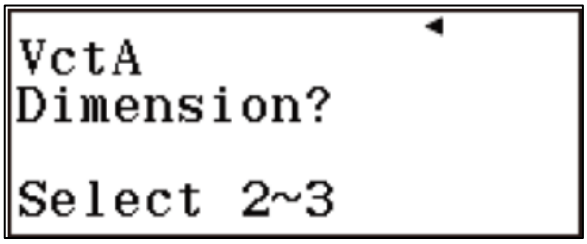
1. To display the vector selection screen, Press [OPTN] [1] (Define Vector)



Note:

- Every time you select Vector mode, the Vector selection image always appears first.

2. Press the number key ([1], [2], [3] or [4]) to select the name of the Vector.

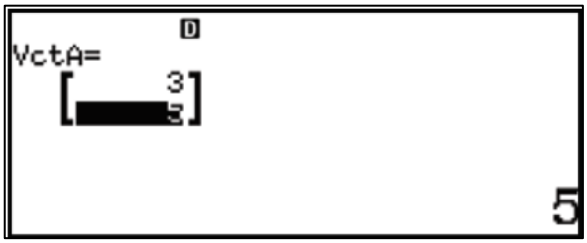


3. Press the number key ([2] or [3]) to select the direction of the vector. The vector editing screen will appear.

4. On the editing screen, enter values for each element of the vector.

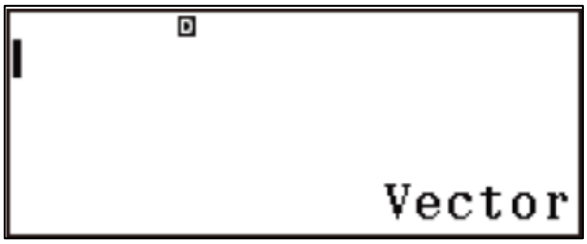
Example: To assign (3,5) to VctA.

[MENU] [5] (VECTOR) [1] (VctA)
[2] [3] [=] [5] [=]



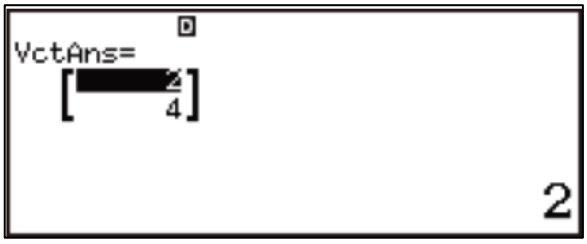
Perform vector calculations

When the vector selection screen or vector editing screen is displayed, pressing [AC] will return to the vector calculation screen.



Memory response vector

After completing the vector calculation, the resulting vector will be assigned to the variable "VctAns" and will be displayed on the screen below.



Use the variable VctAns in vector calculations as follows:

- Perform the following press key operation to assign the variable VctAns into the vector calculation: [OPTN] [7] (VctAns).
- When the VctAns screen is displayed, press one of the following keys to return to the calculation screen: [+], [−], [×], [÷]

Note

- The value of the variable VctAns can't be edited.
- Press [AC] to return to the vector calculation screen

Edit data for vector variables

To edit the value of a vector variable, press the following key:

1. Press [OPTN] [2] (Edit Vector) when the menu appears, select the vector variable you want to change.

2. In the displayed editing screen, move the cursor to the cell with the value you want to edit, input the new value and press [=]

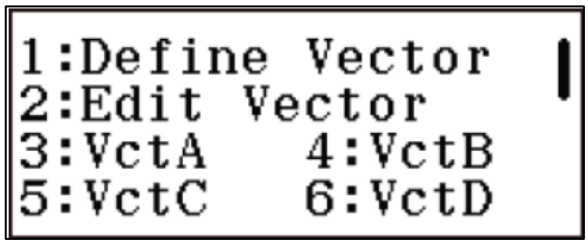
To copy the value of the vector variable VctAns, perform the following key operations:

1. Select the vector you want to copy in the vector editing screen. If you want to copy vector VctAns, press the following key to select:
[OPTN] [7] (VctAns) [=]

2. Press [STO] key, after press one of the keys below to select the copy position, the vector editing screen with the value of the copy will be displayed.
[(−)](VctA), [°,,,](VctB), [x^{-1}](VctC), [sin](VctD).

Categories in Vector mode

Vector calculation screen.

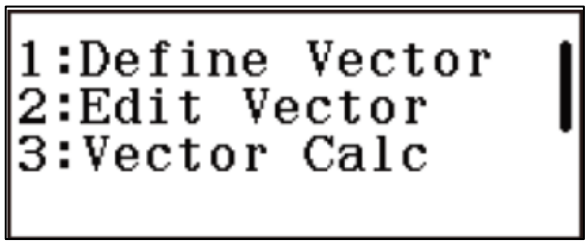


The table below depicts the categories in Vector mode:

Vector mode	Keys press operations
Select a vector (VctA, VctB, VctC, VctD) and determine the direction of the Vector.	[OPTN] [1](Define Vector)
Select a vector vector (VctA, VctB, VctC, VctD) to display and edit the Vector data	[OPTN] [2] (Edit Vector)
Enter "VctA"	[OPTN] [3](VctA)
Enter "VctB"	[OPTN] [4] (VctA)
Enter "VctC"	[OPTN] [5] (VctA)
Enter "VctD"	[OPTN] [6] (VctA)

Vector mode	Keys press operations
Enter "VctAns"	[OPTN] [7](VctA)
Enter the command "." to get the multiply mark of the vector	[OPTN] [8](Dot product)
Enter the function "Angle(" to get the angle	[OPTN] [9](Angle)
Enter the function "UnitV(" to get the unit vector	[OPTN] [(−)](Unit Vector)

Vector editor



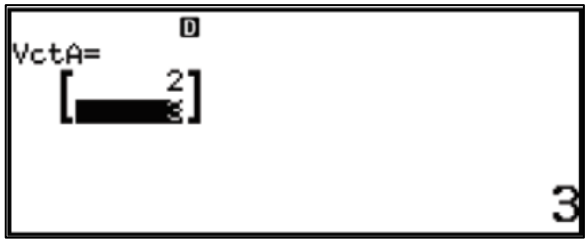
The table below depicts the categories in the vector editor:

Vector editor	Keys press operations
Select a vector (VctA, VctB, VctC, VctD) and determine the direction of the vector	OPTN 1 (Define Vector)
Select a vector (VctA, VctB, VctC, VctD) to display and edit the vector's data	OPTN 2 (Edit Vector)
Display screen calculation Vector	OPTN 3 (Vector Calc)

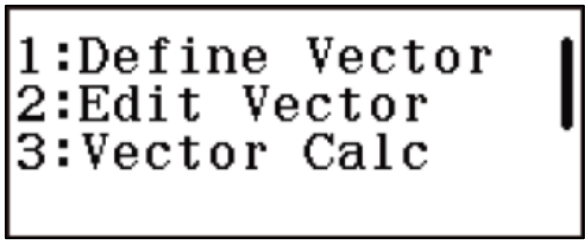
Vector calculation example

Example 1: (2,3) + (4,1) (Vector sum)

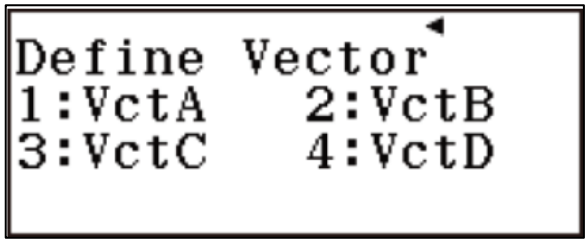
MENU 5 (VECTOR) 1 (VctA)
2 (2 direction) 2 = 3 =



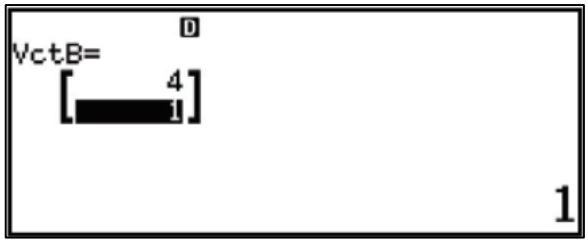
OPTN



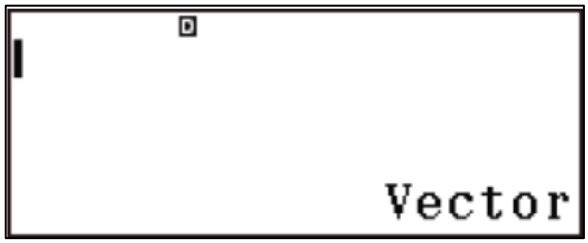
1 (Define Vector)



2 (VctB) 2 (2 direction)
4 = 1 =



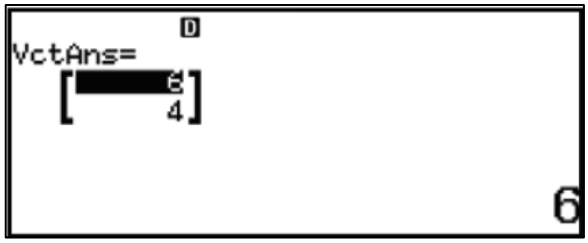
[AC]



VctA + VctB:

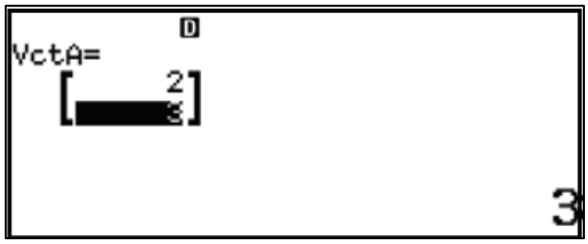
[OPTN] [3] (VctA) [+] [OPTN] [4] (VctB)

[=]

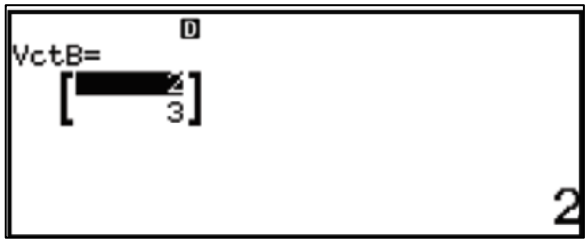


Example 2: To copy $\mathrm{VctA} = (2,3)$ into VctB change the content of VctB to $\mathrm{VctB} = (4,1)$

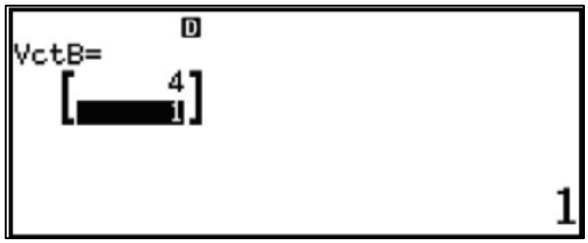
[AC] [OPTN] [3] (VctA) [=]



[STO] [,,,] (VctB)

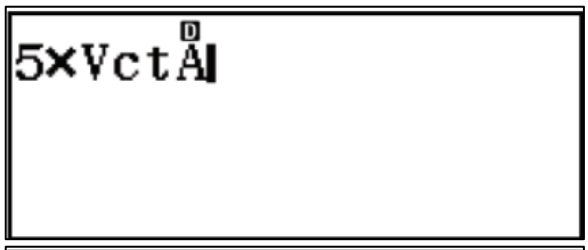


[4] [=] [1] [=]

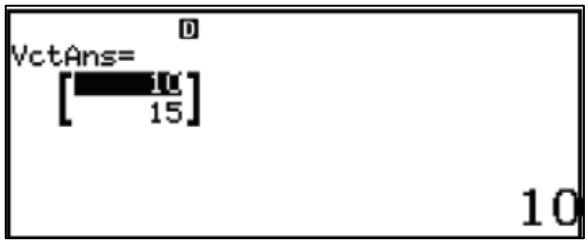


The following example uses $\mathrm{VctA} = (2,3).\ \mathrm{VctB} = (4,1), \mathrm{VctC} = (-3,4,0)$,
Example 3: $5\mathrm{xVctA}$ (Vector scalar multiplication), $\mathrm{VctA} - \mathrm{VctAns}$
(Example calculation using VctAns)

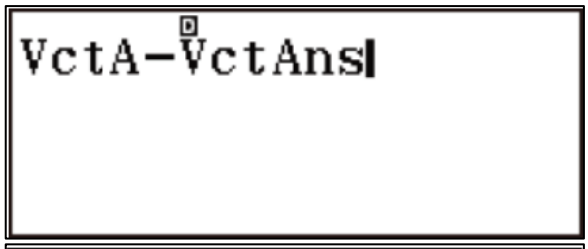
AC 5 × OPTN 3 (VctA)



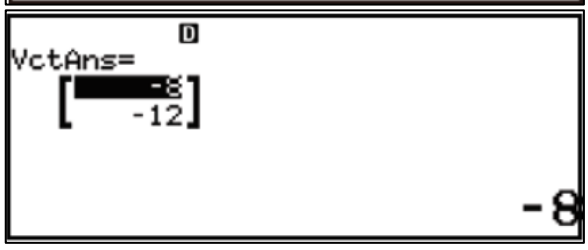
=



OPTN 3 (VctA) − OPTN 7 (VctAns)



=



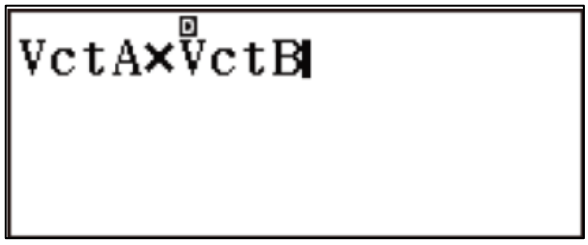
Example 4: VctA. VctB (Dot multiplied by vector).

$(a_1, a_2).(b_1, b_2) = a_1b_1 + a_2b_2$
$(a_1, a_2, a_3).(b_1, b_2, b_3) = a_1b_1 + a_2b_2 + a_3b_3$

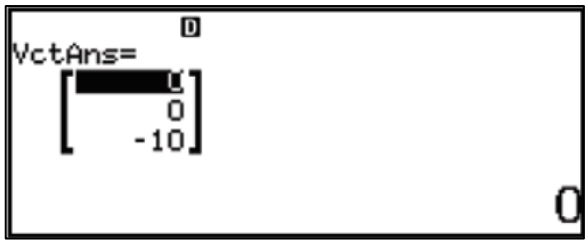
AC OPTN 3 (VctA) OPTN 8 OPTN 4 (VctB)

Example 5: VctA × VctB (Vector multiply mark).
$(a_1, a_2) \times (b_1, b_2) = (0,0, a_1b_2 + a_2b_1)$
$(a_1, a_2, a_3) \times (b_1, b_2, b_3) = (a_2b_3 - a_3b_2, a_3b_1 - a_1b_3, a_1b_2 - a_2b_1)$

AC OPTN 3 (VctA) × OPTN 4 (VctB)



[=]

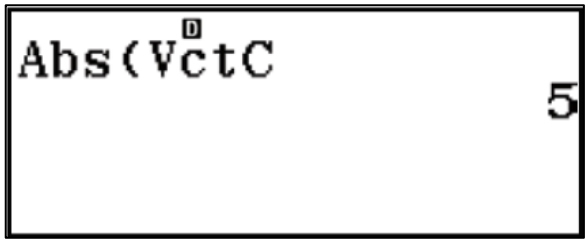


Example 6: To obtain the magnitude of VctC (Abs(VctC)).

$\mathrm{Abs}(\mathrm{a}_1, a_2) = \sqrt{a_1^2 + a_2^2}$

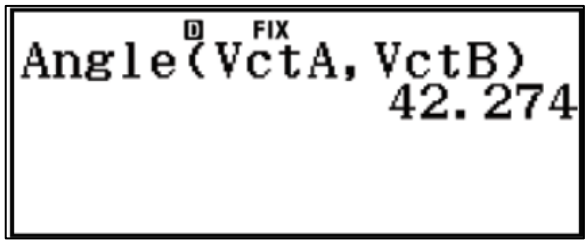
$\mathrm{Abs}(\mathrm{a}_1, a_2, a_3) = \sqrt{a_1^2 + a_2^2 + a_3^2}$

[AC] [SHIFT] [(] (Abs) [OPTN] [5] (VctC) [=]



Example 7: To determine the angle formed by VctA and VctB (Angle (VctA, VctB)) in three decimal places (Fix3).

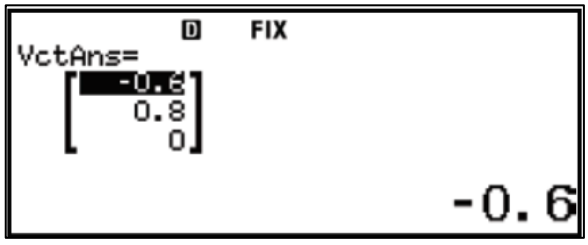
[AC] [OPTN] [9] (Angle) [OPTN] [3] (VctA)
[SHIFT] [)] (,) [OPTN] [4] (VctB) [)] [=]



Example 8: To normalize VctC (UnitV(VctC))

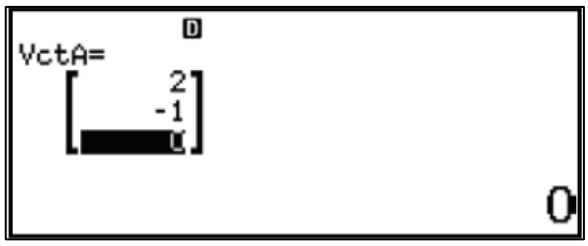
[AC] [OPTN] [(−)] (Unit Vector)
[OPTN] [5] (VctC) [)]

[=]

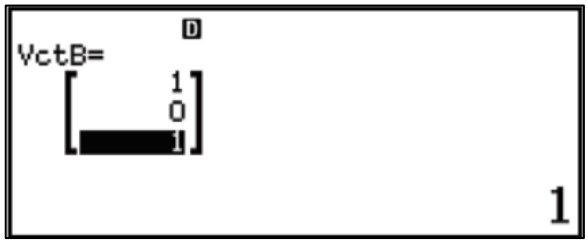


Example 9: To determine the size of the angle formed by vector $\mathrm{A} = (2, -1, 0), \mathrm{B} = (1, 0, 1)$ and one of the sizes of a vector perpendicular to both A and B
(Angle Unit: Degree)

AC OPTN 1 (Define Vector) 1 (VctA)
3 (3 direction) (−) 2 = − 1 =
0 =

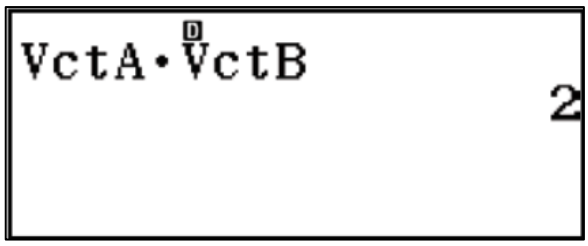


OPTN 1 (Define Vector) 2 (VctB)
3 (3 direction) 1 = 0 = 1 =



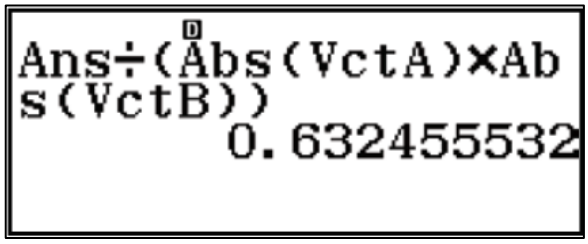
VctA. VctB

AC OPTN 3 (VctA) OPTN
8 (Dot Product) OPTN 4 (VctB) =



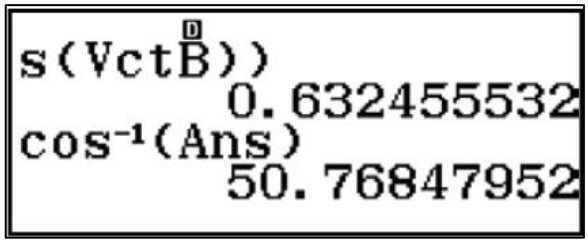
Ans ÷ (Abs(VctA) × Abs(VctB))

AC ÷ (SHIFT ((Abs) OPTN
3 (VctA)) × SHIFT ((Abs)
OPTN 4 (VctB))) =



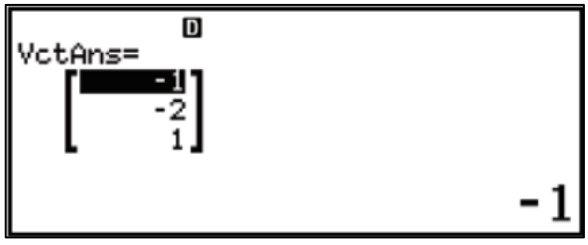
$Cos^{-1}(Ans)$:

SHIFT cos (Cos^{-1}) Ans) =



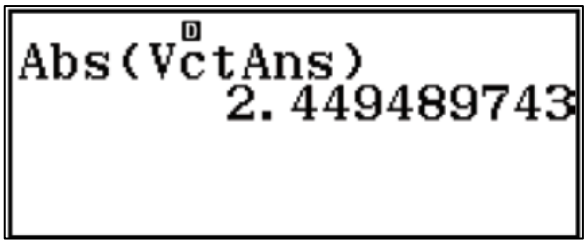
VctA × VctB:

OPTN 3 (VctA) × OPTN 4 (VctB) =



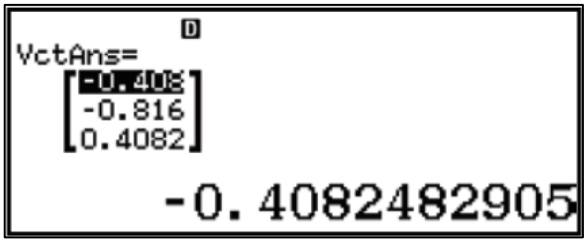
Abs (VctAns):

SHIFT ((Abs) OPTN 7 (VctAns)) =



VctAns ÷ Ans:

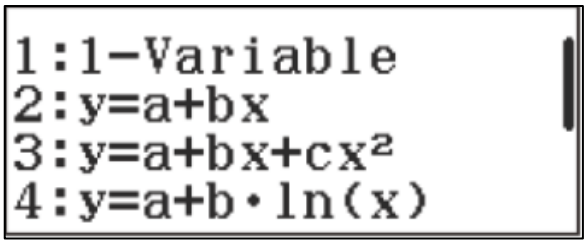
OPTN 7 ÷ Ans =



Statistical calculations (STAT)

To start performing statistical calculations using STAT mode, proceed as follows:

1. Press MENU 6 to enter statistical mode (STAT)



2. Select the Statistical type listed on the screen by selecting the corresponding number. The Statistical mode has the following form:

STAT Mode	Keys press operations
Single variable	1 (1-Variable)
Paired-Variable (x,y), linear regression.	2 (y=a+bx)
Paired-Variable (x,y), Squared regression.	3 ($y=a+bx+cx^2$)
Paired-Variable (x,y). Logistic regression.	4 (y=a+b.ln(x))
Paired-Variable (x,y), e exponential regression.	5 (y=a.e^(bx))
Paired-Variable (x,y), ab exponential regression.	6 (y=a.b^x)
Paired-Variable (x,y), power function.	7 (y=a.x^b)

Paired-Variable (x,y), reverse regression.	8 (y=a+b/x)

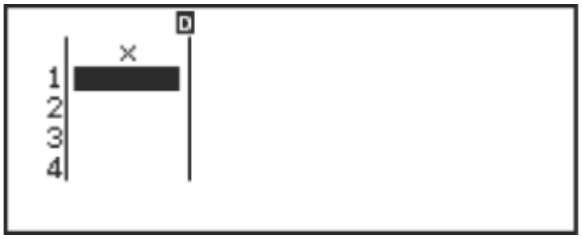
Note

- To change the statistical format we use OPTN 1 (Select type) then select the statistical type to use.

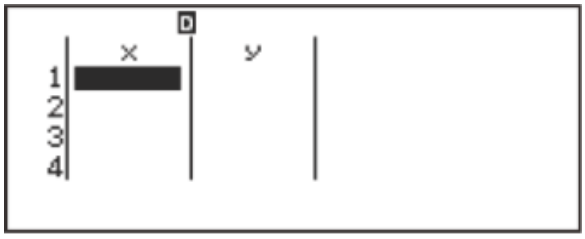
Inputting Data with Statistics Editor.

There are 2 types of statistical formats: Single variable and Paired-Variable.

Single-variable statistical display:



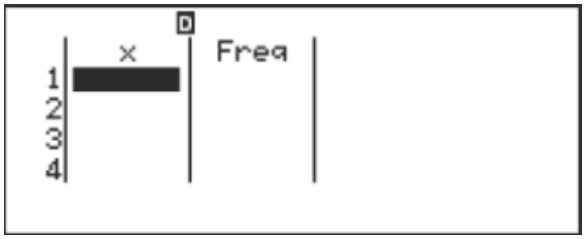
Paired-Variable statistical display:



Frequency column (Freq)

To use the frequency columns, you can enable this function by entering the advanced settings function for Statistics mode. In default mode, the frequency column will be turned off.

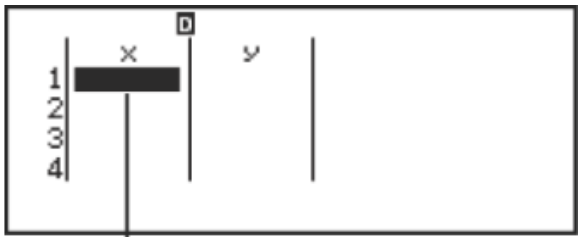
The screen displays the frequency column in single-variable mode.



The screen displays the frequency column in Paired-Variable mode.

Data input rules

- To input data, move the cursor to the position to input then input the data as usual.

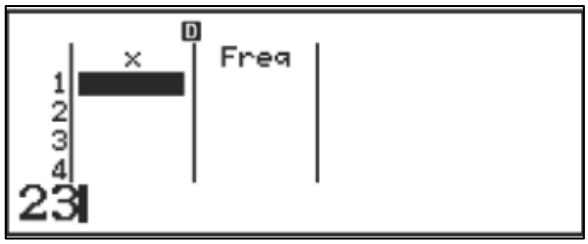


cursor

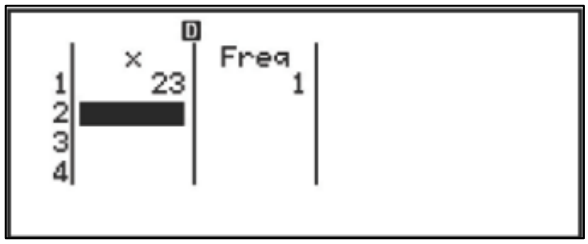
- After input data, press [=] to complete.

Example 1: Input the value 23 in cell X1

[2] [3]



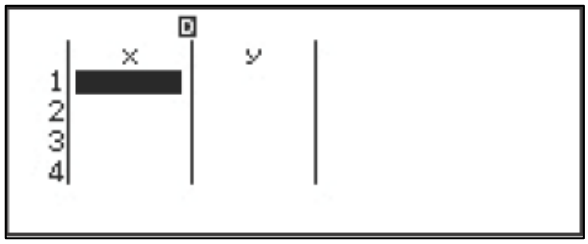
[=]



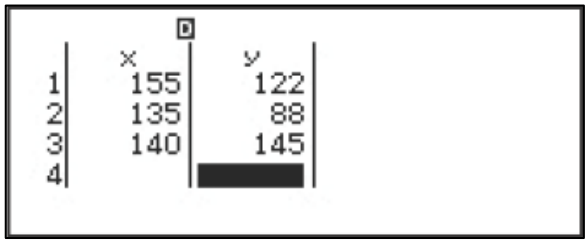
After completing data entry in one cell, the cursor will automatically jump to the next cell.

Example 2: To select logarithmic regression and enter the following data: (155,122), (135, 88), (140, 145).

[OPTN] [1] (Select Type)
[4] (y=a+b.ln(x)) [=]



[1] [5] [5] [=] [1] [3] [5] [=]
[1] [4] [0] [=] [▼] [▶] [1] [2]
[2] [=] [8] [8] [=] [1] [4] [5] [=]



Note

- Depending on the type of statistics, the maximum number of lines that can be entered is also different.

Calculation type/Frequency column	Use	Don't use
Single variable	160 rows	80 rows
Paired-Variable	80 rows	53 rows

- When pressing [AC] on the statistical table data input screen, the calculator will return to the normal data input screen. To return to the statistical table input screen, we operate as follows.
  + Single variable statistical mode: [OPTN] [3]
  + Paired-Variable statistical mode: [OPTN] [4]
- All data will be deleted when we change the statistics format or exit the statistics mode.

Edit Statistical data.

Adjust data in the statistics table.

1. Move the cursor to the position where the data needs to be changed.
2. Input new data then press [=] to complete the adjustment.

Delete rows in the statistics table.

1. Move the cursor to the rows to delete.
2. Press [DEL]

Insert an additional row into the statistics table.

1. Move the cursor to the line to insert, the inserted line will be below the currently selected line position.
2. Press [OPTN] [2] (Editor).
3. Press [1] (Insert Row).

Delete all data in the table.

1. Press [OPTN] [2] (Editor).
2. Press [2] (Delete All).

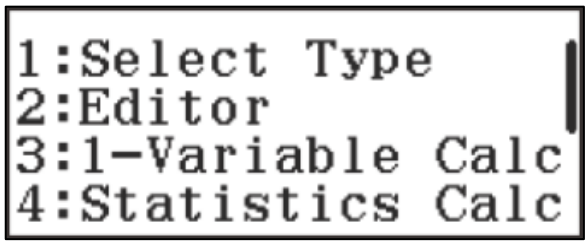
Statistical calculation screen.

The statistical calculation screen is the screen that calculates the statistical values obtained from the statistical table.

Statistics menu

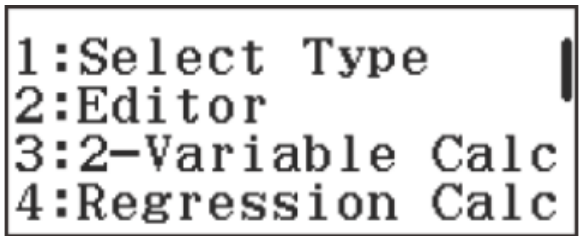
At the statistics calculation screen, press [OPTN] to enter the statistics menu. Depending on the statistics type, the menu screen will be different.

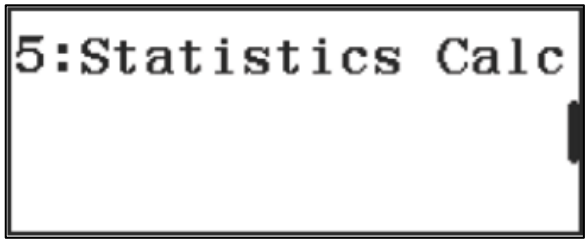
The statistical menu screen: Single-variable



Function	Key press operation
Select statistical types.	[1](Select Type)
Edit statistical data table.	[2](Editor)
Displays statistical values based on the inputted statistical data.	[3](1-Variable Calc)
Enter the statistical calculation screen.	[4](Statistics Calc)

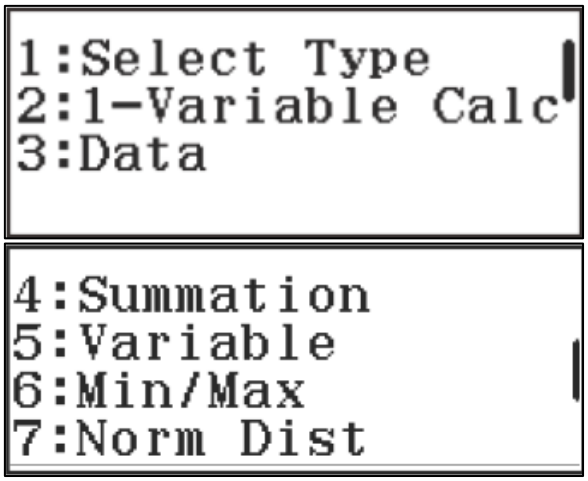
The statistical menu screen: Double-variable.





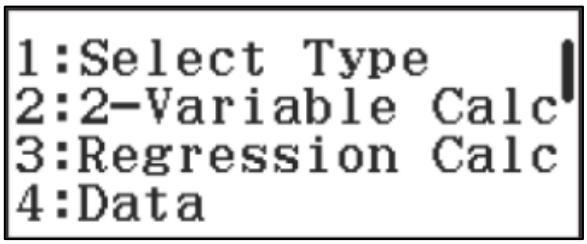
Function	Kes press operation
Select statistical calculation types.	[1] (Select Type)
Edit statistics table.	[2] (Editor)
Displays statistical values based on the entered statistical data	[3] (2-Variable Calc)
Displays the regression calculation based on the entered statistical data.	[4] (Regression Calc)
Return to the screen that calculates statistical values based on input data.	[5] (Statistics Calc)

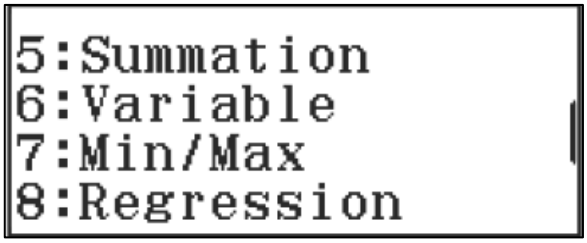
The statistical results calculation screen: Singer-variable



Function	Key press operation
Select statistical calculation types	[1] (Select Type)
Displays statistical values based on the input statistical data.	[2] (1-Variable Calc)
Statistical data.	[3] (Data)
Sub-menu of the Summation.	[4] (Summation)
The Variable sub-menu contains functions to find the average value and standard deviation...	[5] (Variable)
Sub-menu of the Functions to find Min/Max value.	[6] (Min/Max)
Menu of Norm Dist calculation functions.	[7] (Norm Dist)

The statistical results calculation screen: Paired-Variable s





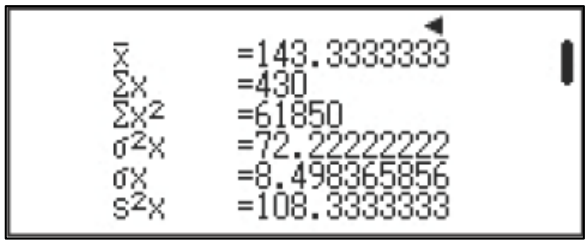
Function	Key press operation
Select statistical calculation types.	[1](Select Type)
Displays statistical values based on the input statistical data.	[2](2-Variable Calc)
Displays regression calculated values based on input values.	[3](Regression)
Display statistics table.	[4](Data)
Sub-menu of the Summation.	[5](Summation)
The Variable sub-menu contains function to find the average value and standard deviation...	[6](Variable)
Sub-menu of the function to find maximum/minimum value.	[7](Min/max
Menu of regression calculation functions.	[8](Regression)

Displays statistical values based on input data.

At the statistical menu screen, you can operate as follows to view statistical results: [OPTN] [3] (1-Variable Calc or 2-Variable Calc).

At the statistical results calculation screen, you can operation as follows: to view statistical results:

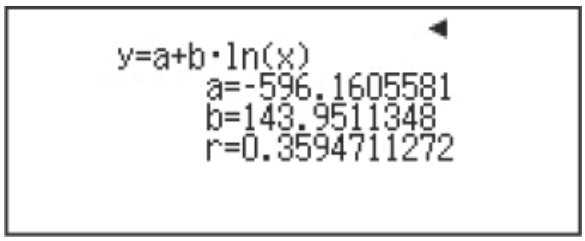
[OPTN] [2] (1-Variable Calc or 2-Variable Calc).



Display regression calculation results (only available in Paired-Variable statistical)

At the statistical menu screen, you can operation as follows to view statistical results: OPTN 4 (Regression Calc)

At the statistical results calculation screen, you can operation as follows to view statistical results: OPTN 3 (Regression Calc)



Calculation functions are in Singer-Variable statistical format.

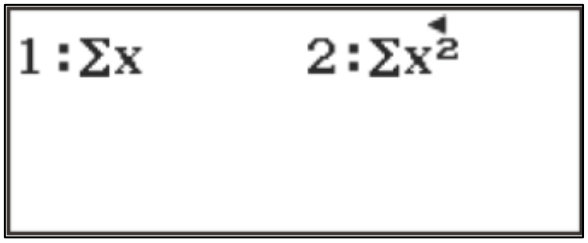
At the Singer-Variable statistical format you can use the following functions: Summation, Variable, Min/Max, Norm Dist.

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

Summation Sub-menu

To enter Summation sub-menu, you can operation as follows: OPTN 4 (Summation).

Below is a table explaining the functions in the sub-menu.

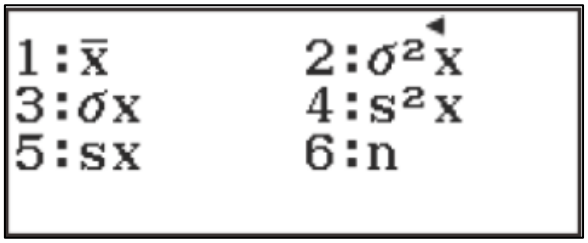


Key press operation	Function
1 $(\sum x)$	Sum value of statistical samples
2 $(\sum x^2)$	Sum of squares of statistical sample

Variable submenu

To enter the Variable sub-menu, you can operate as follows: OPTN 5 (Variable).

Below is a table explaining the functions in the sub-menu:

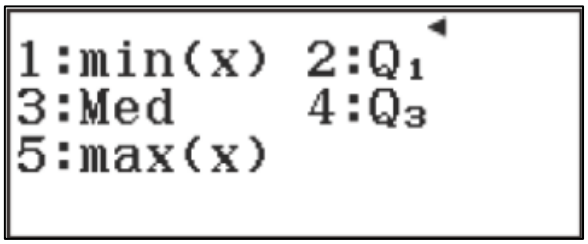


Key press operation	Function
1 $(\bar{x})$	Average value of sample data
2 $(\sigma^2 x)$	Sum variance
3 (σx)	Sample space standard deviation
4 $(S^2 x)$	Variance x
5 $(S\ x)$	Standard deviation x
6 (n)	Number of statistical samples

Min/Max sub-menu

To enter the Min/Max sub-menu, you can operation as follows: OPTN 6 (Min/Max)

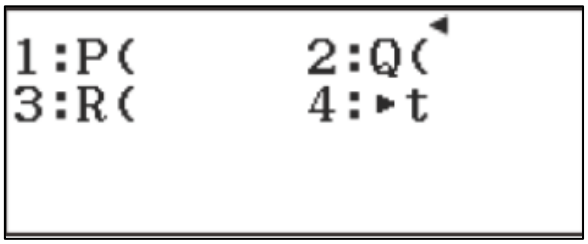
Below is a table explaining the functions in the sub-menu:



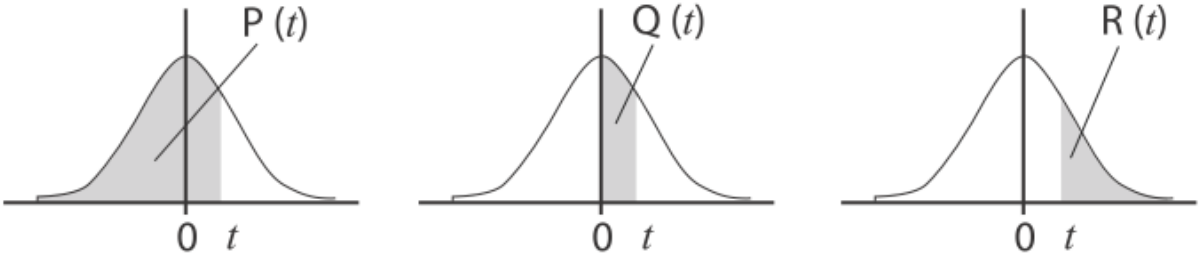
Key press operation	Function
1 $(min\ (x))$	Min value
2 (Q_1)	First quartile
3 (Med)	Median
4 (Q_3)	Third quartile
5 $(max\ (x))$	Max value

Norm Dist Sub-menu

To enter the Min/Max Norm Dist, you can operation as follows: OPTN 7 (Norm Dist)



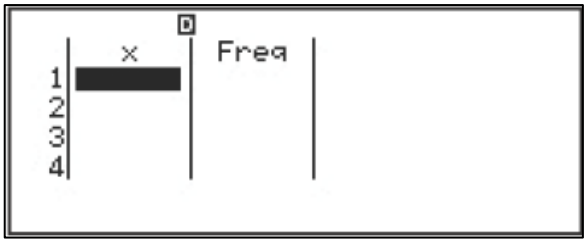
Normal distribution Sub-Menu.



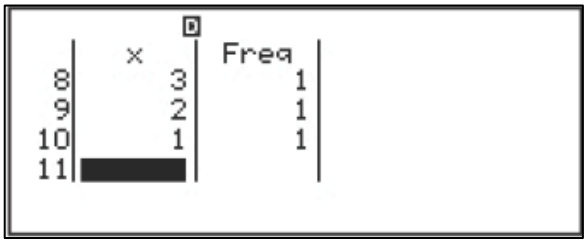
Example of statistical calculation for single variable

Select the single variable and input the following data: {10, 9, 8, 7, 6, 5, 4, 3, 2, 1}. (Statistics: On)

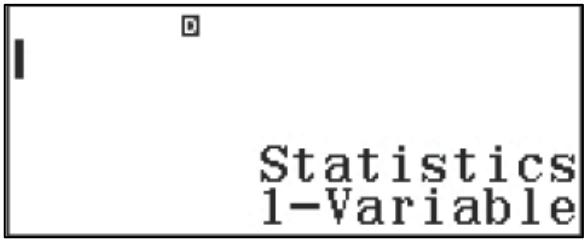
[OPTN] [1] (Select Type) [1] (1-Variable)



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

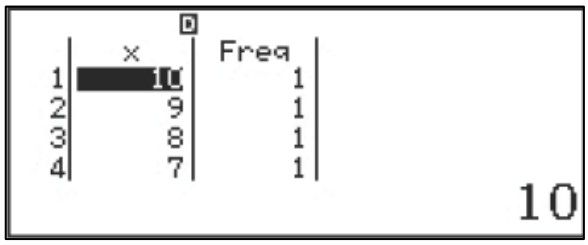


[AC]

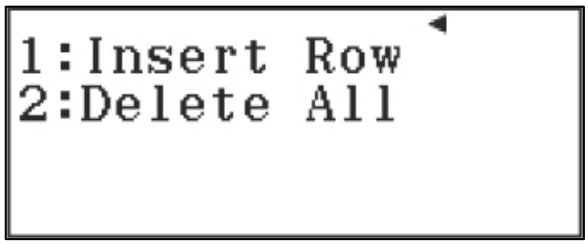


Input data as below, using insert and delete: {10, 9, 8, 7, 6, 5, 4, 3, 2, 1}. (Statistics: On)

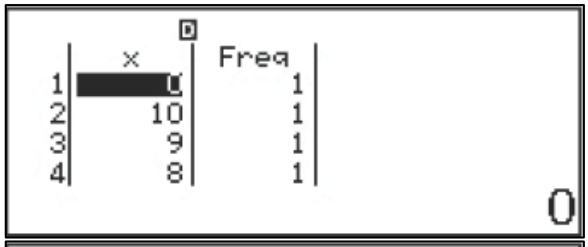
OPTN 1 (Data)



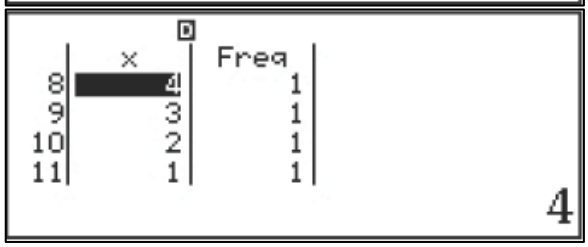
OPTN 1 (Editor)



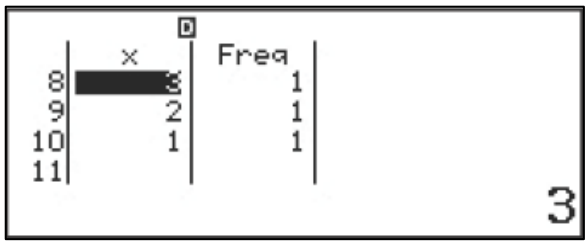
1 (Insert Row)



▲▲▲▲▲



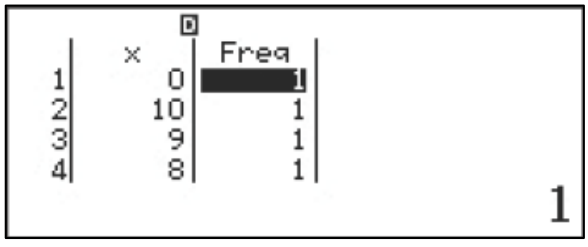
DEL



AC

Input Freq data following the steps below: {1, 2, 3, 4, 4, 3, 2, 1, 1, 2}

OPTN 3 (Freq) ▶

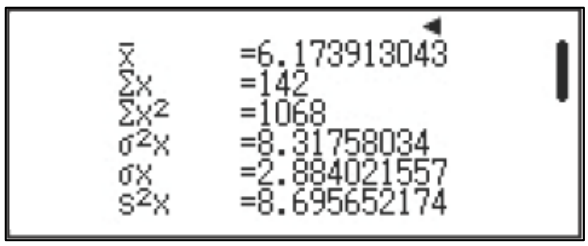


[1] [▼] [2] [=] [▼] [3] [=] [4]
[=] [3] [=] [2] [=] [1] [=] [1]
[=] [2] [=]

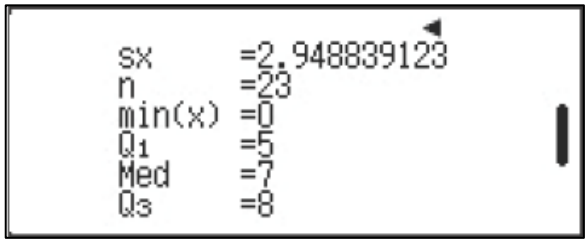
[AC]

Displays statistical values based on input data.

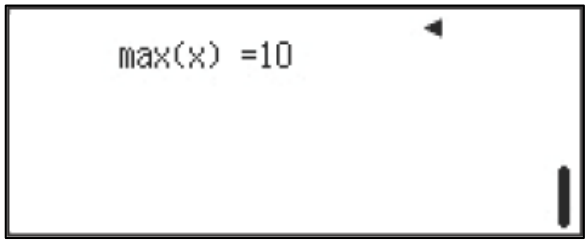
[OPTN] [2] (1-Variable)



[▼]

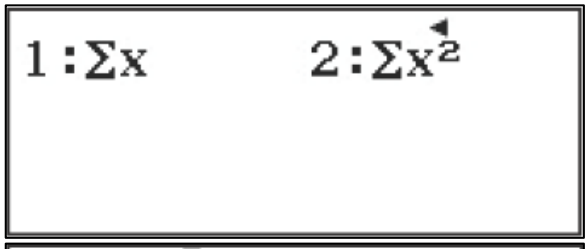


[▼]

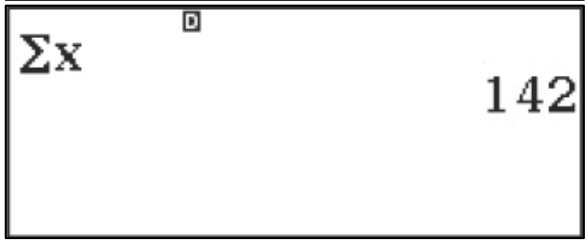


Calculate the sum and sum of squares of sample data.

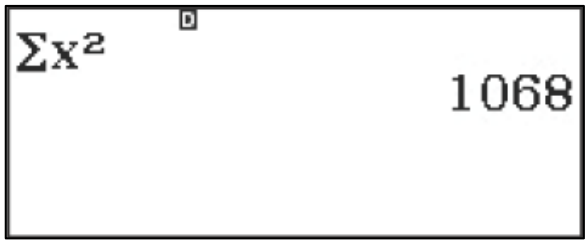
[OPTN] [4] (Summation)



[1] (∑ x) [=]

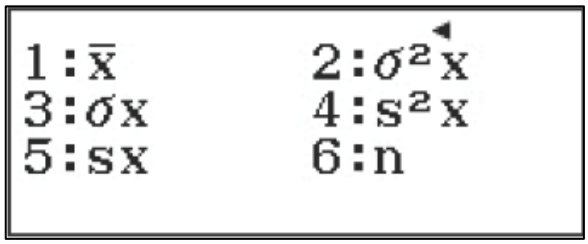


AC OPTN 4 (Summation)
2 ($\sum x^2$) =

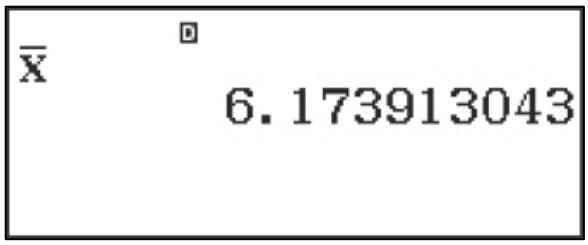


Calculate the average value of sample data, average value and standard deviation.

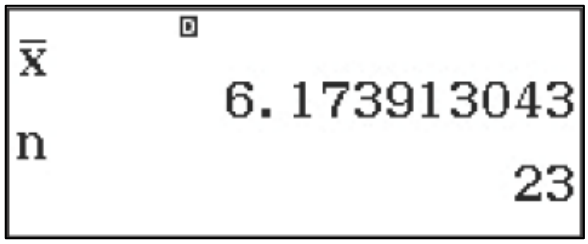
OPTN 5 (Variable)



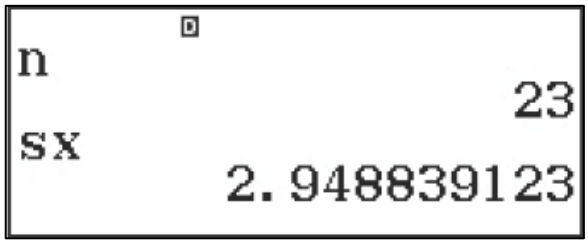
1 ($\bar{x}$) =



OPTN 5 (Variable) 6 (n) =

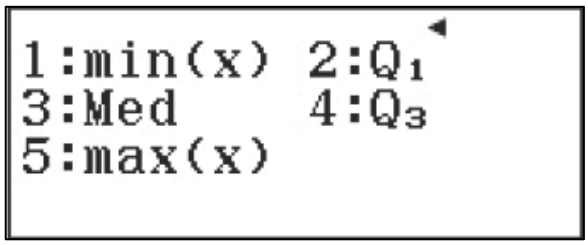


OPTN 5 (Variable) 5 (Sx) =

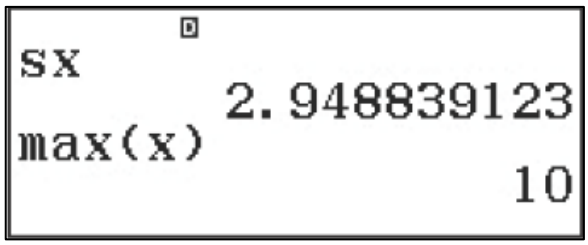


Calculate the Minimum value and Maximum value.

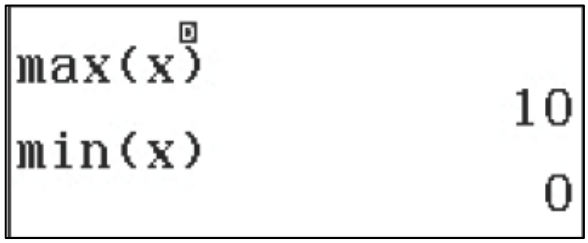
OPTN 6 (Min/Max)



5 (max(x)) =



OPTN 6 (Min/Max) 1 (min(x)) =

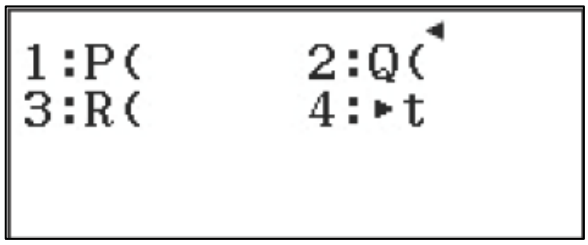


Approximate the distribution based on statistical data to find the probability of the distribution.

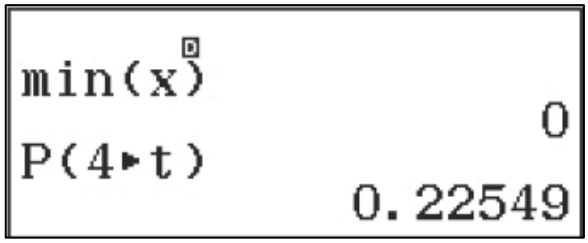
The probability of the distribution is a value smaller than the standardized variation when the sample data value is 3 (P-value for standardized variation when X=3).

The probability of the distribution is a value larger than the standardized variation when the sample data value is 7 (R value for standardized variation when X=7).

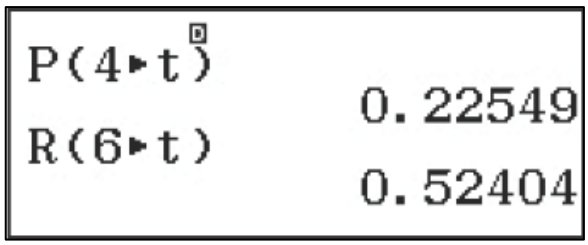
OPTN 7 (Norm Dist)



1 (P() 4 OPTN 7 (Norm Dist)
4) =



OPTN 7 (Norm Dist) 3 (R() 6 OPTN
7 (Norm Dist) 4) =



Linear regression calculation commands (y=a+bx)

With linear regression, regression is performed according to the following sample equation:$y = a + bx$

The following is the calculation formula used for each function:

$$\bar{x} = \frac{\sum x}{n} \qquad a = \frac{\sum y - b.\sum y}{n}$$

$$\sigma_x = \sqrt{\frac{\sum(x-\bar{x})^2}{n}} \qquad b = \frac{n\sum xy - \sum x.\sum y}{n\sum x^2 - (\sum x)^2}$$

$$S_x = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}} \qquad r = \frac{n\sum xy - \sum x.\sum y}{\sqrt{\{n\sum x^2 - (\sum x)^2\}\{n\sum y^2 - (\sum y)^2\}}}$$

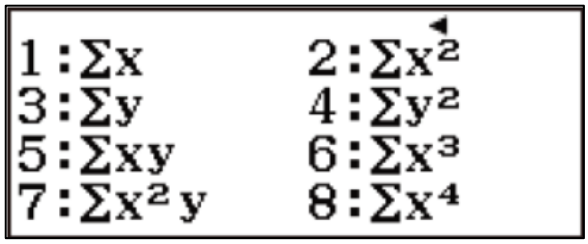
$$\bar{y} = \frac{\sum y}{n} \qquad \hat{x} = \frac{y-a}{b}$$

$$\sigma_y = \sqrt{\frac{\sum(y-\bar{y})^2}{n}} \qquad \hat{y} = a + bx$$

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

Summation sub-menu

To enter the Summation Sub-menu, you can operation as follows:
OPTN 5 (Summation)
Below is a table explaining the functions in the sub-menu:

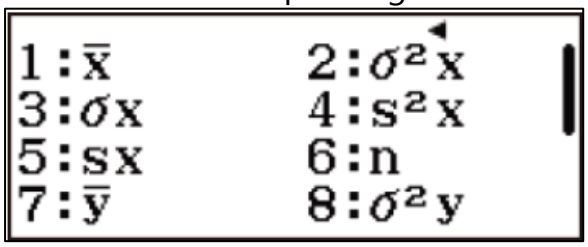


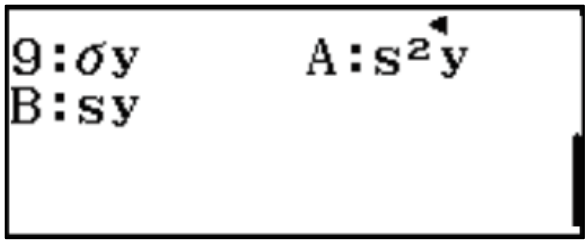
Key press operation	Function
1 $(\sum x))$	Sum value x
2 $\sum x^2)$	Sum of squares of x
3 $(\sum y)$	Sum value y
4 $(\sum y^2$	Sum of squares of y
5 $(\sum xy)$	Sum of products of $x.y$
6 $(\sum x^3)$	Sum of cubes of of x^3
7 $(\sum x^2y)$	Sum of (x squares × y)
8 $(\sum x^4)$	Sum of biquadrate of the x^4

Variable Sub-menu

To enter the Variable Sub-menu, you can operation as follows: OPTN 6 (Variable)

Below is a table explaining the functions in the sub-menu:



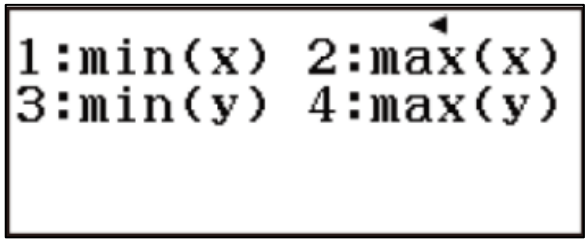


Key Press operation	Function
1 $(\bar{x})$	Average value of sample data x
2 $(\sigma^2 x)$	Sum variance x
3 (σx)	Population standard deviation x
4 $(S^2 x)$	Variance x
5 $(S\,x)$	Standard deviation x
6 (n)	Number of population standard deviation items
7 $(\bar{y})$	Average value of sample data y
8 $(\sigma^2 y)$	Sum variance y
9 (σy)	Population standard deviation y
(−) $[A](S^2 y)$	Variance y
,,, $[B](S\,y)$	Standard deviation y

Min/max sub-menu

To enter the Variable Sub-menu, you can operation as follows: OPTN 6 (Min/Max).

Below is a table explaining the functions in the sub-menu:

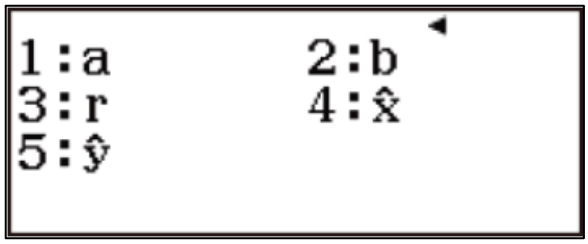


Key Press operation	Function
1 $(\min(x))$	Minimum value of x
2 $(\max(x))$	Maximum value of x
3 $(\min(y))$	Minimum value of y
4 $(\max(y))$	Maximum value of y

Regression Sub-menu

To enter the Variable Sub-menu, you can operate as follows: OPTN 6 (Min/Max).

Below is a table explaining the functions in the sub-menu:



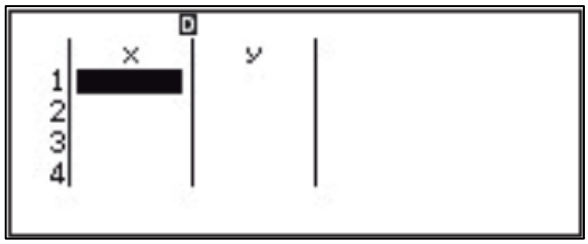
Key Press operation	Function
1 (a)	Constant of regression coefficient a
2 (b)	Regression coefficient of b
3 (r)	Correlation coefficient of r
4 ($\hat{x}$)	Estimated value of x
5 ($\hat{y}$)	Estimated value of y

Example of linear regression calculation.

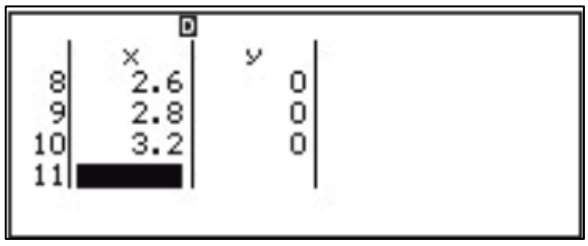
Select logarithm regression and input data following the table below:

x	y	x	y
1,1	1,2	2,0	1,8
1,3	1,4	2,3	1,9
1,4	1,5	2,6	2,0
1,7	1,6	2,8	2,2
1,8	1,7	3,2	2,4

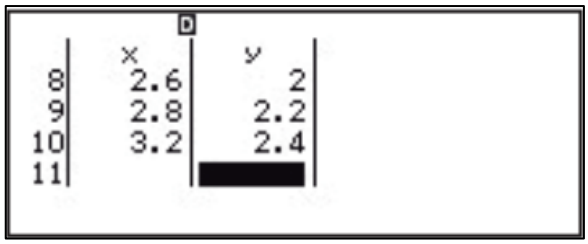
OPTN 1 (Select Type) 2 (y=a+bx)



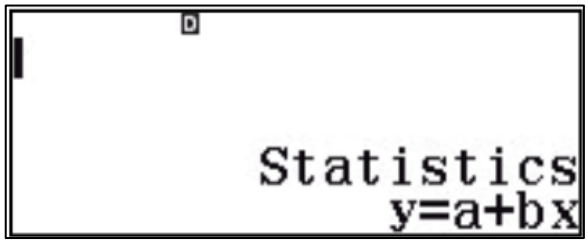
1 • 1 = 1 • 3 =
1 • 4 = 1 • 7 =
1 • 8 = 2 • 0 =
2 • 3 = 2 • 6 =
2 • 8 = 3 • 2 =



▼ ▶ 1 . 2 = 1 . 4 =
1 . 5 = 1 . 6 =
1 . 7 = 1 . 8 =
1 . 9 = 2 . 0 =
2 . 2 = 2 . 4 =

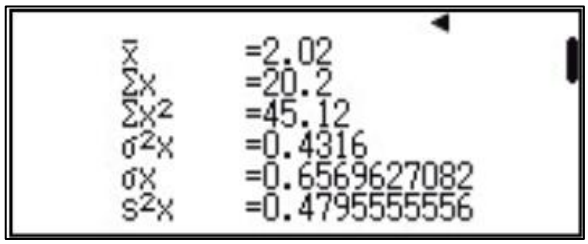


AC

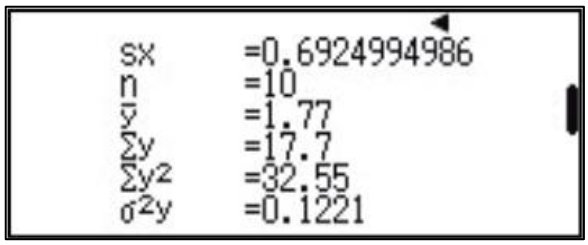


The Statistical values based on input data:

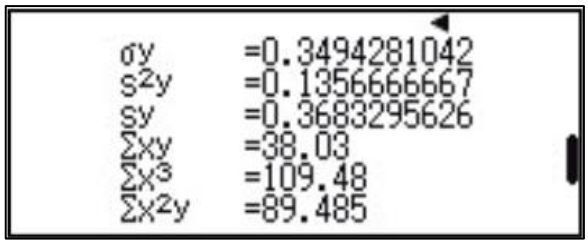
OPTN 2 (2-Variable Calc)



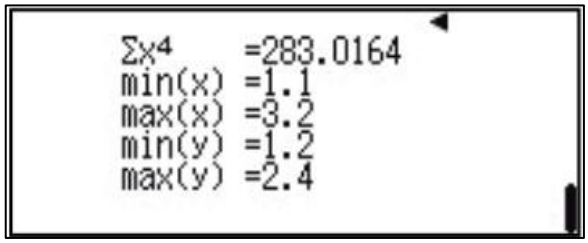
▼



▼

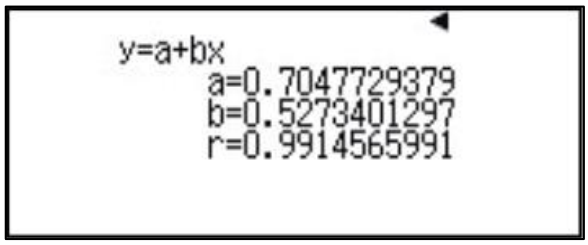


▼



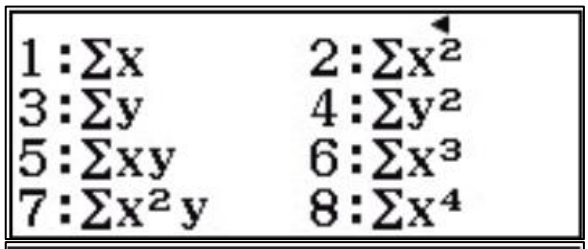
The results of regression calculations based on the input data.

AC OPTN 3 (Regression Calc)

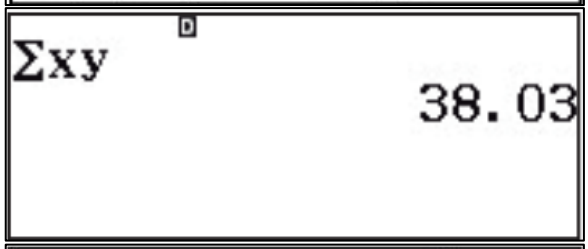


Calculate the sum of the products of x and y in the sample space standard and maximum value of x.

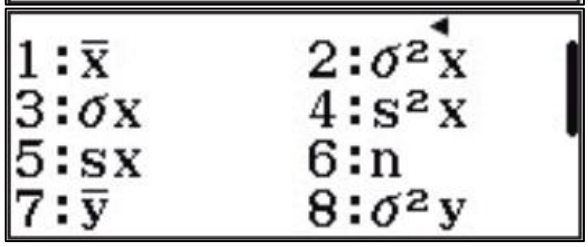
AC OPTN 5 (Summation)



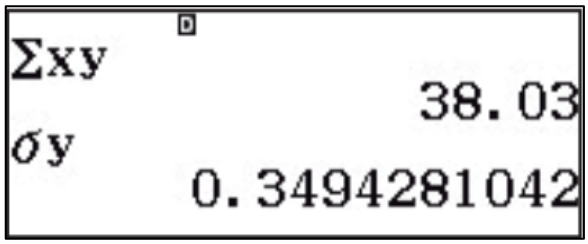
5 ($\sum xy$) =



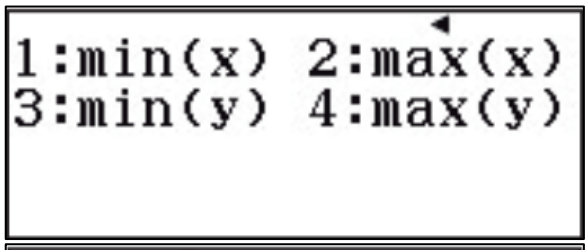
AC OPTN 6 (Variable)



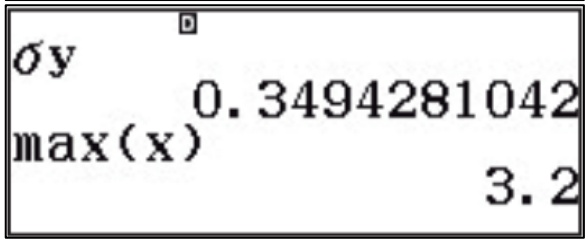
9 (σ_y) =



OPTN 7 (Min/Max)

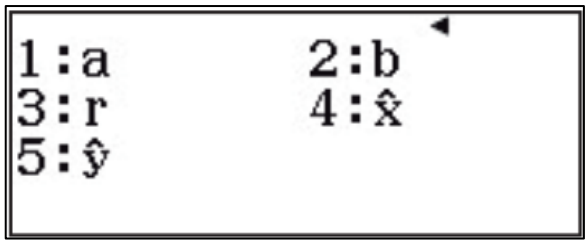


2 ($max(x)$) =

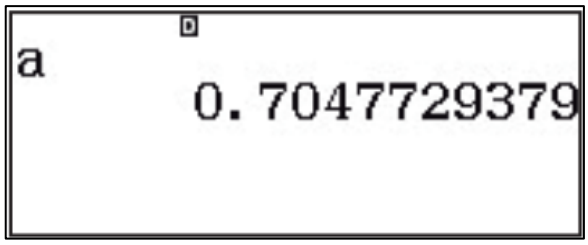


Determine the constant of the regression coefficient b and the correlation coefficient r.

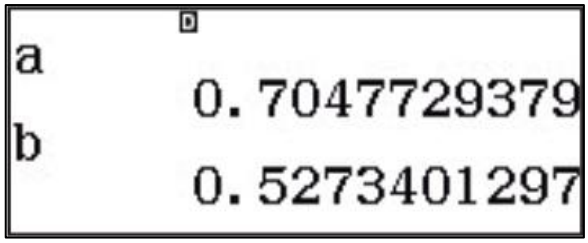
AC OPTN 8 (Regression)



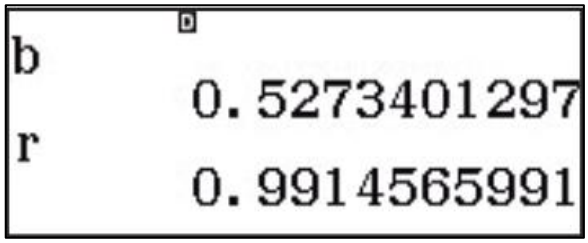
1 (a) =



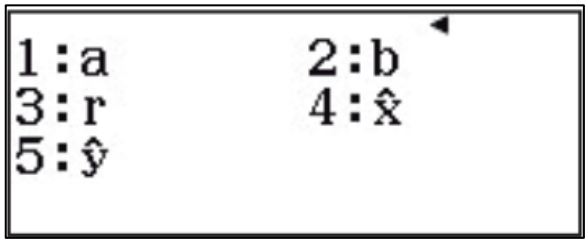
OPTN 8 (Regression) 2 (b) =



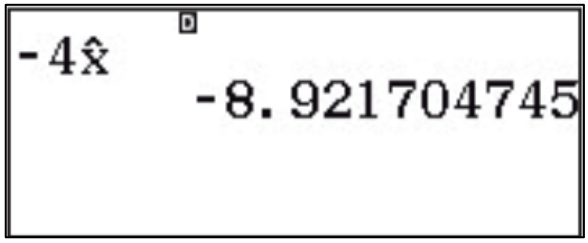
OPTN 8 (Regression) 3 (r) =



Calculate estimated value.
$(y = -1 \rightarrow \bar{x} = ?)$

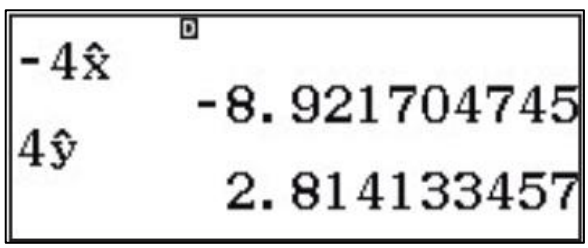


AC (−) 4 OPTN 8 (Regression)



4 ($\bar{x}$) =

$(y = 4 \rightarrow \hat{y} = ?)$



4 OPTN 8 (Regression) 5 $\hat{y}$ =

Commands to calculate quadratic regression ($y=a+bx+cx^2$)

With quadratic regression, regression is performed according to the following equation: **$y=a+bx+cx^2$**

The following is the calculation formula used for each command:

$$a = \frac{\sum y}{n} - b\left(\frac{\sum x}{n}\right) - c\left(\frac{\sum x^2}{n}\right) \qquad b = \frac{Sxy.Sx^2x^2 - Sx^2y.Sxy^2}{Sxy.Sx^2x^2 - (Sxx^2)^2}$$

$$c = \frac{Sx^2y.Sxx - Sxy.Sxx^2}{Sxx.Sx^2x^2 - (Sxx^2)^2} \qquad Sxx = \sum x^2 - \frac{(\sum x)^2}{n}$$

$$Sxy = \sum xy - \frac{(\sum x.\sum x)}{n} \qquad Sxx^2 = \sum x^3 - \frac{(\sum x.\sum x^2)}{n}$$

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

$$\hat{x}1 = \frac{-b + \sqrt{b^2 - 4C(a-y)}}{2C} \qquad \hat{x}2 = \frac{-b - \sqrt{b^2 - 4C(a-y)}}{2C}$$

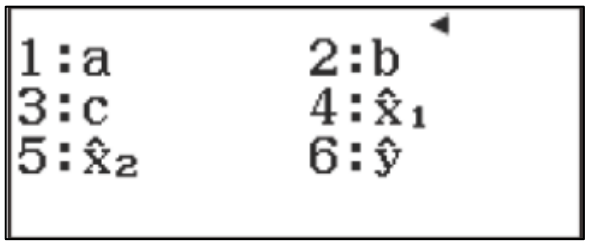
$$\hat{y} = a + bx + cx^2$$

The Summation, Variable and Min/Max Sub-menu operation is similar to linear regression calculations.

Regression Sub-menu.

To enter the Regression Sub-menu, you can operate as follows: [OPTN] [8] (Regression).

Below is a table explaining the functions in the sub-menu:



Keys press operation	Function
[1] (a)	Constant of regression a
[2] (b)	Linear coefficient of regression coefficient of b
[3] (c)	Quadratic coefficient of regression coefficient c.
[4] ($\hat{x}1$)	Estimated value of $x1$

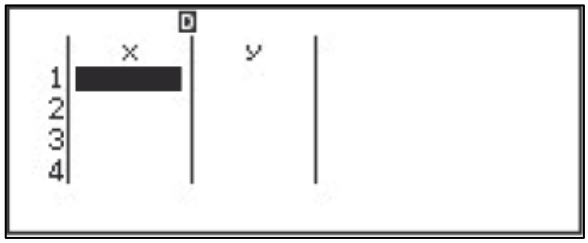
[5] ($\hat{x}2$)	Estimated value of $x2$
[6] ($\hat{y}$)	Estimated value of y

Example of calculating quadratic regression

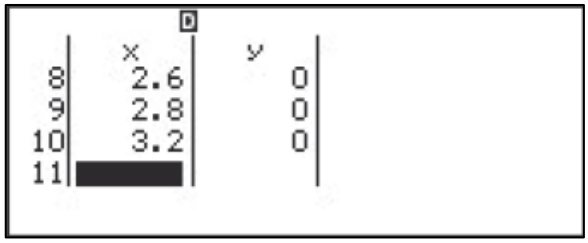
Select quadratic regression and input data according to the table below:

x	y	x	y
1,1	1,2	2,0	1,8
1,3	1,4	2,3	1,9
1,4	1,5	2,6	2,0
1,7	1,6	2,8	2,2
1,8	1,7	3,2	2,4

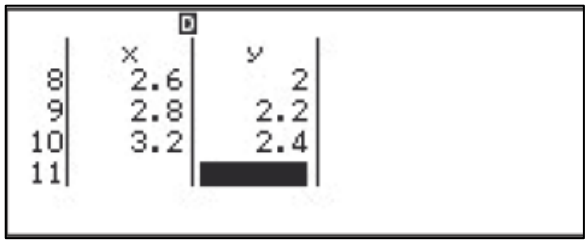
[OPTN] [1] (Select Type) [3] ($y=a+bx+cx^2$)



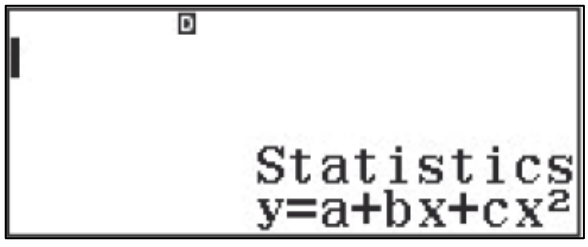
[1] [•] [1] [=] [1] [•] [3] [=] [1] [•] [4] [=] [1] [•] [7] [=] [1] [•] [8] [=] [2] [•] [0] [=] [2] [•] [3] [=] [2] [•] [6] [=] [2] [•] [8] [=] [3] [•] [2] [=]



[▼] [▶] [1] [•] [2] [=] [1] [•] [4] [=] [1] [•] [5] [=] [1] [•] [6] [=] [1] [•] [7] [=] [1] [•] [8] [=] [1] [•] [9] [=] [2] [•] [0] [=] [2] [•] [2] [=] [2] [•] [4] [=]

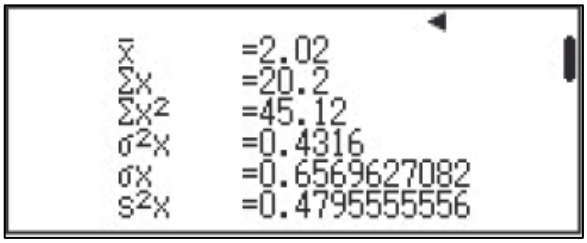


[AC]

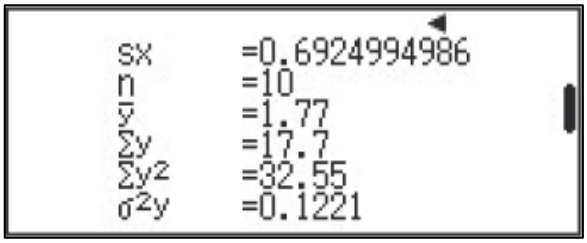


View statistical values based on input data.

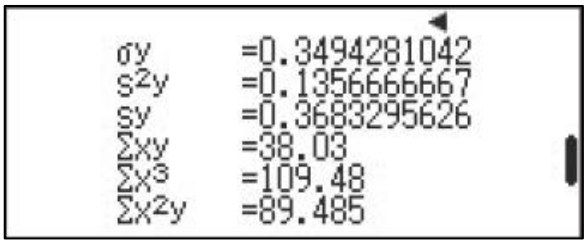
OPTN 2 (2-Variable Calc)



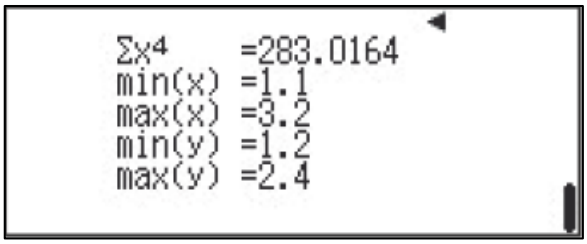
▼



▼

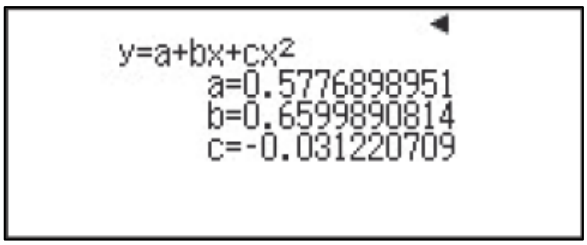


▼



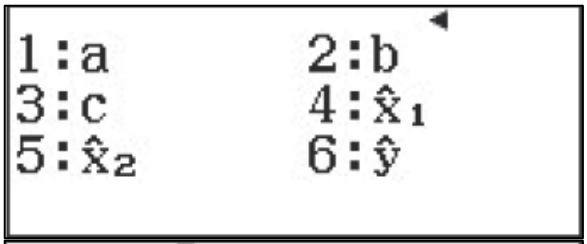
View the results of regression calculations based on input data.

AC OPTN 3 (Regression Calc)

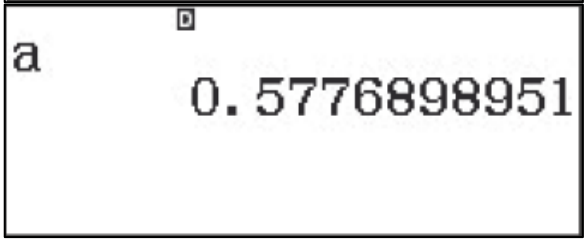


Calculate the constant of regression a, regression coefficient b and quadratic coefficient of regression c.

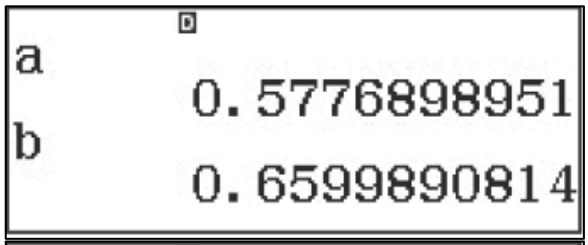
AC OPTN 8 (Regression)



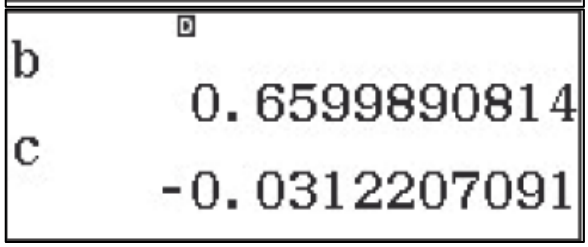
1 (a) =



AC OPTN 8 (Regression) 2 (b) =



AC OPTN 8 (Regression) 3 (c) =



Calculate Regression Logarithm (y=a+bln(x))

With Regression Logarithm, regression is performed according to the following equation.

$$\boldsymbol{y = a + b.ln(x)}$$

The following is the calculation formula used for each command:

$$a = \frac{\sum y - b\sum \ln x}{n}$$

$$b = \frac{n.\sum(\ln x)y - \sum \ln x\,.\sum y}{n.\sum(\ln x)^2 - (\sum \ln x)^2}$$

$$r = \frac{n.\sum(\ln x)y - \sum \ln x\,.\sum y}{\sqrt{\{n.\sum(\ln x)^2 - (\sum \mathrm{lnx})^2\}\{n.\sum y^2 - (\sum y)^2\}}}$$

$$\hat{x} = e^{\frac{y-a}{b}}$$

$$\hat{y} = a + blnx$$

The Summation, Variable, Min/Max, and Regression sub-menu operations are similar linear regression calculations.

Example of calculating Logarithm Regression.

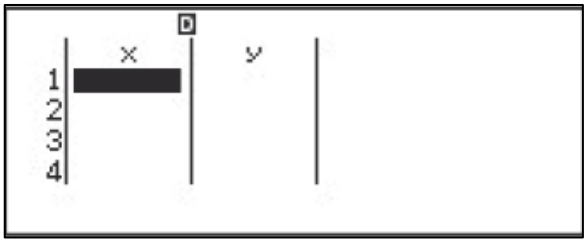
Select Logarithm regression and input the following data.

(Statistics: Off)

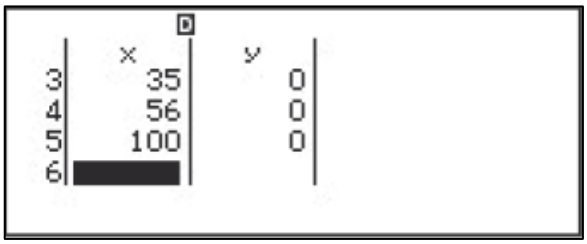
x	x
40	25
32	30
35	42
56	52

100	78

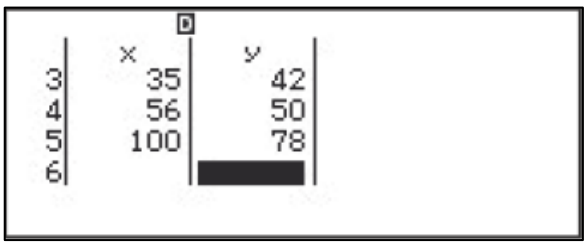
[OPTN] [1] (Select Type) [4] (y=a+b.Ln(x))



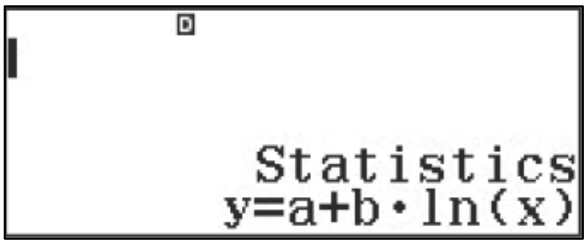
[4] [0] [=] [3] [2] [=] [3] [5] [=] [5] [6] [=] [1] [0] [0] [=]



[▼] [▶] [2] [5] [=] [3] [0] [=] [4] [2] [=] [5] [0] [=] [7] [8] [=]

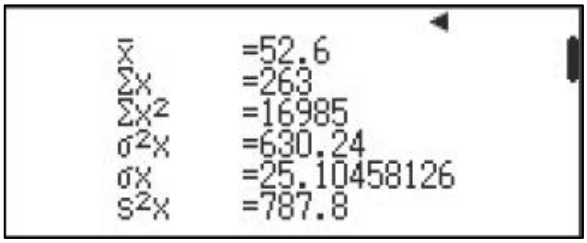


[AC]

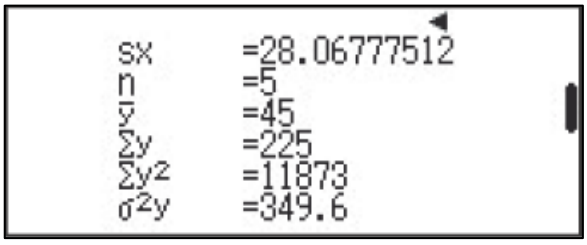


View statistical values based on input data.

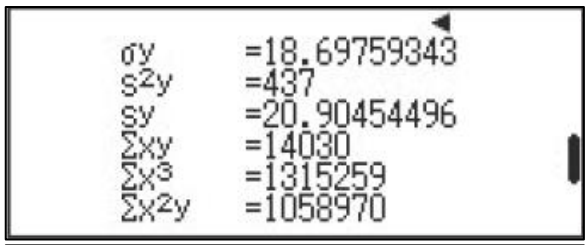
[OPTN] [2] (2-Variable Calc)



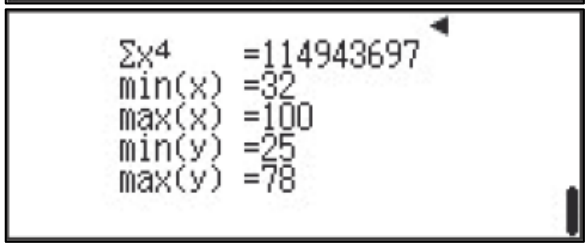
[▼]



▼

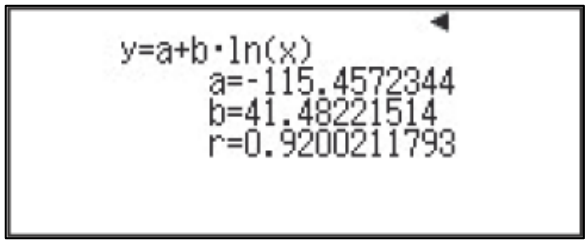


▼



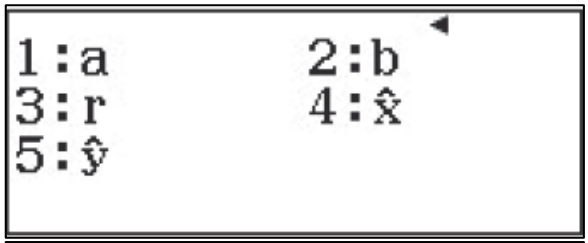
View the results of regression calculations based on input data.

AC OPTN 3 (Regression calc)

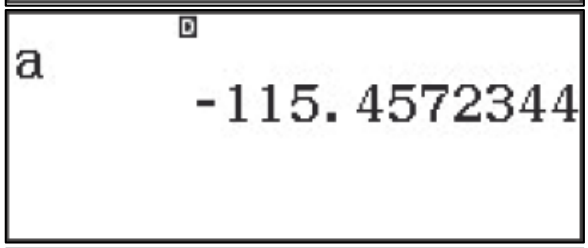


Calculate the constant of regression a, regression coefficient b and correlation coefficient r.

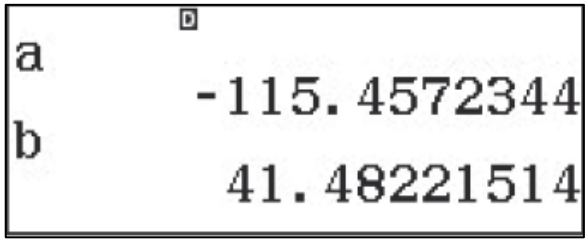
AC OPTN 8 (Regression)



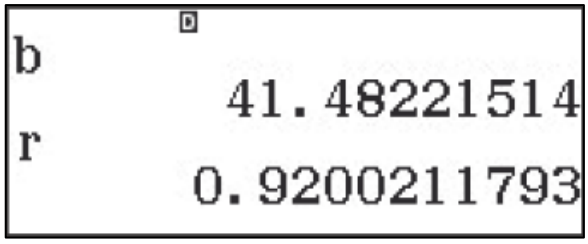
1 (a) =



OPTN 8 (Regression) 2 (b) =

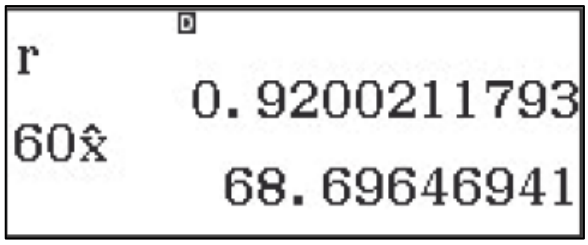


OPTN 8 (Regression) 3 (b) =



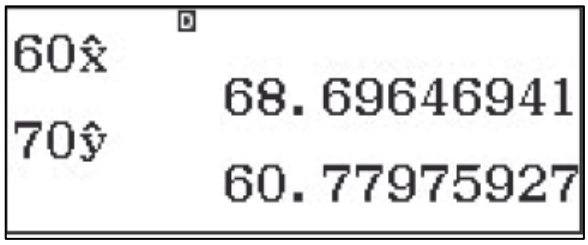
Calculate estimated value of x, y.
$(y = 60 \rightarrow \hat{x} = ?)$

[6] [0] [OPTN] [8] (Regression)
[4] $(\hat{x})$ [=]



$(x = 70 \rightarrow \hat{y} = ?)$

[7] [0] [OPTN] [8] (Regression) [5] $(\hat{y})$ [=]



Calculate Exponential Regression e (y=a.e^(bx))

With Exponential Regression **e**, regression is performed according to the following sample equation:

$$\boldsymbol{y = a.e^{bx}}$$

The following is the calculation formula used for each command:

$$a = exp\left(\frac{\sum lny - b.\sum x}{n}\right)$$

$$b = \frac{n.\sum xlny - \sum x \sum lny}{n\sum x^2 - (\sum x)^2}$$

$$r = \frac{n\sum x\, lny - \sum x \sum lny}{\sqrt{\{n.\sum x^2 - (\sum x)^2\}\{n.\sum (lny)^2 - (\sum lny)^2\}}}$$

$$\hat{x} = \frac{lny - lna}{b}$$

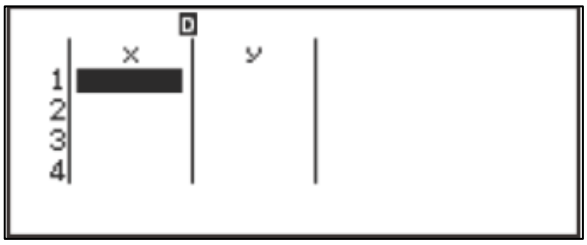
$$\hat{y} = a.e^{bx}$$

The Summation, Variable, Min/Max, and Regression sub-menu operations are similar linear regression calculations.

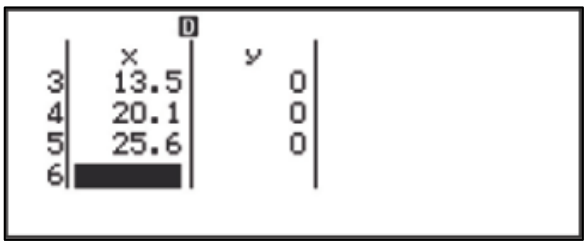
Example of calculating Exponential Regression e.
Select Exponential Regression e and input the following data.
(Statistics: Off)

x	y
1.5	3.7
10.2	7.9
13.5	5.2
20.1	7.2
25.6	4.3

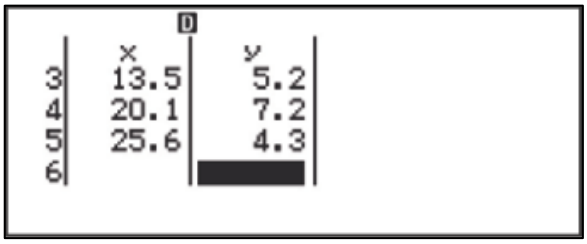
OPTN 1 (Select Type) 5 (y=a.e^(bx))



1 • 5 = 1 0 • 2 = 1 3 • 5 = 2 0 • 1 = 2 5 • 6 =



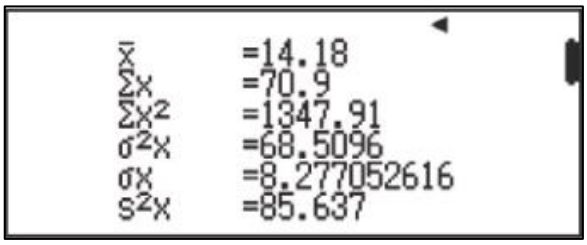
▼ ▶ 3 • 1 = 7 • 9 = 5 • 2 = 7 • 2 = 4 • 3 =



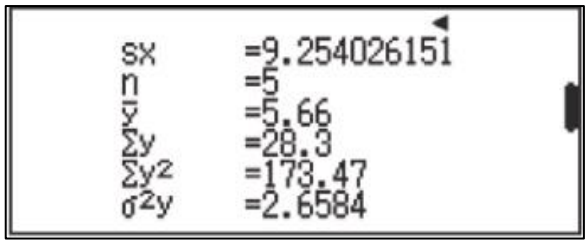
AC

View statistical values based on input data.

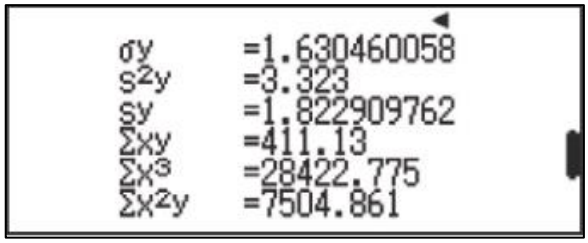
OPTN 2 (2-Variable Calc)



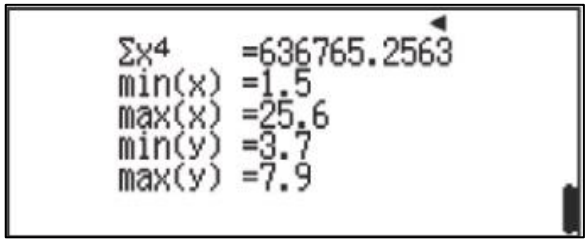
▼



▼

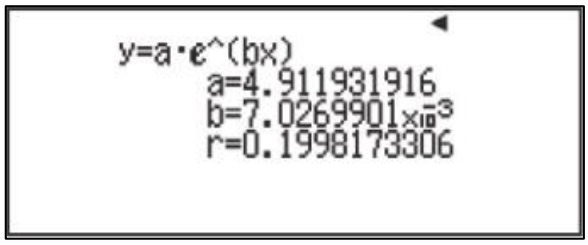


▼



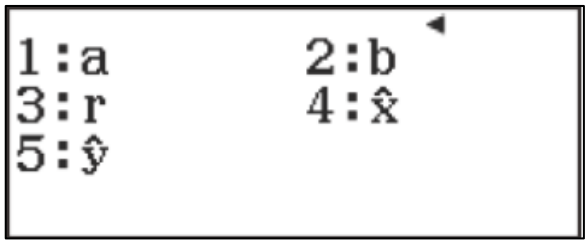
View the results of regression calculations based on input data.

AC OPTN 3 (Regression Calc)

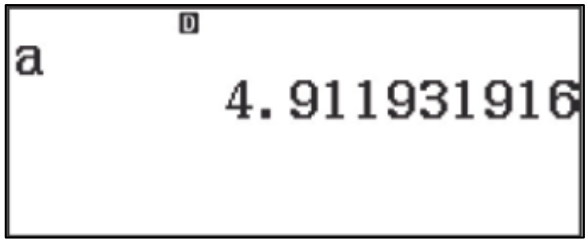


Calculate the constant of regression a, regression coefficient b and correlation coefficient r.

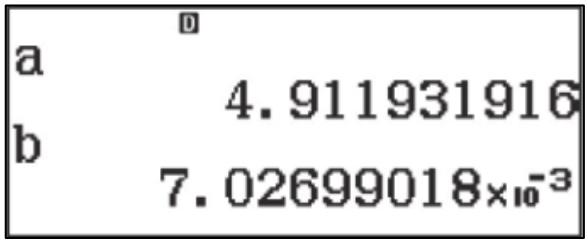
AC OPTN 8 (Regression)



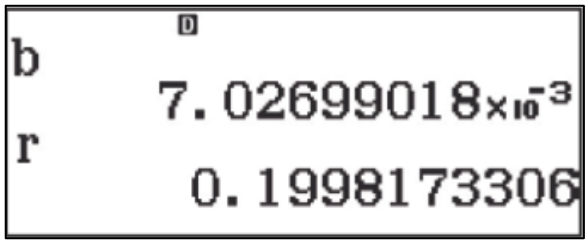
1 (a) =



OPTN 8 (Regression) 2 (b) =

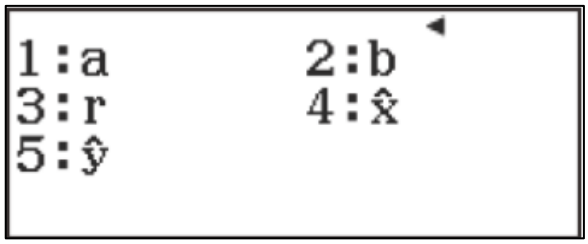


[OPTN] [8] (Regression) [3] (r) [=]

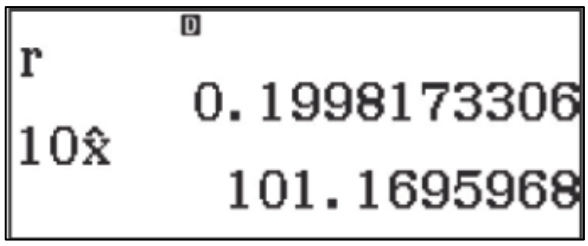


Calculate estimated value of x, y
$(y = 10 \rightarrow \hat{x} = ?)$

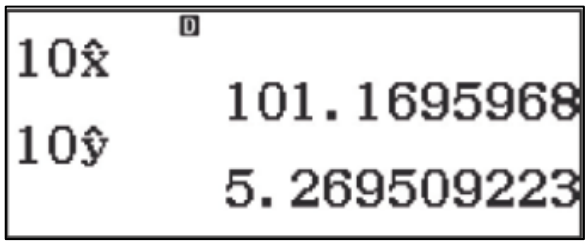
[1] [0] [OPTN] [8] (Regression)



[4] $(\hat{x})$ [=]



[1] [0] [OPTN] [8] (Regression) [5] $(\hat{y})$ [=]



Calculate Exponential Regression ab (y=a.b^x)

With Exponential Regression **ab**, regression is performed according to the following sample equation:

$$\boldsymbol{y = ab^x}$$

The following is the calculation formula used for each command:

$$a = exp\left(\frac{\sum lny - lnb.\sum x}{n}\right)$$

$$b = exp\left(\frac{n.\sum xlny - \sum x.\sum lny}{n\sum x^2 - (\sum x)^2}\right)$$

$$r = \frac{n.\sum x\,lny - \sum x.\sum lny}{\sqrt{\{n.\sum x^2 - (\sum x)^2\}\{n.\sum (lny)^2 - (\sum lny)^2\}}}$$

$$\hat{x} = \frac{lny - lna}{lnb}$$

$\hat{y} = a.b^x$

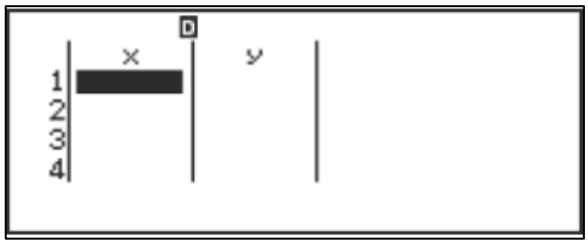
The Summation, Variable, Min/Max, and Regression sub-menu operations are similar linear regression calculations.

Example of calculating Exponential Regression ab.

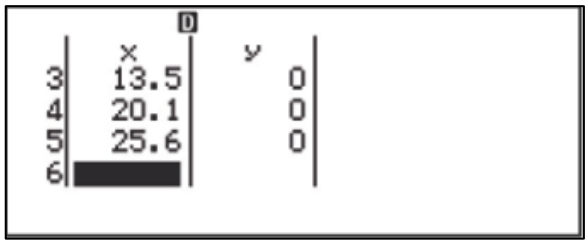
Select Exponential Regression ab and input the following data.
(Statistics: Off)

x	y
1.5	3.7
10.2	7.9
13.5	5.2
20.1	7.2
25.6	4.3

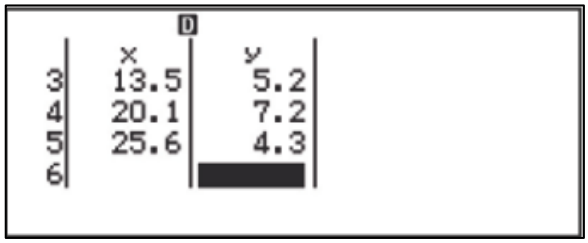
[OPTN] [1] (Select Type) [6] (y=a.b^x)



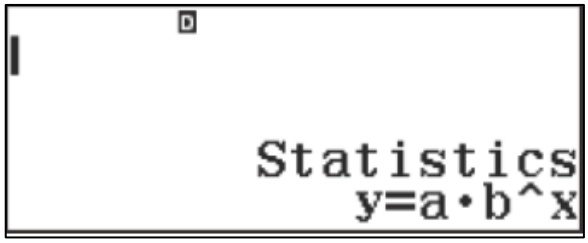
[1] [•] [5] [=] [1] [0] [•] [2] [=] [1] [3] [•] [5] [=] [2] [0] [•] [1] [=] [2] [5] [•] [6] [=]



[▼] [▶] [3] [•] [7] [=] [7] [•] [9] [=] [5] [•] [2] [=] [7] [•] [2] [=] [4] [•] [3] [=]

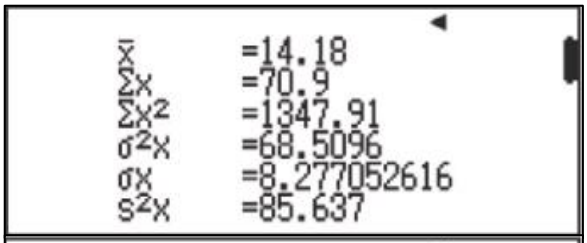


[AC]

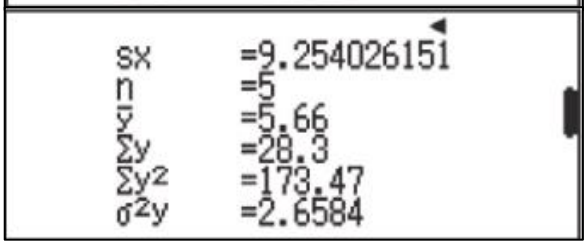


View statistical values based on input data.

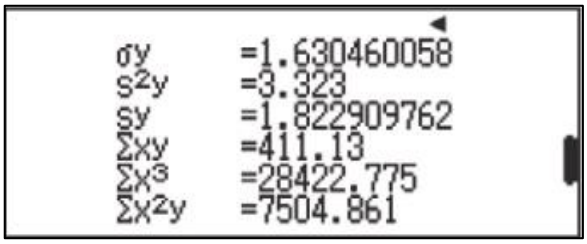
OPTN 2 (2-Variable)



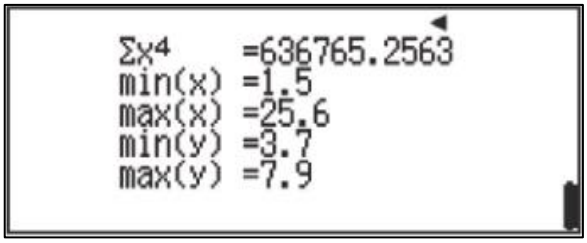
▼



▼

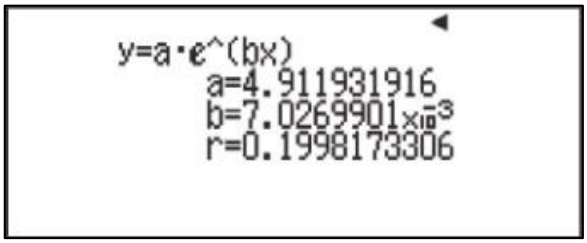


▼



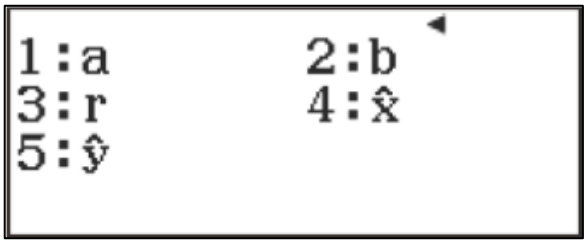
View the results of regression calculations based on input data.

AC OPTN 2 (Regression Calc)

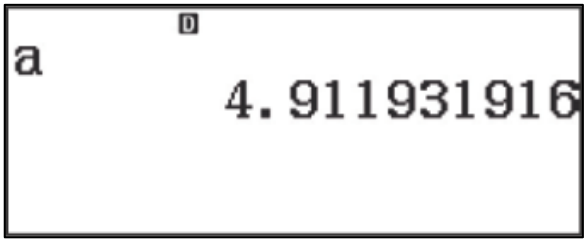


Calculate the constant of regression a, regression coefficient b and correlation coefficient r.

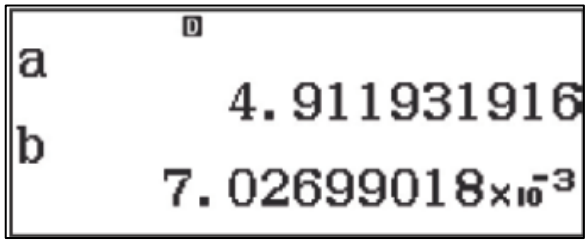
AC OPTN 8 (Regression)



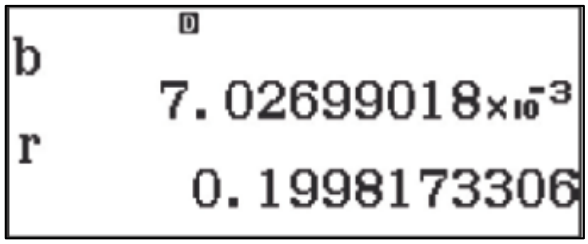
1 (a) =



AC OPTN 8 (Regression) 2 (b) =

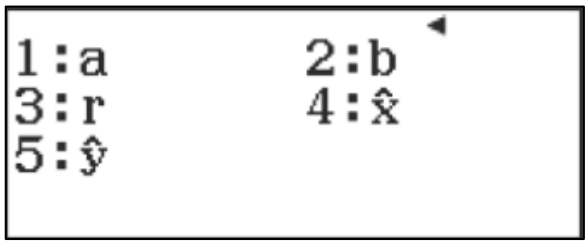


AC OPTN 8 (Regression) 3 (r) =

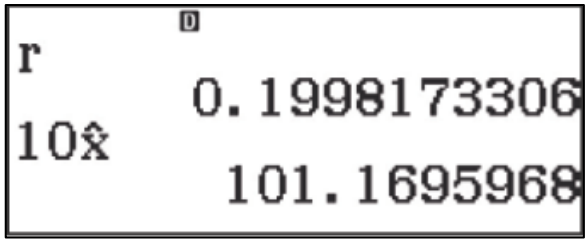


Calculate estimated value of x, y
$(y = 10 \rightarrow \hat{x} = ?)$

1 0 OPTN 8 (Regression)

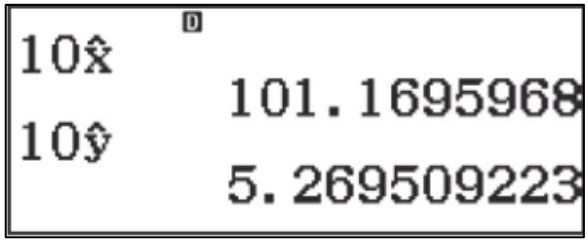


4 ($\hat{x}$) =



$(x = 10 \rightarrow \hat{y} = ?)$

1 0 OPTN 8 (Regression) 5 ($\hat{y}$) =



Calculate Exponential Regression x (y=a.x^b)

With Exponential Regression **x**, regression is performed according to the following sample equation:

$$y = ax^b$$

The following is the calculation formula used for each command:

$$a = exp\left(\frac{\sum lny - b.\sum lnx}{n}\right)$$

$$b = exp\left(\frac{n.\sum lnxlny - \sum lnx\,.\sum lny}{n.\sum(lnx)^2 - (\sum lnx)^2}\right)$$

$$r = \frac{n.\sum lnx\,lny\; - \sum lnx\,.\sum lny}{\sqrt{\{n.\sum(lnx)^2 - (\sum lnx)^2\}\{n.\sum(lny)^2 - (\sum lny)^2\}}}$$

$$\hat{x} = e^{\frac{lny - lna}{b}}$$

$$\hat{y} = a.x^b$$

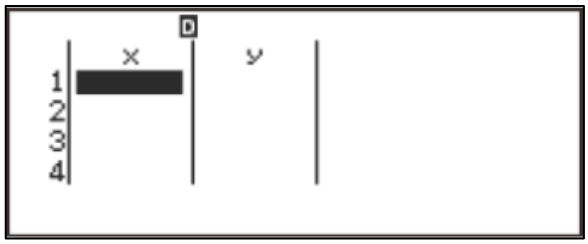
The Summation, Variable, Min/Max, and Regression sub-menu operations are similar linear regression calculations.

Example of calculating Exponential Regression of x.

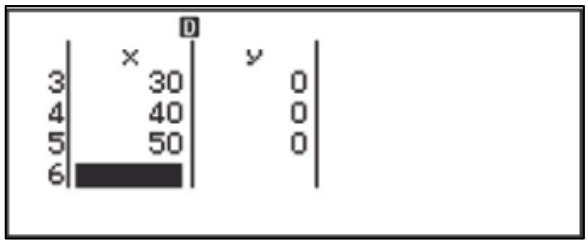
Select Exponential Regression x and input the following data.
(Statistics: Off)

x	y
10	1500
20	2000
30	4500
40	2500
50	3000

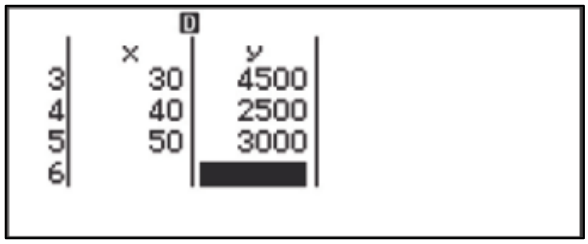
[OPTN] [1] (Select Type) [7] (y=a.x^b)



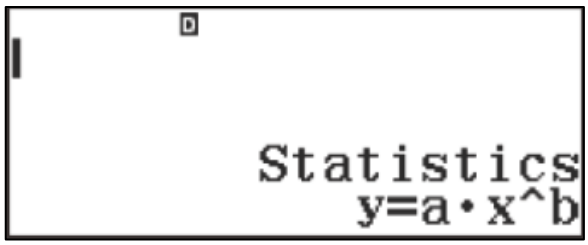
[1] [0] [=] [2] [0] [=] [3] [0] [=] [4] [0] [=] [5] [0] [=]



[▼] [▶] [1] [5] [0] [0] [=] [2] [0] [0] [0] [=] [4] [5] [0] [0] [=] [2] [5] [0] [0] [=] [3] [0] [0] [0] [=]

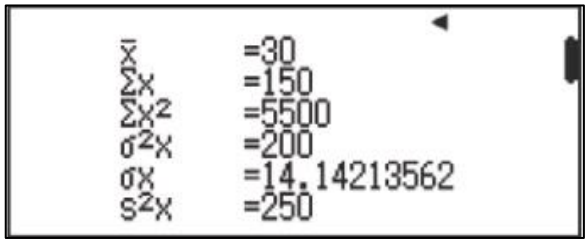


AC

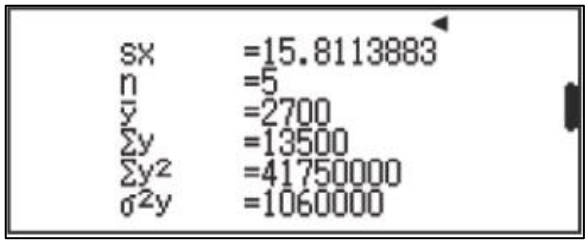


View statistical values based on input data.

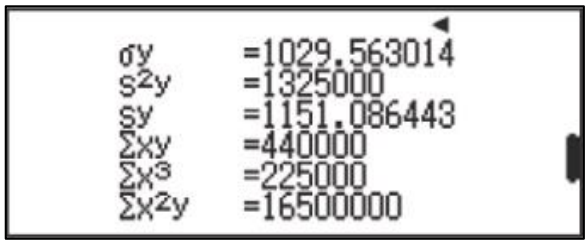
OPTN 2 (2-Variable Calc)



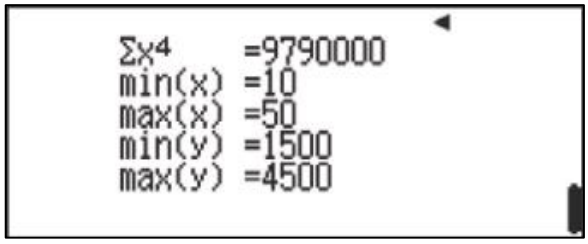
▼



▼

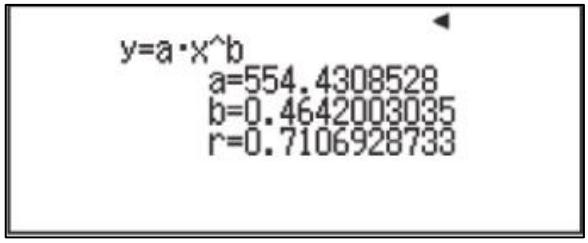


▼



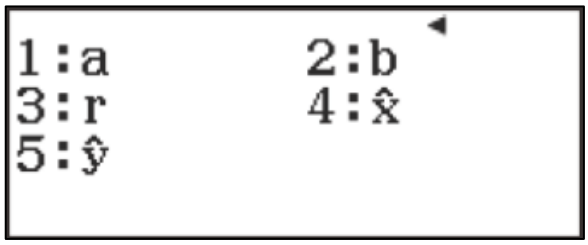
View the results of regression calculations based on input data.

AC OPTN 3 (Regression Calc)

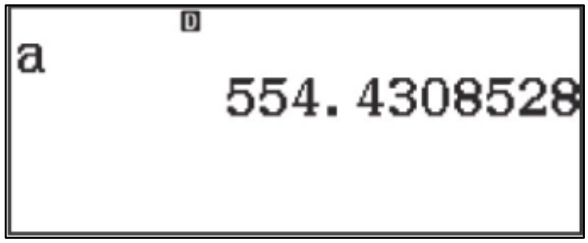


Calculate the constant of regression a, regression coefficient b and correlation coefficient r.

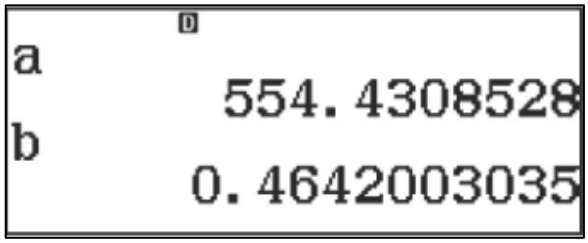
AC OPTN 8 (Regression)



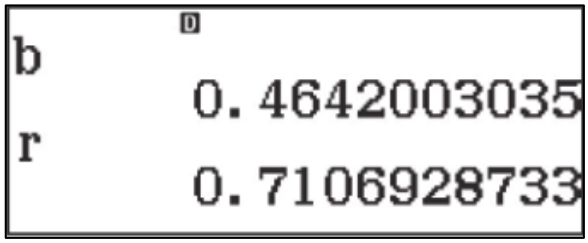
1 (a) =



OPTN 8 (Regression) 2 (b) =

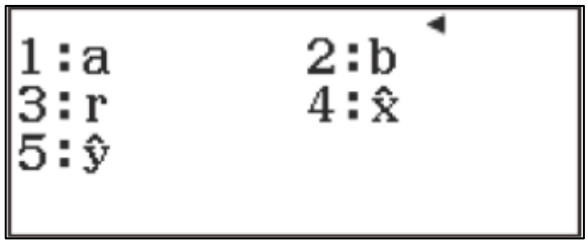


OPTN 8 (Regression) 3 (c) =

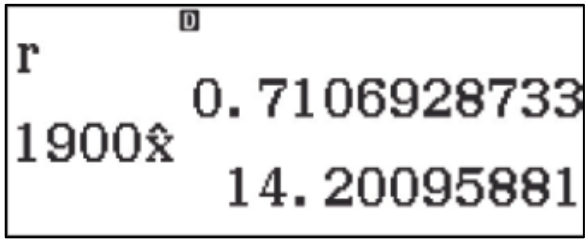


Calculate estimated value of x, y.
($y = 1900 \rightarrow \hat{x} = ?$)

1 9 0 0 OPTN 8 (Regression)

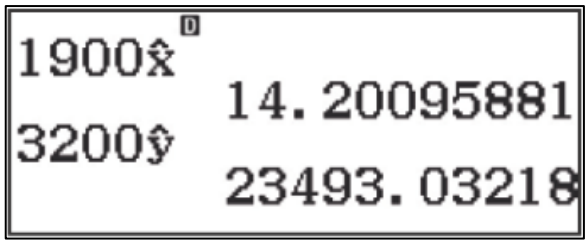


4 ($\hat{x}$) =



($x = 3200 \rightarrow \hat{y} = ?$)

3 2 0 0 OPTN 8 (Regression)
5 ($\hat{y}$) =



Calculate Inverse Regression.

With Inverse regression, regression is performed according to the following sample equation.

$$y = a + \frac{b}{x}$$

The following is the calculation formula used for each command:

$$a = \frac{\sum y - b.\sum x^{-1}}{n} \qquad b = \frac{Sxy}{Sxx}$$

$$r = \frac{Sxy}{\sqrt{Sxx.Syy}} \qquad Sxx = \sum (x^{-1})^2 - \frac{(\sum x^{-1})^2}{n}$$

$$Syy = \sum y^2 - \frac{(\sum y)^2}{n} \qquad Sxy = \sum (x^{-1})y - \frac{\sum x^{-1}.\sum y}{n}$$

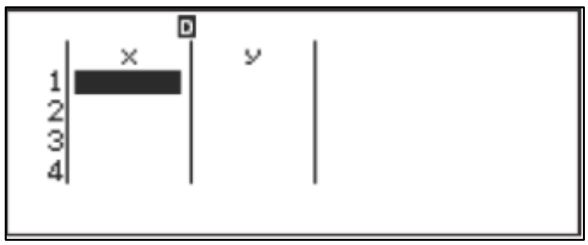
$$\hat{x} = \frac{b}{y - a} \qquad \hat{y} = a + \frac{b}{x}$$

The Summation, Variable, Min/Max, and Regression sub-menu operations are similar linear regression calculations.

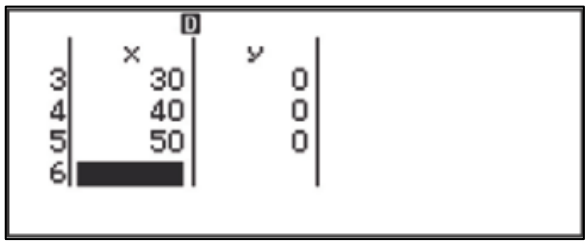
Example of an inverse regression calculation.

x	y
10	1500
20	2000
30	4500
40	2500
50	3000

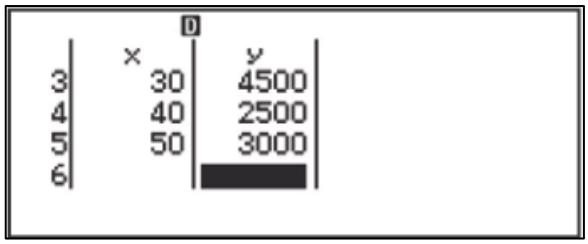
[OPTN] [1] (Select Type) [8] (y=a+b/x)



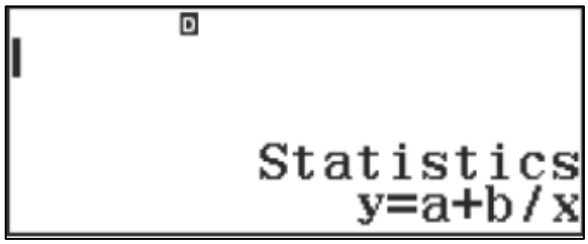
[1] [0] [=] [2] [0] [=] [3] [0] [=] [4] [0] [=] [5] [0] [=]



▼ ▶ 1 5 0 0 = 2 0 0 0 = 4 5 0 0 = 2 5 0 0 = 3 0 0 0 =

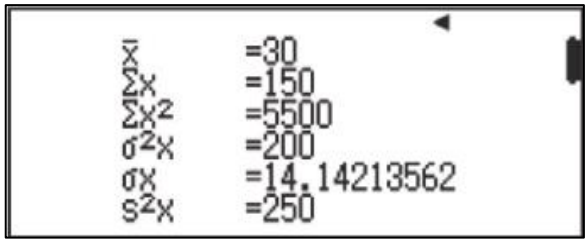


AC

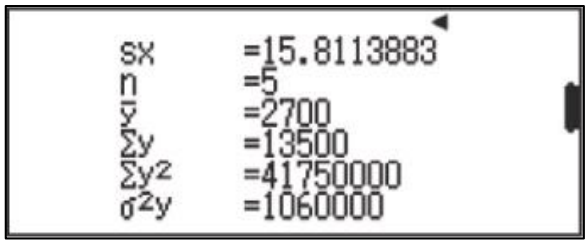


View statistical values based on input data.

OPTN 2 (2-Regression Calc)



▼



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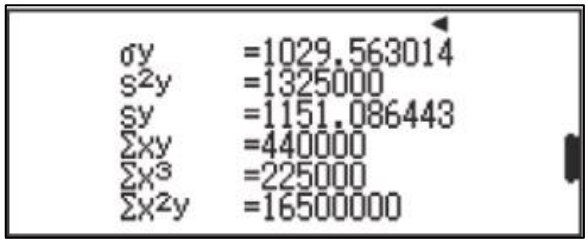
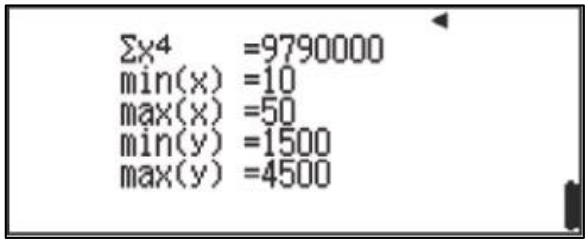
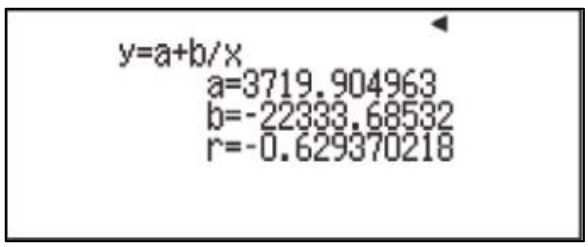


▼



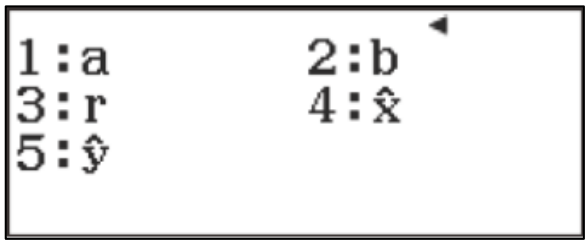
View the results of regression calculations based on input data.

AC OPTN 3 (Regression Calc)

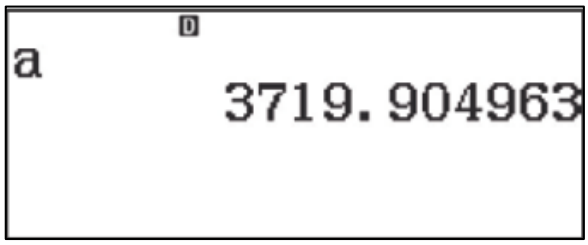


Calculate the constant of regression a, regression coefficient b and correlation coefficient r.

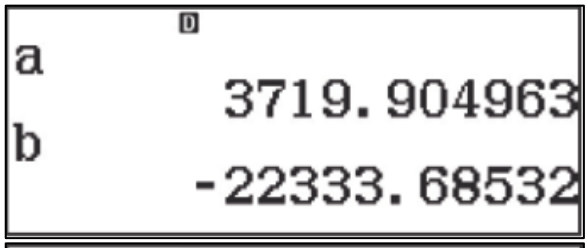
AC OPTN 8 (Regression)



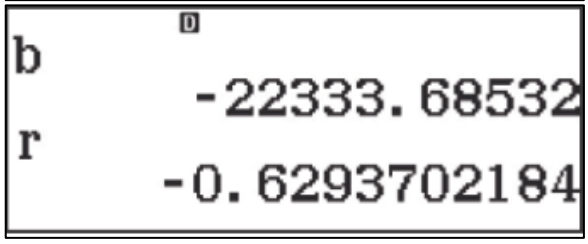
1 (a) =



AC OPTN 8 (Regression) 2 (b) =

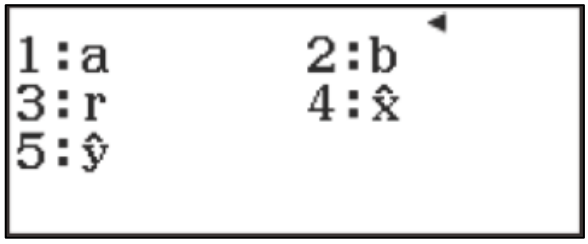


AC OPTN 8 (Regression) 3 (r) =

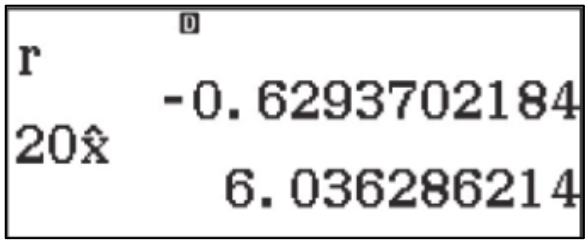


Calculate estimated value of x, y.
($y = 20 \rightarrow \hat{x} = ?$)

2 0 OPTN 8 (Regression)

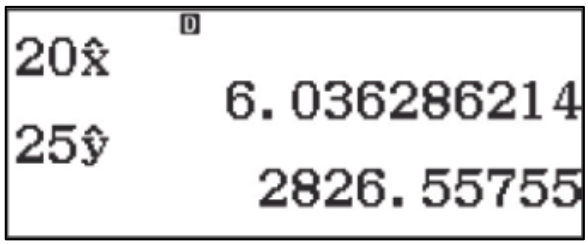


4 ($\hat{x}$) =



($x = 25 \rightarrow \hat{y} = ?$)

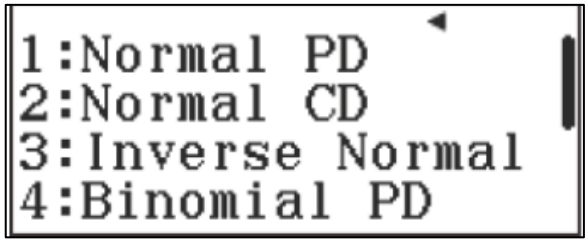
[2] [5] [OPTN] [8] (Regression) [5] ($\hat{y}$) [=]



Calculate the distribution (DIST)

In calculations Distribution have 7 different calculation modes described in the following steps.

Step 1: An [MENU] select [7] (Distribution mode), then press [=]



Step 2: On the displayed list, key press operation as in the table below to select the distribution calculation mode:

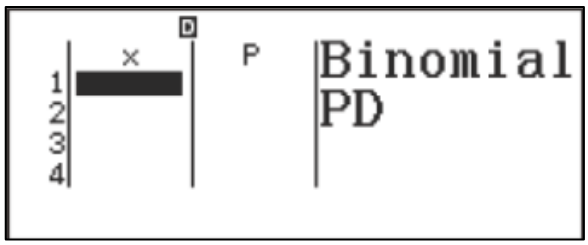
Key press operation	Distributed calculation mode
[1] (Normal PD)	Normal probability distribution
[2] (Normal CD)	Normal cumulative distribution
[3] (Inverse Normal)	Inverse normal cumulative distribution
[4] (Binomial PD)	Binomial probability distribution
[5] (Binomial CD)	Binomial cumulative distribution
[6] (Poisson PD)	Poisson probability distribution
[7] (Poisson CD)	Poisson cumulative distribution

Note

- If you select Normal PD, Normal CD or Inverse Normal calculation mode, skip step 3 of this procedure.

Step 3: On the displayed screen, select a method to input data (x)

- Press the [1] (List) key to input x data items.
- Press the [2] (Variable) key to input one x data item.
- If you select the List input method, the editing screen will display so you can input the values of x.



Step 4: Input values for the variables.

- Depending on the calculation mode selected in step 2, there will be different variables that need to be inputted.

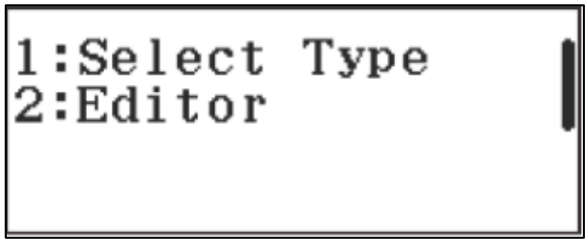
Step 5: After inputting values for all variables, press [=] to display the calculation results.

Note

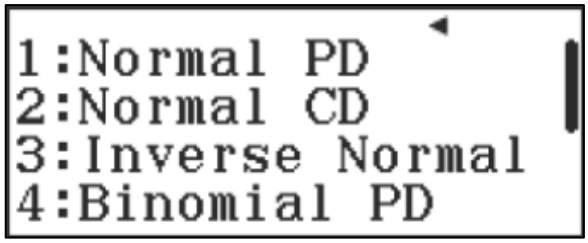
- When the calculation results screen is displayed, pressing [=] will return to the variable value input screen.
- If you select the input method other "List" in step 3, the calculation results will be saved in the results memory (Ans).
- In Distributed calculation mode, calculation accuracy is up to 6 significant digits.

To change the Distribution calculation mode, perform the following key press operation:

Step 1: Press [OPTN]



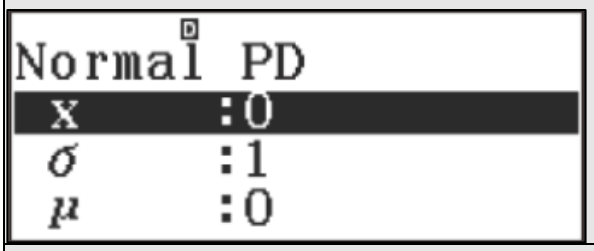
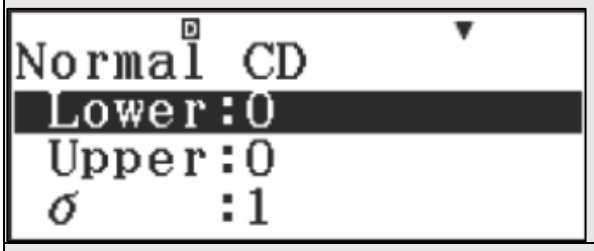
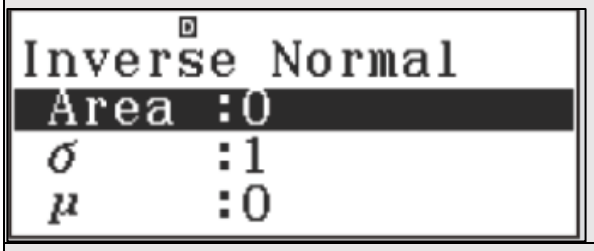
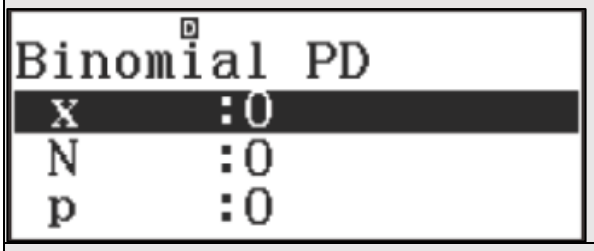
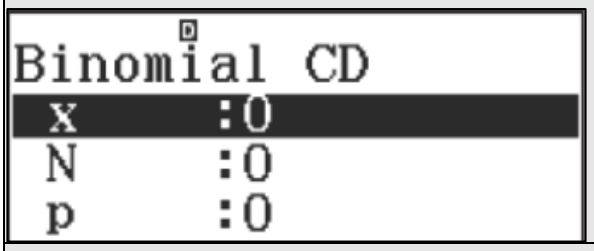
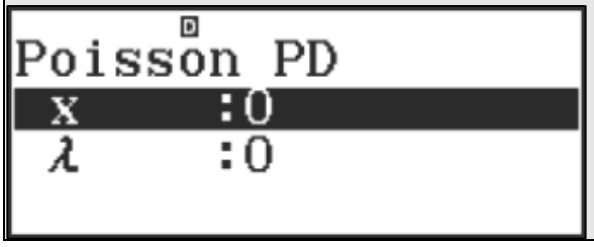
Step 2: Press [1] (Select Type)



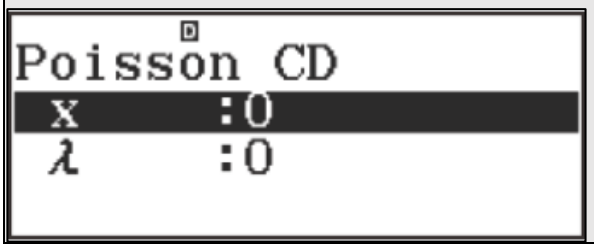
Step 3: Select the distribution calculation mode you want to use.

Inputting values for the variables.

The variables that need to be entered for each distribution calculation mode are listed in the table below:

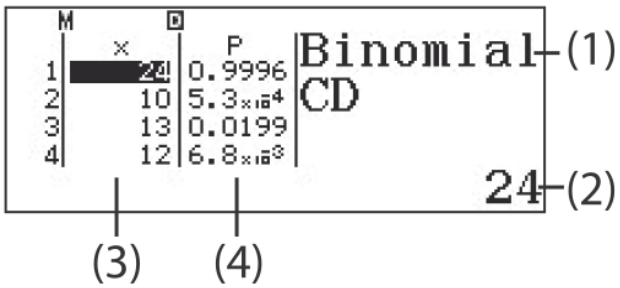
Normal PD 	x … data x σ… Standard deviation ($\sigma > 0$) μ… Average value
Normal PD 	Lower … Lower boundary Upper … Upper boundary σ… Standard deviation ($\sigma > 0$) μ… Average value
Inverse Normal 	Area … Probability value ($0 \leq Area \leq 1$) σ… Standard deviation ($\sigma > 0$) μ… Average value
Binomial PD 	x … data x N … Number of tests p … Probability of success ($0 \leq p \leq 1$)
Binomial CD 	x … data x N … Number of tests p … Probability of success ($0 \leq p \leq 1$)
Poisson PD 	x … data x λ … Average value

Poisson PD	x ... data x λ ... Average value



Data display screen

Each variable in the Distribution calculation can be entered up to 45 data. The calculation results are also displayed on the data screen.



(1) Distributed calculation mode.
(2) The value at the current cursor position.
(3) Input data for x
(4) Calculation results

Edit data

Move the cursor to the location where the data you want to edit is located, enter new data, and press =

Delete data

Move the cursor to the location where the data you want to delete is located, then press DEL to delete.

To insert a row

Inputting data according to the press key below:

Step 1. Move the cursor to the position where you want to insert data.

Step 2. Press [OPTN] [2] (Editor)

Step 3. Press [1] (Insert Row)

Step 4. Input data.

Delete all list screen contents

Perform the following press key to delete data.

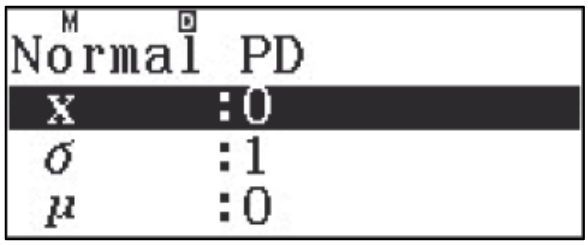
Press [OPTN] [2] (Editor) [2] (Delete All).

Distribution mode calculation example

Example 1: Calculate the standard probability density with $x = 24, \sigma = 1.2, \mu = 7.8$

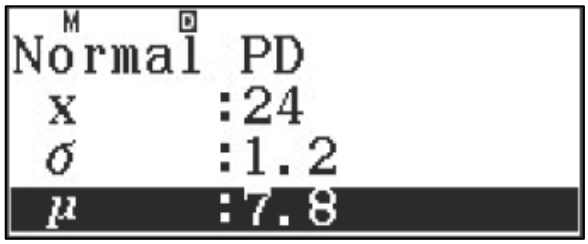
Step 1. Press the key as below to select Normal PD

[OPTN] [1] (Select Type) [1] (Normal PD)

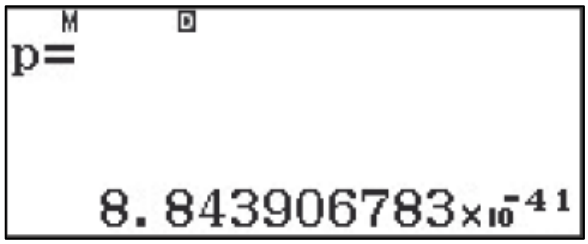


Step 2. Enter the value for $x = 24, \sigma = 1.2, \mu = 7.8$

[2] [4] [=] [1] [•] [2] [=] [7] [•] [8] [=]



Step 3. Press [=]



Press [=] again or press [AC] to return to the variable input screen in step 1.

Note.

- The value of the solution being displayed can be assigned to a variable. The assignment is as follows: Press [STO], then press the key corresponding to the variable name you want to assign.

Example 2: Calculate the binomial cumulative probability distribution for data {24, 10, 13, 12} when N = 25 and p = 0.7

Step 1. Press the key below to select Binomial CD.

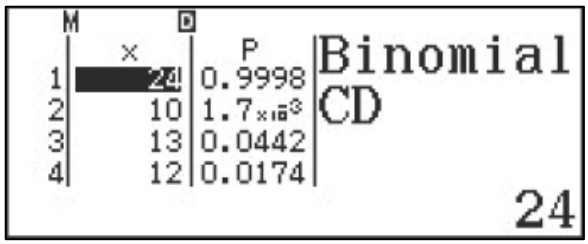
[OPTN] [1] (Select Type) [5] (Binomial CD)

Step 2. Input the value for x: {24, 10, 13, 12}.

Step 3. Input value for N and p.

[2] [5] [=] [0] [•] [7] [=]

Step 4. Press [=] to see the results



Press [=] to return to the variable input screen.

Note

- In the example above, just change any x value in step 6 and all calculation results will be deleted and return to step 2.
- Except for the x value that has been changed, all other x values and the values assigned to N and p remains.
- On a data input screen, the value of a data cell can be assigned to a variable. The assignment operation is as follows.
  Move the cursor to the data cell you want to assign, press [STO], then press the key corresponding to the variable name you want to assign
- The error message " ERROR": Will appear in column P of the results screen if the value inputted for the corresponding data is outside the allowable range.

Create Table.

Table mode is used to create a table of numbers based on the $f(x)$ function or two $f(x)$ and $g(x)$ functions.

General Procedure for Creating a Number Table

Perform the operations below to create a number table.

Step 1. Press [MENU] to select [7] (table mode), the data input screen for the function will appear.

Step 2. Use the variable x while entering data for the two $f(x)$ and $g(x)$ functions .

Note

- Only use the variable x to input data into the function. (Press x or [ALPHA] [(] (x)). All variables other than x are considered constants.
- The $f(x)$ function will be used by default when selecting a only function,

Step 3. When the Table Range screen is displayed, input values for Start, End, and Step. The values of Table Range are described in the table below:

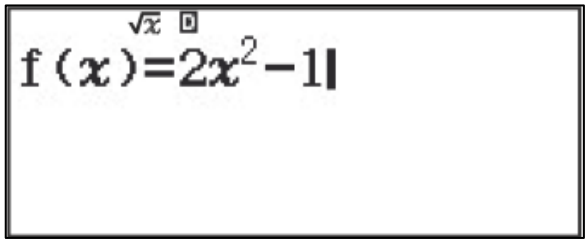
Value	Meaning
Start	Start value for variable x (default = 1)
End	End value for variable x (default = 5)

Step	Step of x (default is 1) **Note:** The number table is created with the Start value and is increased sequentially by Step value until the End value. For example: If you input Start = 5, Step =5 and End = 20, the value of x will increase is: 5, 10, 15, 20.

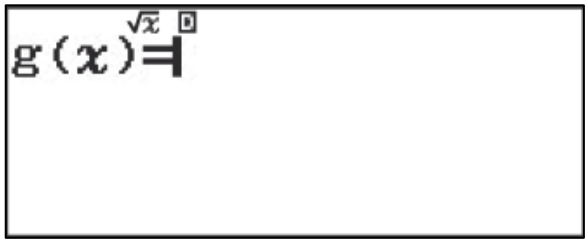
- Press [=] to input values for Table Range elements and display the number table.
- While the number table screen is being displayed, pressing [AC] will return to the function data input screen.

For example: To create a number table for the function.
$f(x) = 2x^2 - 1 \; and \; g(x) = x^2 + 1$. Start value = 1, End value = 10, Step = 2.

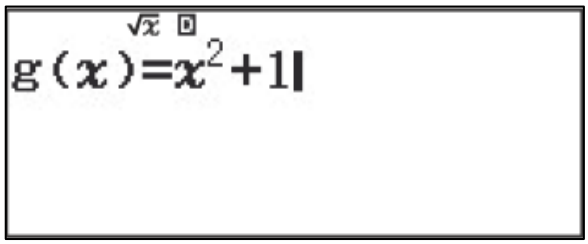
[2] [x] [x²] [−] [1]



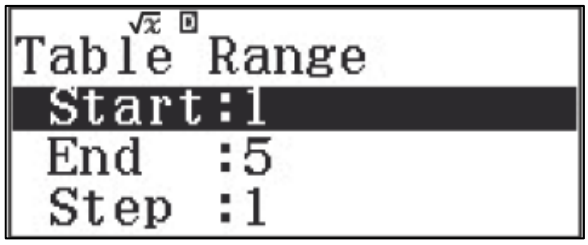
[=]



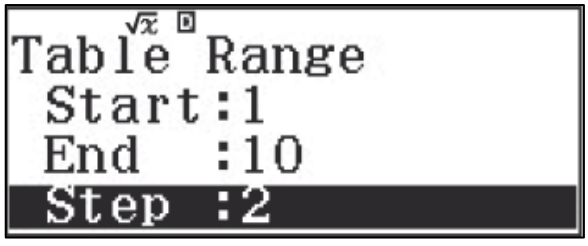
[x] [x²] [+] [1]



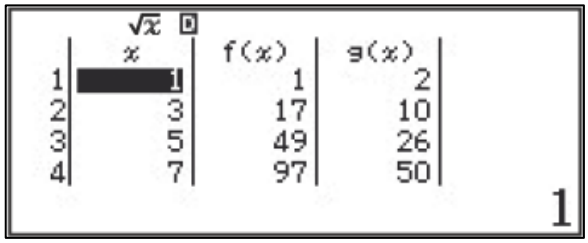
[=]



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



[=]



Suggest

- In the number table, the value of x at the current cursor position (highlighted position) can be changed. When changing the value of x, the value of the functions $f(x)$ and $g(x)$ on the same row will also change accordingly.
- In the value column of x, for the current cursor position (highlighted position) without a value. If you press [=], then automatically input a value. A value = upper value + Step value.

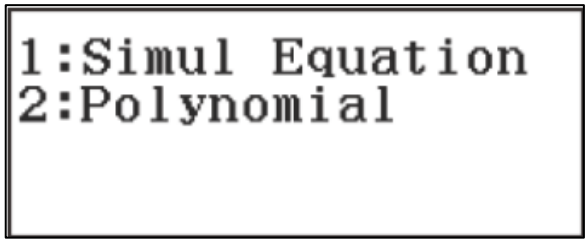
Note

- If you install one function $f(x)$, you can create up to 45 rows in the number table. If you install two functions $f(x)$, and $f(x)$, you can create up to 30 rows in the number table.
- When changing the settings for Input/Output, the current data in Table mode will be deleted.

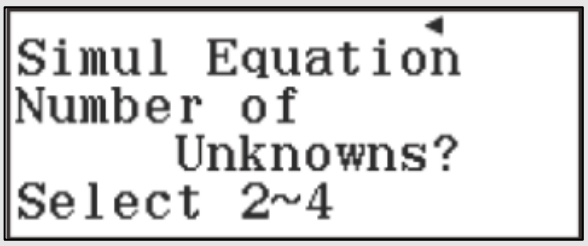
Solve the Equation (EQUATION/FUNC)

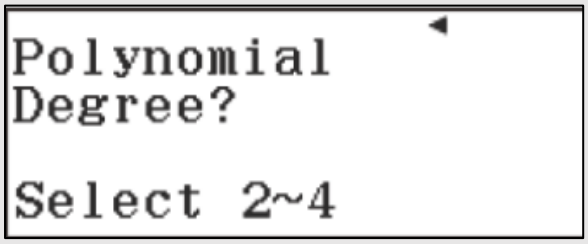
To solve the equation, perform the following operations.

Step 1: Press [MENU] to select [9] (Equation/Func mode).



Step 2: On the menu that appears, select the Equation type or Equation system. following to the table below:

Select the calculation mode.	Key press operations
Equation system with two, three or 4 unknowns.	Press [1] (Simul Equation).  Press the number keys from [2] to

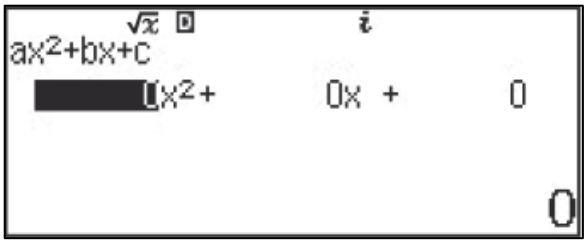
	[4] to determine the unknown number chosen for the equation system.
Polynomial: Quadratic equations, cubic equations, and quadratic equations.	Press [2] (Polynomial).  Press the number keys [2] to [4] to determine degree of equations.

Step 3. Input the value for the coefficient on the currently displayed screen then press [=]. The value of the coefficient can be displayed in up to 6 digits (including the "." decimal). Pressing [AC] will clear all coefficients to 0.

Example Solve the equation.

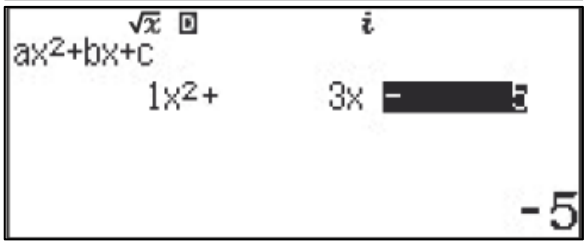
Example: Solve the equation: $x^2 + 3x - 5 = 0$

In step 2, press [2] (Polynomial), then press [2]



Input the value for the coefficient.

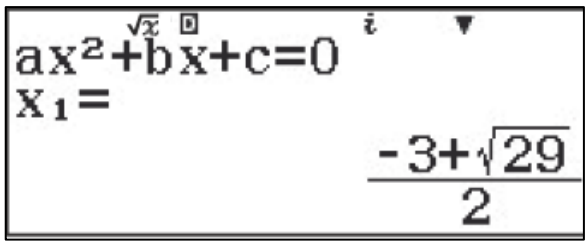
[1] [=] [3] [=] [(-)] [5] [=]



Step 4. After inputting values for all coefficients, press [=] and the solution will be displayed.

Each time you press [▼] or press [=], other solutions will be displayed.

When the final solution has been displayed, pressing [=] will return to the coefficient editing screen.

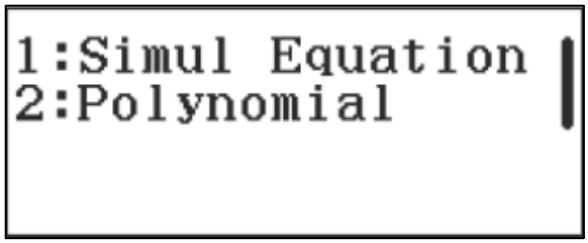


Note:

- If the equation has no solutions or has infinitely many solutions, a message will appear that has "no solutions" or "All Real Number". Press [AC] to return to the coefficient editing screen.
- Depending on the settings for Input/Output and for Equation/Func, the display format of the solution will be different.
- The value of the currently displayed solution can be assigned to a variable. To perform the assignment, press [STO] and press the key corresponding to the variable name you want to assign.
- Solutions with √ are displayed only when the calculation mode is selected as equation.

Change calculation mode selection.

In the current calculation screen, pressing [OPTN] will return to the calculation mode selection screen. Then select the calculation mode you want to change.



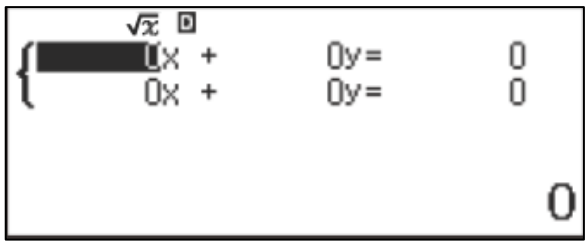
Note

- When changing the calculation format, the values of all coefficients will be deleted to 0.

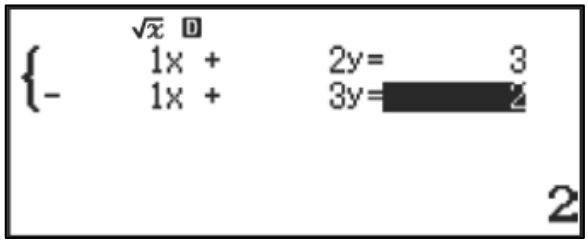
Equation/Func method calculation example

Example 1: Solve the equations system: $\begin{cases} x + 2y = 3 \\ -x + 3y = 2 \end{cases}$

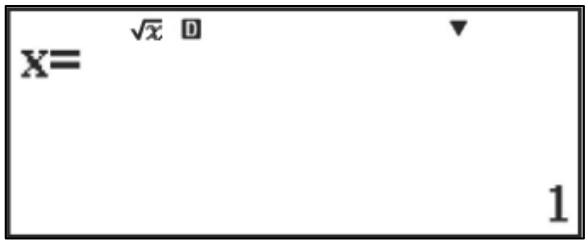
OPTN 1 (Simul Equation) 2



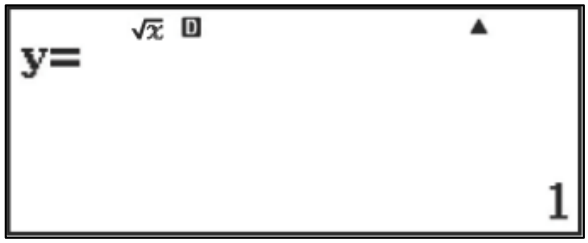
1 = 2 = 3 = (−) 1 = 3 = 2 =



=

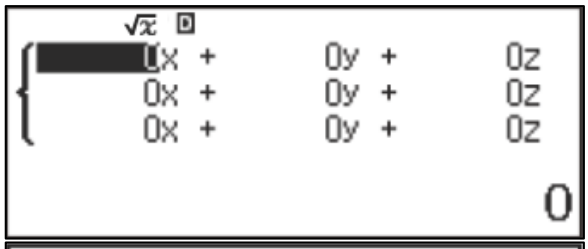


▼

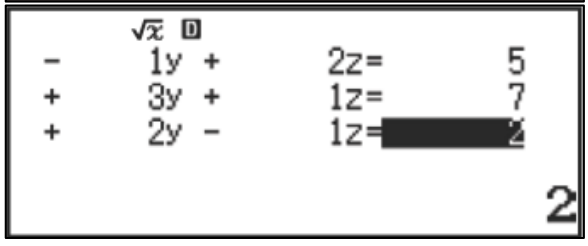


Example 2: Solve the equations system: $\begin{cases} x - y + 2z = 5 \\ -2 + 3y + z = 7 \\ x + 2y - z = 2 \end{cases}$

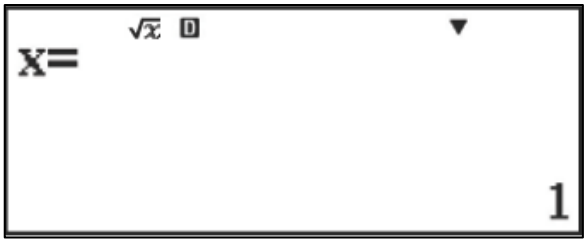
OPTN 1 (Simul Equation) 3



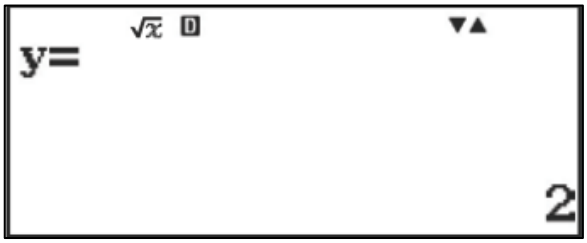
1 = (−) 1 = 2 = 5 = (−) 2 = 3 = 1 = 7 = 1 = 2 = (−) 1 = 2 =



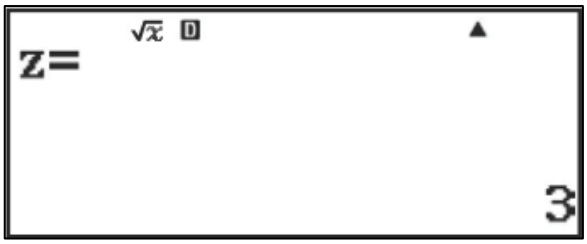
[=]



[=]

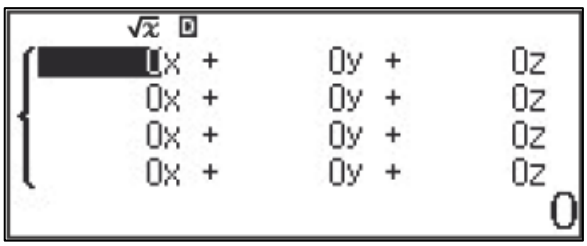


[=]

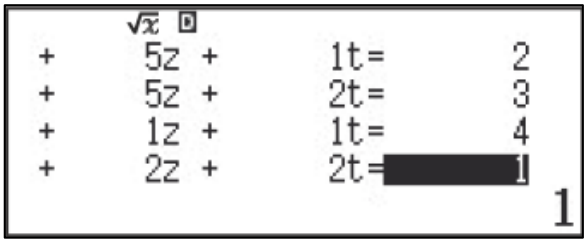


Example 3: Solve the equations system: $\begin{cases} 2x + 4y + 5z + t = 2 \\ 4x + y + 5 + 2t = 3 \\ x + 2y + z + t = 4 \\ 3x + y + 2z + 2t = 1 \end{cases}$

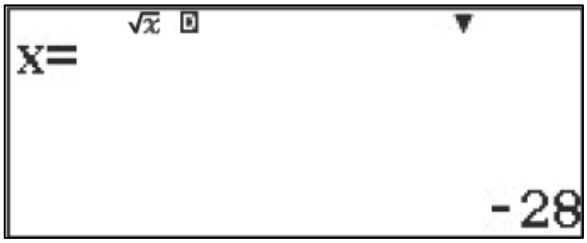
[OPTN] [1] (Simul Equation) [4]



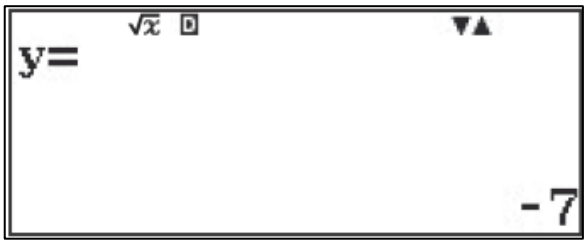
[2] [=] [4] [=] [5] [=] [1] [=] [2] [=] [4]
[=] [1] [=] [5] [=] [2] [=] [3] [=] [1] [=]
[2] [=] [1] [=] [1] [=] [4] [=] [3] [=] [1]
[=] [2] [=] [2] [=] [1] [=]



[=]



▼



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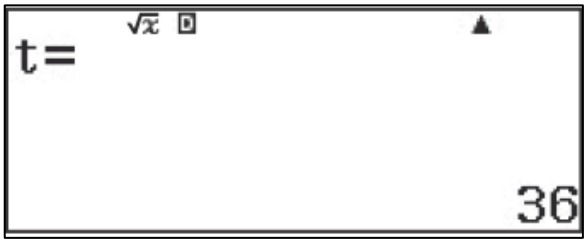
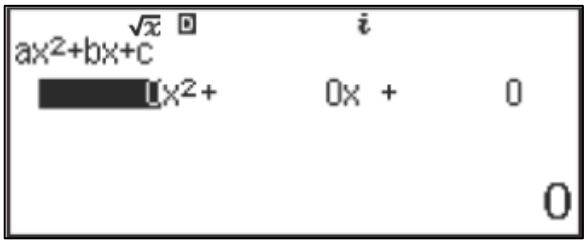
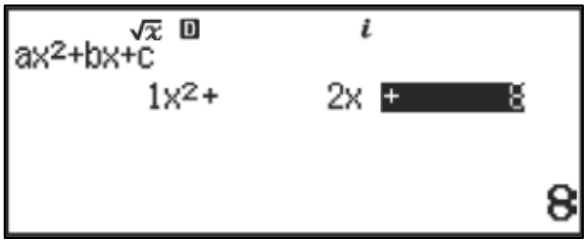


Example 4: Solve the equation: $x^2 + 2x + 8 = 0$

OPTN 2 (Polynomial) 2



1 = 2 = 8 =



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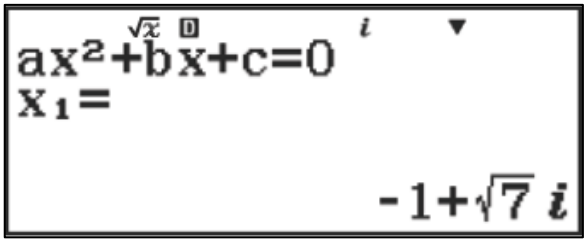

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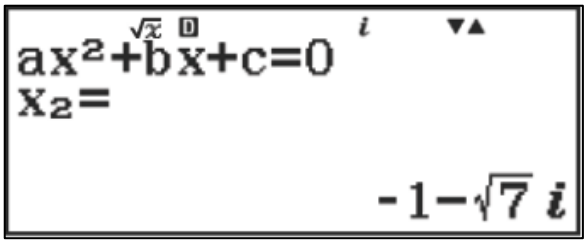
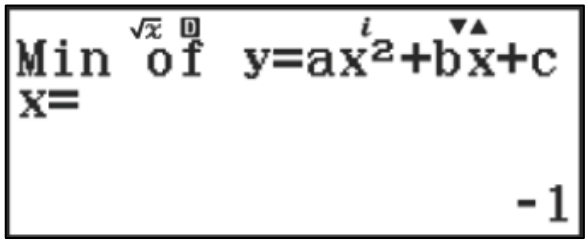
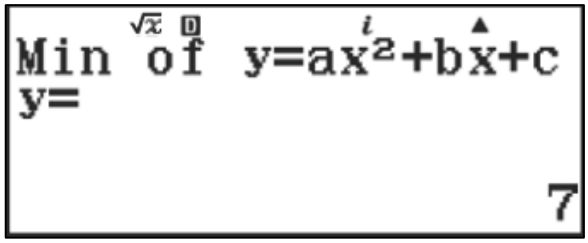


[=]

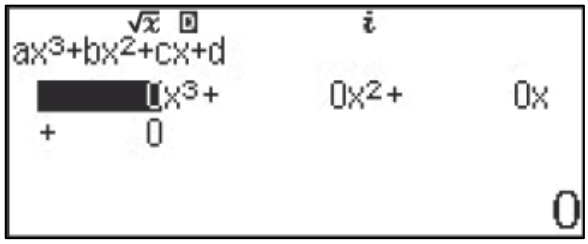


[=]

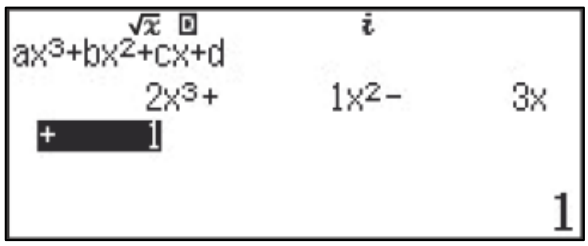


Example 5: Solve the equation: $2x^3+x^2-3x+1=0$

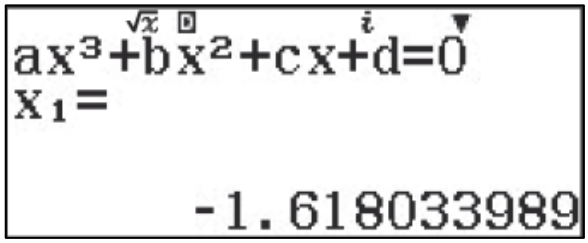
[OPTN] [2] (Polynomial) [3]



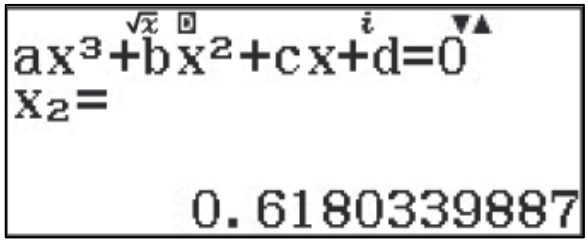
[2] [=] [1] [=] [(−)] [3] [=] [1] [=]



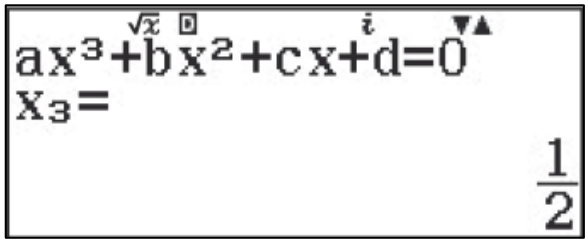
[=]



[=]



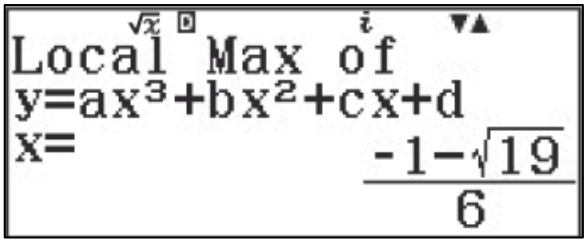
[=]



Displays the x and y coordinates of the maximum value of $2x^3+x^2-3x+1=$

0.

=



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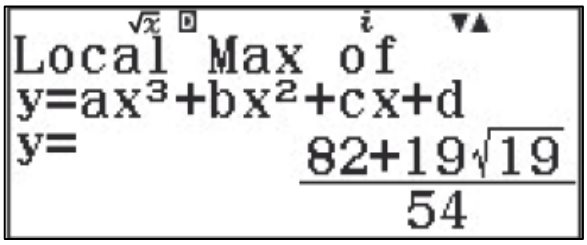
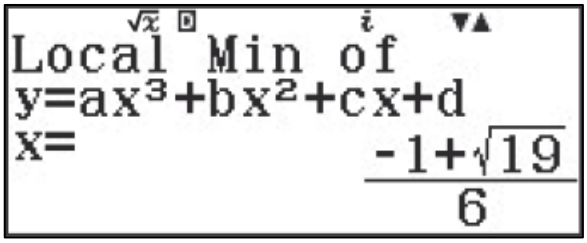


Displays the x and y coordinates of the smallest value of $2x^3 + x^2 - 3x + 1 = 0$.

=



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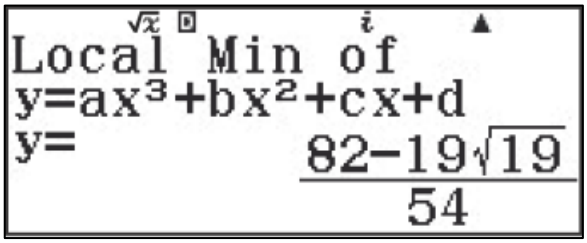
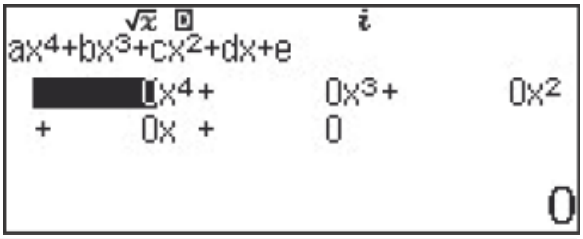
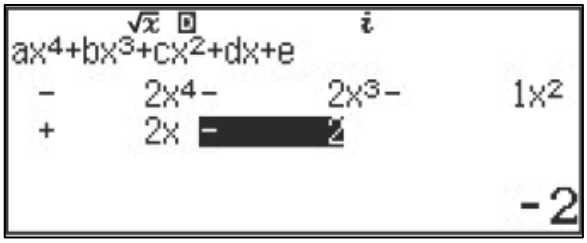


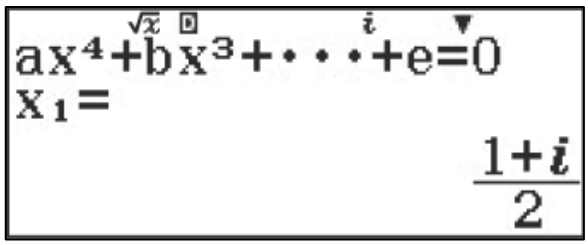
Example 6: Solve the equation $-2x^4 - 2x^3 - x^2 + 2x - 2 = 0$

OPTN 2 (Polynomial) 4

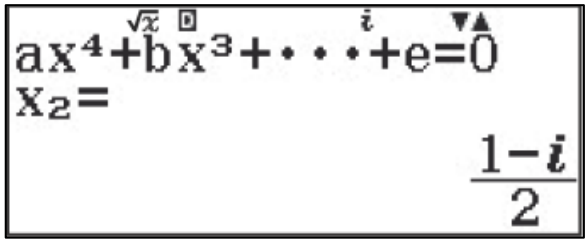




(−) 2 = (−) 2 = (−) 1 = 2 = (−) 2 =



=



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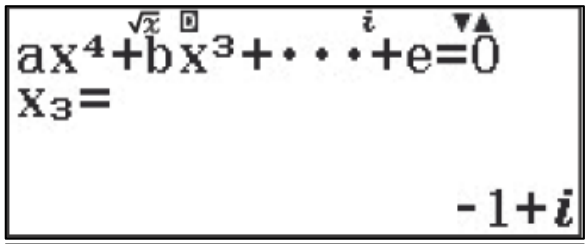

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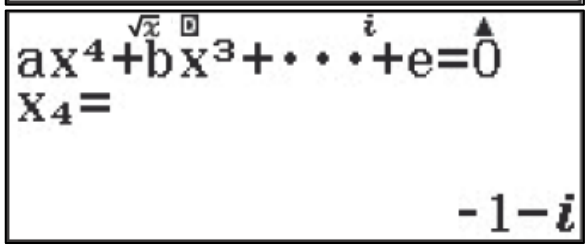
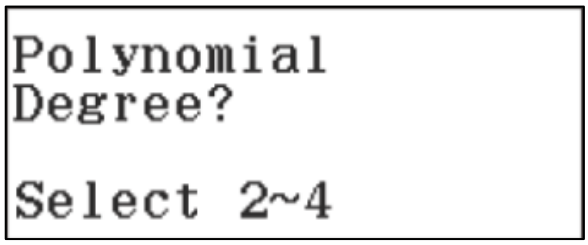


Solve Inequalities.

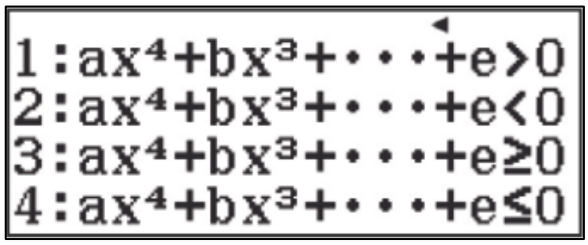
Inequality Solving mode allows solving 2nd, 3rd, and 4th degree inequalities. To perform inequality solving, we operate as follows:

1: Press MENU then press (−) [A] (inequality solving mode).

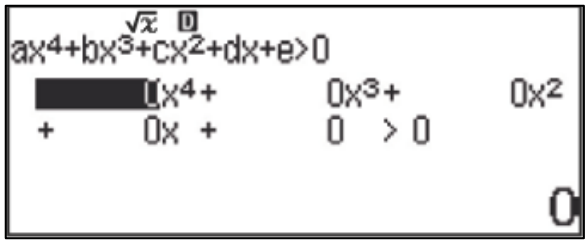


2. Press 1 of the 3 keys 2, 3 or 4 to select the degree of inequality to be solved.

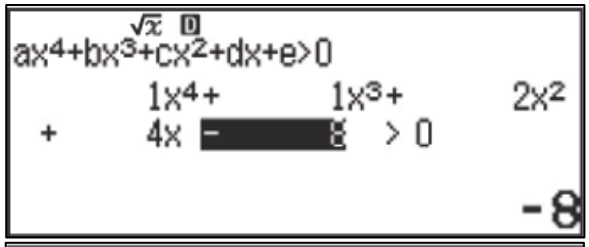
For example: Press 4 to select the 4th degree Inequality Solving Mode.



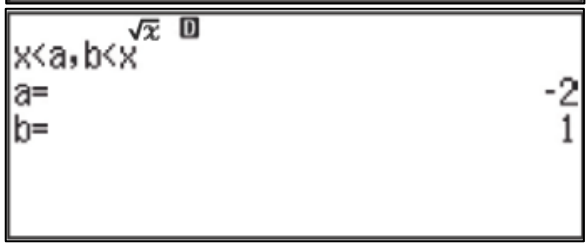
3. To select the Inequality type, press the corresponding key to solve.
For example: Press [1] to select the 1-degree inequality solving mode.
$(ax^4 + bx^3 + cx^2 + dx + e > 0)$



4. Input the values of inequality.
For example: To solve the inequality $(x^4 + x^3 + 2x^2 + 4x - 8 > 0)$
Input the coefficient values.



After inputting the coefficients. Press [=] to solve the inequality.

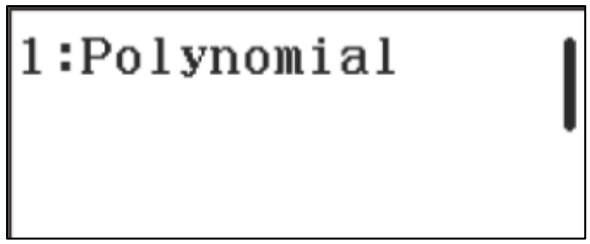


Note

- Press [AC] to delete all values of the inequality.
- Use the cursor to move to the position to be edited. After inputting the new value, press [=] to complete editing.
- The display format of the results and input values depends on the display mode.

To change the format of inequality, we operate as follows.

1. Press [OPTN]



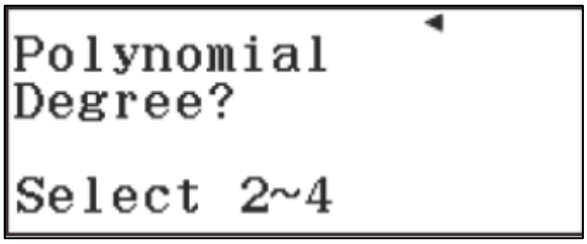
2: Press [1] (Polynomial), then press [2] , [3] or [4] to select the type of inequality to solve.

Note

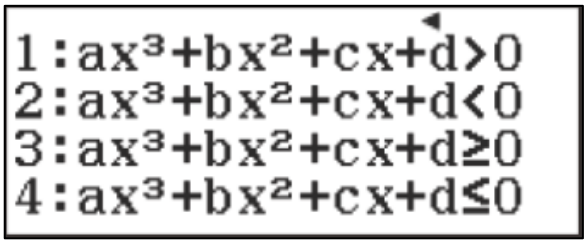
- When changing the format of Inequality. The value of the coefficients will return to 0.

Example 1: Solve inequalities: $x^3 - 3x^2 - 6x > 0$

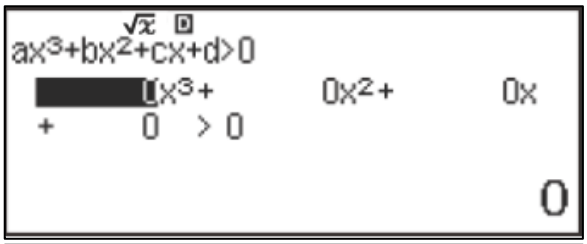
[OPTN] [1] (Polynomial)



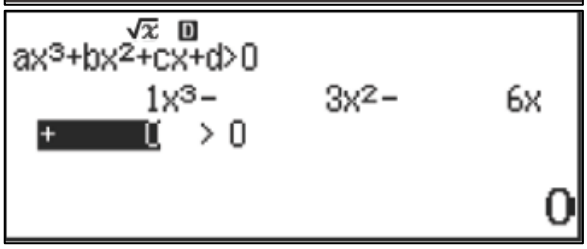
[3] (3rd degree inequality)



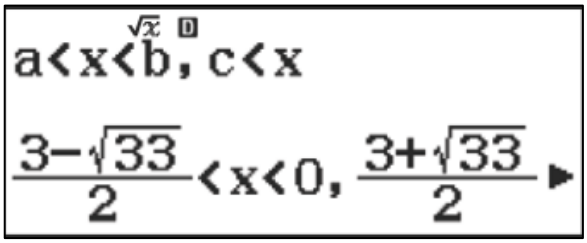
[1] $(ax^3 + bx^2 + cx + d > 0)$



[1] [=] [(−)] [3] [=] [(−)] [6] [=]

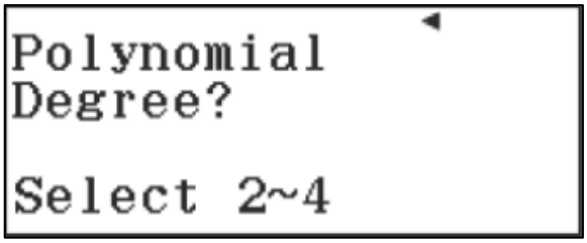


[=]

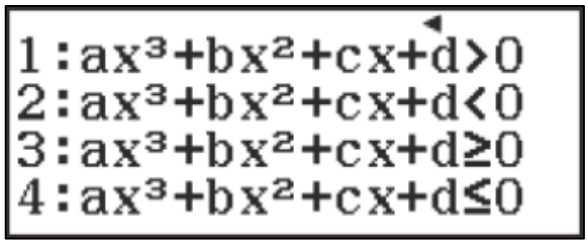


Example 2: Solve inequalities: $3x^3 + 3x^2 - 1x > 0$

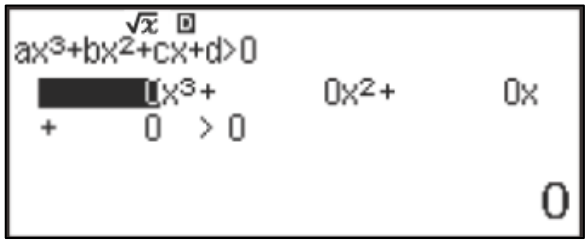
[OPTN] [1] (Polynomial)



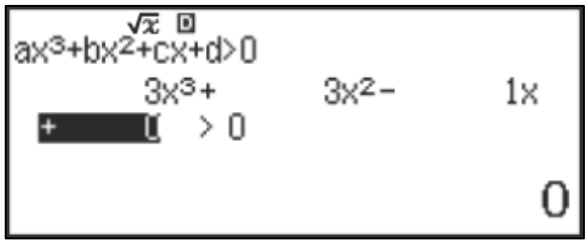
[1] $(ax^3 + bx^2 + cx + d > 0)$



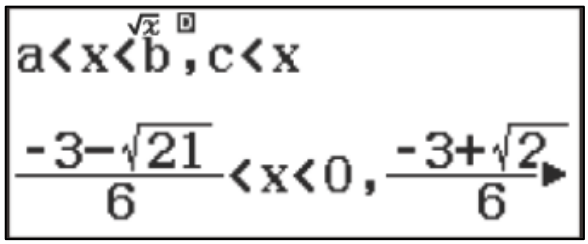
[3] [=] [(−)] [3] [=] [(−)] [1] [=]



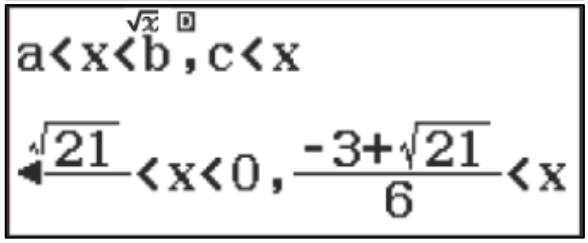
[=]



[=]

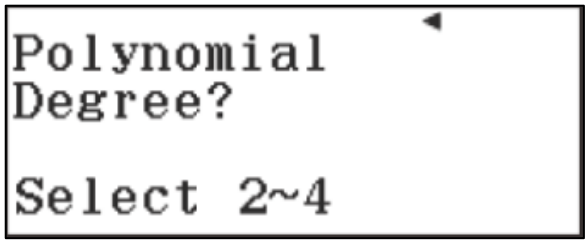


[▶] [▶] [▶] [▶]

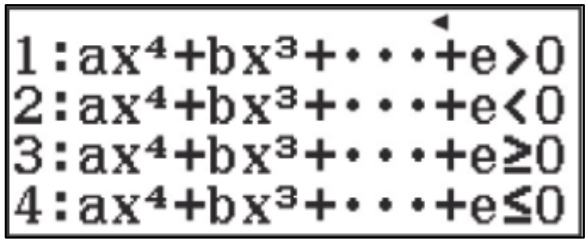


Example 3: Solve inequalities: $x^4 - x^3 - 5x^2 + 4x + 4 \leq 0$

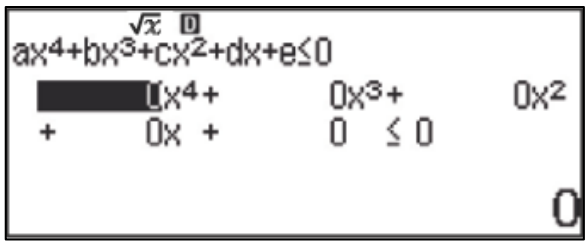
[OPTN] [1] (Polynomial)



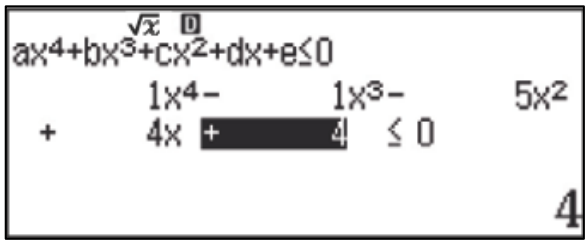
[4] $(ax^4 + bx^3 + cx^2 + dx + e \leq 0)$



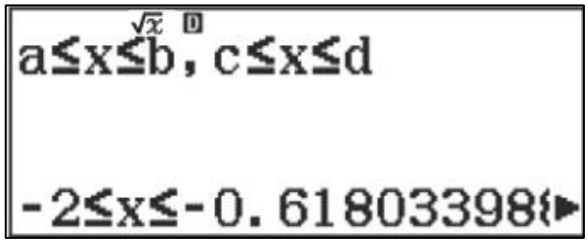
[4]



[1] [=] [(−)] [1] [=] [(−)] [5] [=] [4] [=] [4] [=]

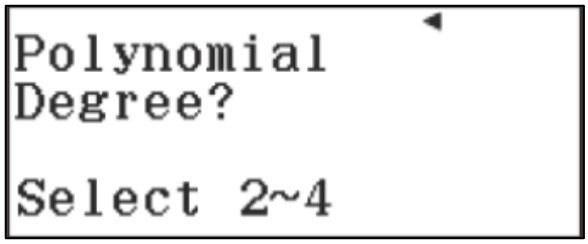


[=]

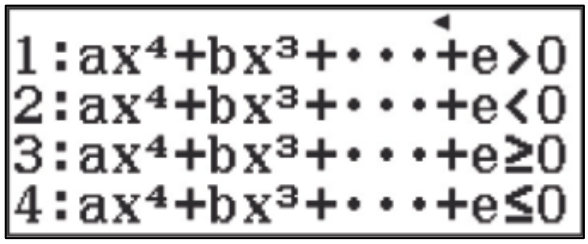


Example 4: Solve inequalities: $x^4 - 2x^2 - 3x + \frac{7}{16} > 0$

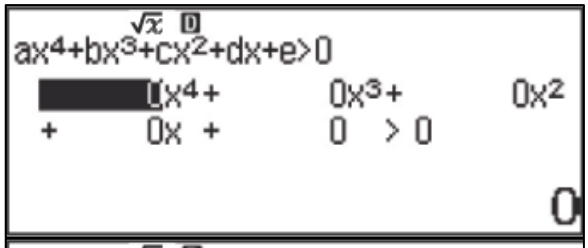
[OPTN] [1] (Polynomial)



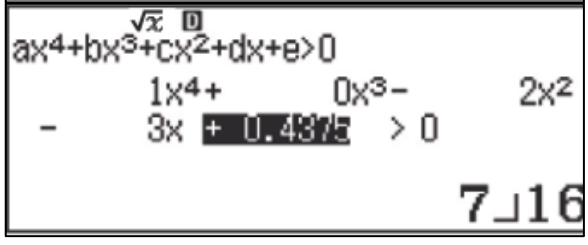
[4] $(ax^4 + bx^3 + cx^2 + dx + e > 0)$



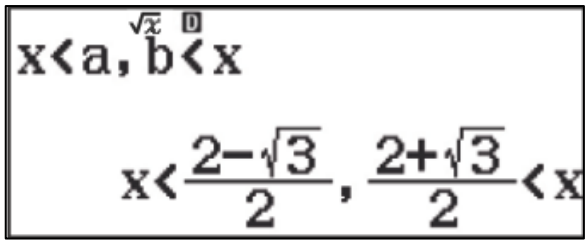
[1]



[1] [=] [0] [=] [(−)] [2] [=] [(−)] [3] [=] [7] [▤] [1] [6] [=]



[=]

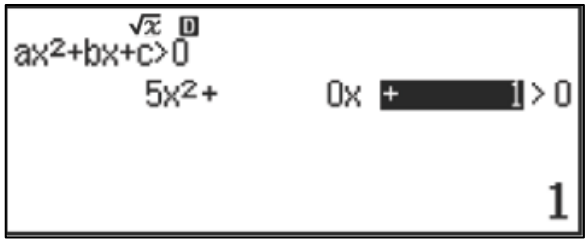


Display special solutions.

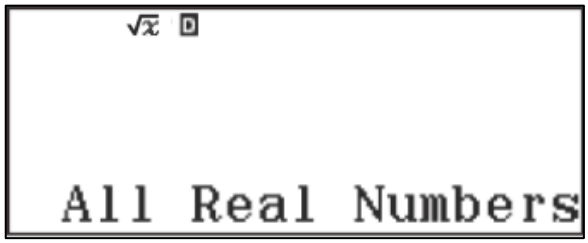
- When the inequality has an All-Real Numbers, the screen displays the message "All Real Numbers".

For example: $5x^2 + 1 > 0$

[OPTN] [1] (Polynomial) [2] [1] $(ax^2 + bx + c > 0$ [5] [=] [0] [=] [1] [=]



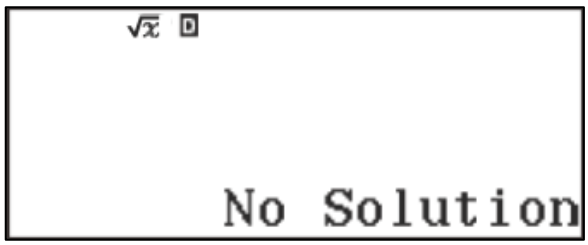
[=]



When inequality has no solution, the message screen will display "No solution."

For example: $5x^2 < 0$

[OPTN] [1] (Polynomial) [2] [2] $(ax^2 + bx + c < 0$ [5] [=] [=]

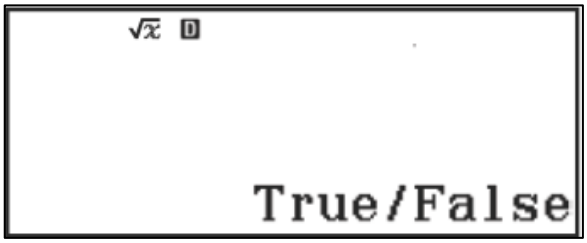


Verify the Correctness of the Expression (VERIFY)

Verify is a function that verifies the true or false. of an expression or a comparison. If the expression or comparison is true, the screen will display True and false the screen will display False. Press [MENU] to select [,,,] [B] (**VERIFY** mode).

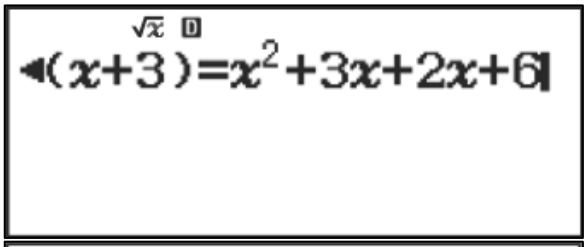
To perform comparison, input values /expressions to the following:
[Value/Expression] [Comparison operator] [Value/expression]
Example: $(x + 2)(x + 3) = x^2 + 3x + 2x + 6$

1: Press AC, then press ⋯ [B] in to the Verify mode.

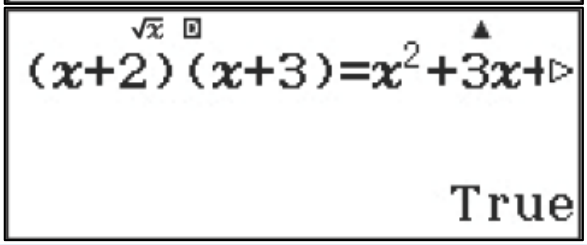


2: Input $(x+2)(x+3)=x^2+3x+2x+6$

(x) + 2) (x) + 3)
OPTN 1 x x² + 3 x + 2 x
+ 6

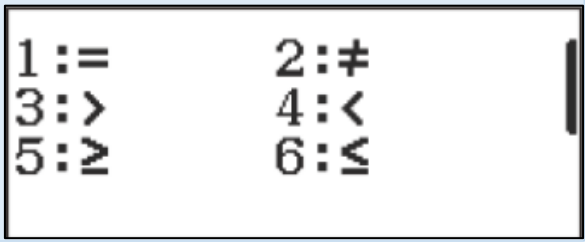


3: Press =



Note:

- Select the Comparisons operator, you can press OPTN, then press the number corresponding to the Comparisons operator.

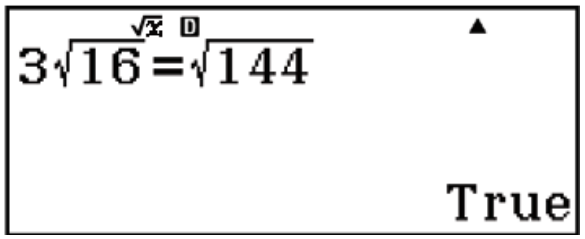


Below are the types of expressions that when compared, the calculator will give an error or can't be checked.

- The expression has more inverse comparison operators.
- The expression has two comparison operators similar to the following example: $5 > 2 \neq 1$

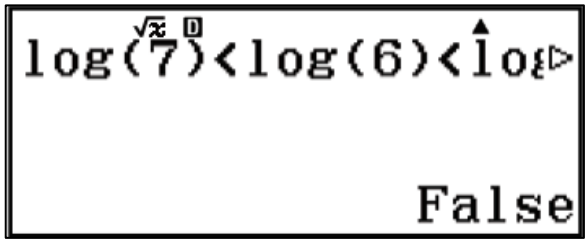
Example 1: Check the following expression: $3\sqrt{16} = 12 = \sqrt{144}$

3 √■ 1 6 ▶ OPTN 1 (=)
1 2 OPTN 1 (=) √■ 1 4 4 =



Example 1: Check the following expression: $\log 7 < \log 6 < \log 5$

SHIFT (−) (log) 7) OPTN 4 $(=)$
SHIFT (−) (log) 6) OPTN
4 $(=)$ SHIFT (−) (log) 5) =

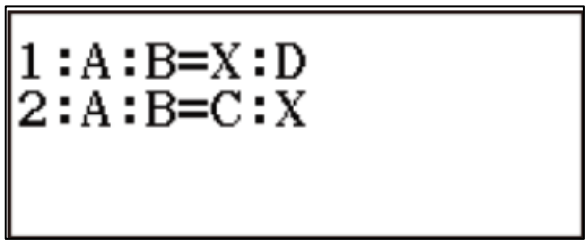


Ratio calculation

Ratio mode allows finding the value of x in the expression: A:B=X:D or A:B=C:X with A, B, C and D as given values. Press MENU to select x^{-1} [C] (**VERIFY** mode) to enter Ratio mode.

To perform the search for x, you can operate as follows:

Step 1: Press MENU then press x^{-1} [C] to enter Ratio mode



Step 2: Press 1 or 2 to select the expression type.

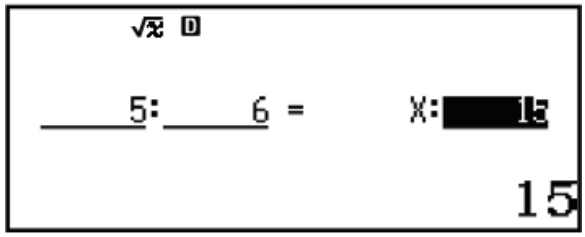
Step 3: Input values for A, B, C, and D

For example

Example 1: To find x with $5:6 = X:15$

Step 1. Input values for A, B and D

5 = 6 = 1 5 =



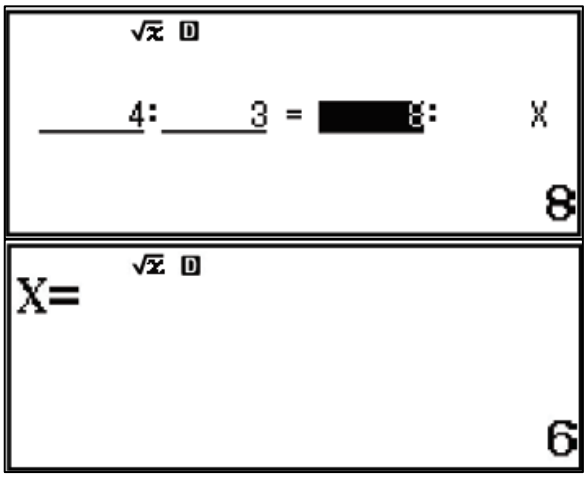
Step 2: Press = to find x. Press AC to delete all values in the expression.

Note:

- To change the expression type, press OPTN then press the number corresponding to the expression type. All values in the old expression will be deleted.

Example 2: To find x with $4 : 3 = 8 : X$

[OPTN] [1] (Select Type) [2] (A:B=C:X)
[4] [=] [3] [=] [8] [=]



[=]

Geometry mode (New Function)

Geometry mode allows entering points, lines, planes, circles, spheres, calculate and solve related problems. To perform geometry mode, you can operate as follows:

1. Press [MENU] [sin] [D] enter to the Geometry mode.
2. Select the type of data to enter by selecting the corresponding number.

Keys press operation	Function
[1] Point	Allows inputting points in Oxy and Oxyz coordinate systems, finding lengths and equations of straight lines.
[2] Lines	Allows inputting straight lines in Oxy and Oxyz coordinate systems.
[3] Plane	Allows inputting planes in Oxy and Oxyz coordinate systems.
[4] Circle	Allows inputting circle and calculate the area of the circle.
[5] Sphere	Allows inputting sphere, calculate the area of the sphere and the volume of the sphere

Note:

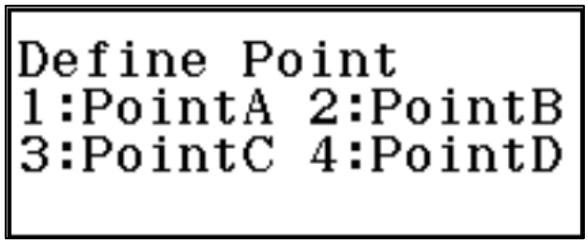
- To change the geometry type, press [SHIFT] [OPTN] [1] (Geometry type), then select the geometry type need to be change.

Calculation involves points (POINT MODE)

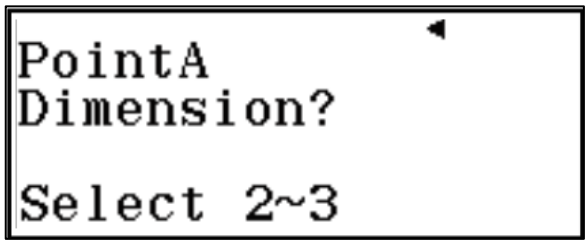
Use Point mode to find the straight lines or the length of a line when 2 points are known. To calculate you can use point variables (Point A, PointB, PointC, PonitD).

Create on point.

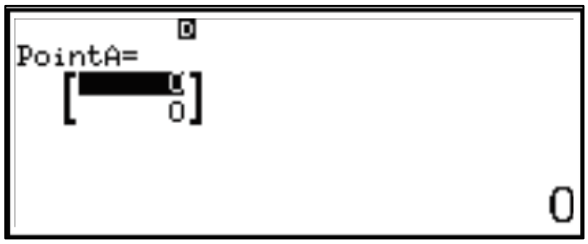
Step 1: Press [OPTN] [1] (Define Point)



Step 2: Press [1], [2], [3] or [4] to select the point that need use.

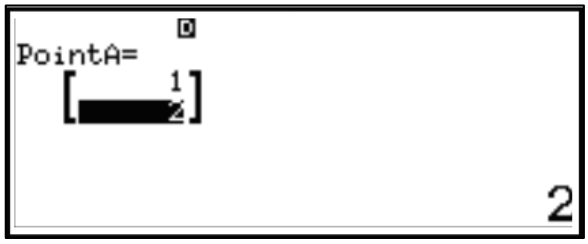


Step 3: Press [2] or [3] to select the point in plane or space.



Step 4: Input point coordinates.
Example: Assign value (2, 1) for Point A.

[1](Point A)[2] (plane coordinates)[1][=][2][=]



Edit point coordinates.

Press [OPTN][2] (Edit Point) then select the point to edit.

At the point coordinates screen, move the cursor to the position to be edited, input the new coordinate value then press [=] to complete.

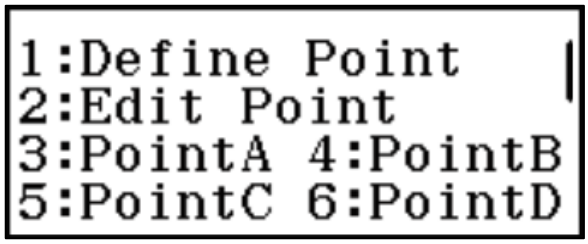
Copy points variable value.

Use the editor screen to display the point you want to copy.

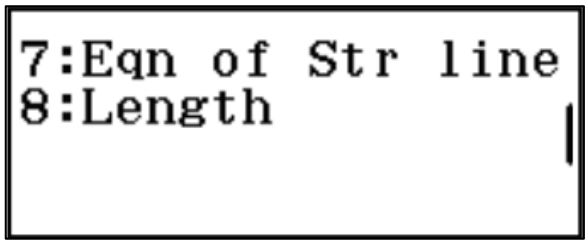
Press [OPTN], then press one of the following keys to select where to copy: [(−)](PointA), [,,,](PointB), [x^{-1}](PointC), [sin](PointD).

Menu

The following are the point menu items that appear:



Keys press operation	Function
OPTN 1 (Define Point)	Select a point (PointA, PointB, PointC or PointD) and define the coordinate system.
OPTN 2 (Edit Point)	Select a point (PointA, PointB, PointC or PointD) and edit.
OPTN 3 (PointA)	Call PointA
OPTN 4 (PointB)	Call PointB
OPTN 5 (PointC)	Call PointC
OPTN 6 (PointD)	Call PointD



Keys press operation	Function
OPTN 7 (Eqn of Str line)	Find the equation of the line
OPTN 8 (Length)	Find the length of the line segment

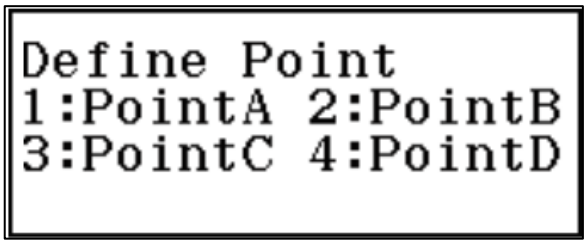
Point editor

Keys press operation	Function
OPTN 1 (Define Point)	Select a point (PointA, PointB, PointC or PointD) and define the coordinate system

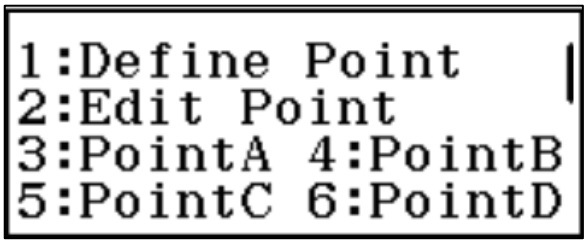
OPTN 2 (Edit Point)	Select a point (PointA, PointB, PointC or PointD) and edit
OPTN 3 (Calc)	Displays the calculation screen

Example 1: Create 2 points $A(1,2,4)$ and $B(3,-1,2)$.
Press MENU, then press sin to enter Point mode.

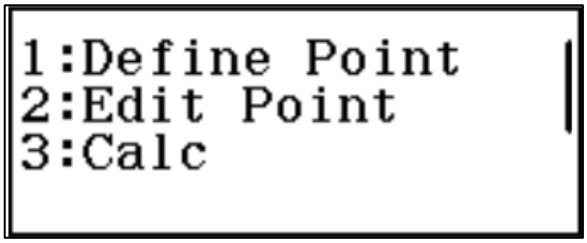
1 (PointA) 3 (space coordinates)
1 = 2 = 4 =



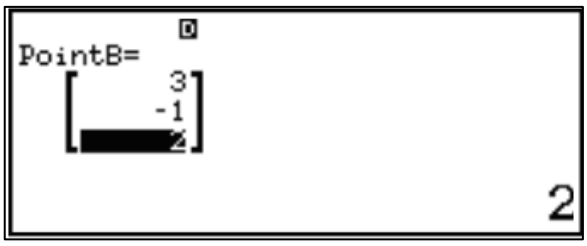
OPTN



1 (Define Point)

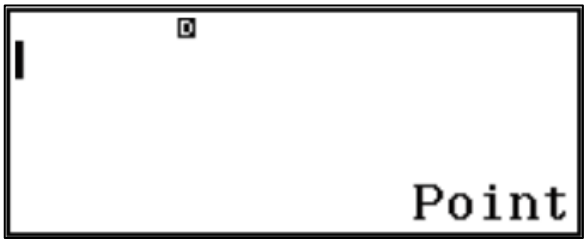


2 (PointB) 3 (space coordinates)
3 = (−) 1 = 2 =

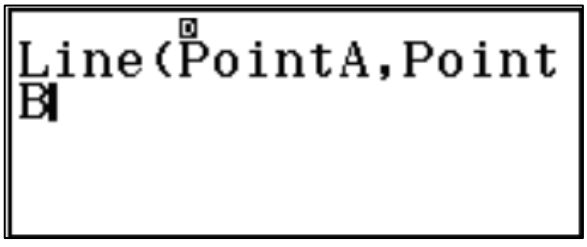


Example 2: Find the equation of the line with 2 points $A(1,2,4)$ and $B(3,-1,2)$.
At the point editor screen.

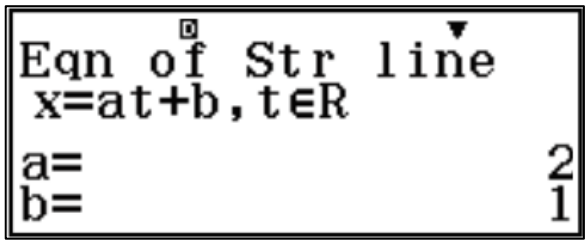
Press AC to return to the calculation screen



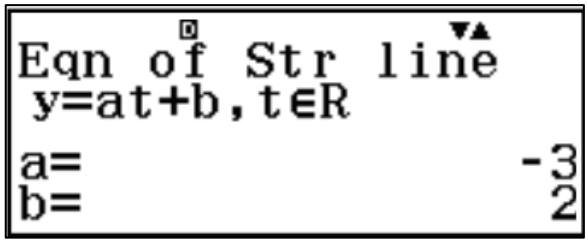
OPTN 7 (Eqn of Str Line)
OPTN 3 SHIFT) OPTN 4



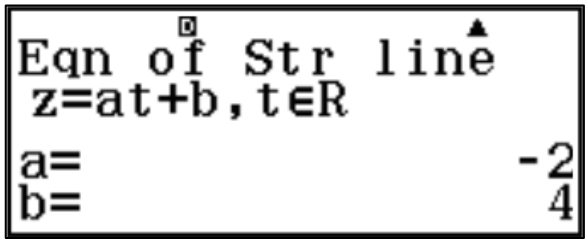
[=]



[=]



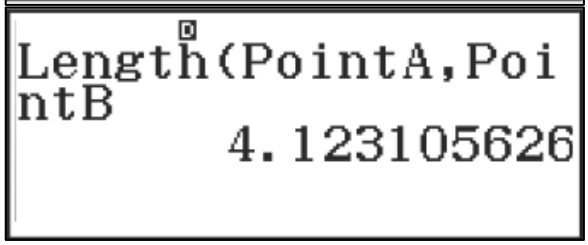
[=]



Example 3: Find the length of the line created by 2 points $A(1,2,4)$ and $B(3,-1,2)$. At the point editor screen, press [AC] to return to the calculation screen.

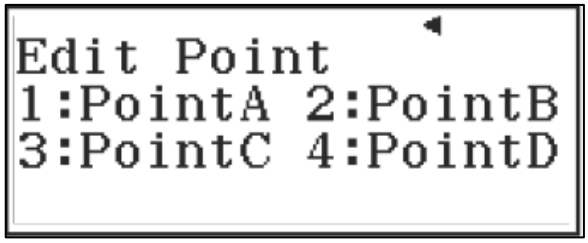
Press [AC]

[OPTN] [8](Length of EQN) [OPTN] [3] [SHIFT] [)] [OPTN] [4] [=]



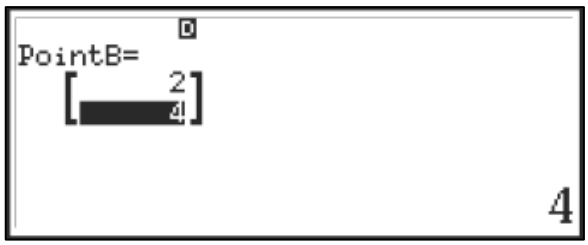
Example 4: Copy point A (1,2) into B and edit point B to B (2,4)

[AC] [OPTN] [2] (Edit Point) [1](Point A) [2]



[1] [=] [2] [=]

STO , (Point B) 2 = 4 =



Calculation involves Line (LINE MODE)

The line equation has the following format: (P) $\begin{cases} x = a_1 + b_1 t \\ y = a_2 + b_2 t \\ z = a_3 + b_3 t \end{cases}$

To enter a Line mode, we need to determine the following:

- Coordinates of the point belongs to the straight line.
- Direction vector of straight line.

After determining the above information, you can key press operation as follows:

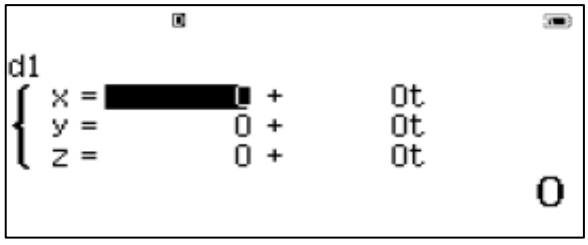
Press MENU sin 2 (Line) or SHIFT OPTN 1 (Geometry type) 2 (Line) if you are in another geometry mode.

The calculator screen will display the following:

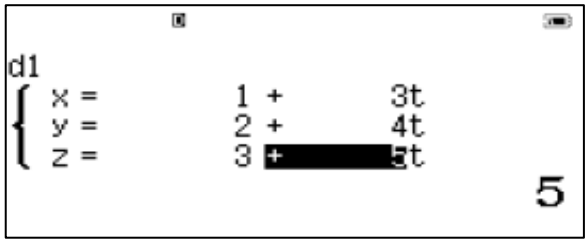
Keys press operation	Function
OPTN 1 (Define Line)	Select a line (d1, d2 or d3)
OPTN 2 (Edit Line)	Select a line (d1, d2 or d3) and edit.
OPTN 3 (d1)	Call line d1
OPTN 4 (d2)	Call line d2
OPTN 5 (d3)	Call line d3

Example: Input the straight line equation d1 that passes through point A (1, 2 ,3) and has direction vector t(3, 4, 5). Parametric equation of line d1: $\begin{cases} x = 1 + 3t \\ y = 2 + 4t \\ z = 3 + 5t \end{cases}$

OPTN 1 (Define Point) 1 (d1)(or SHIFT OPTN 1 2 OPTN OPTN 1 (Define Point) 1 (d1) if you are in another geometry mode)



1 = 3 = 2 = 4 = 3 = 5 =



You have completed input the equation value of straight line d1.

Calculation involves Plane (PLANE MODE)

The plane equation has the following format: (P) $ax + by + cz + d = 0$

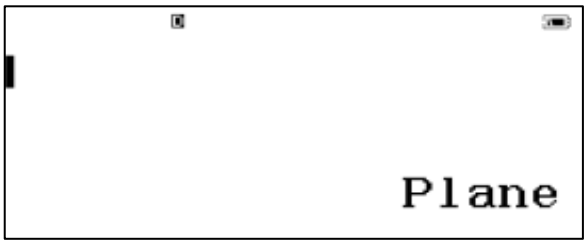
To enter the plane equation into the calculator, you can key press operation as follows: MENU sin [D] 3(Plane) or SHIFT OPTN 1 (Geometry type) 3(Plane) if you are in another geometry mode.

The calculator screen will display the following:

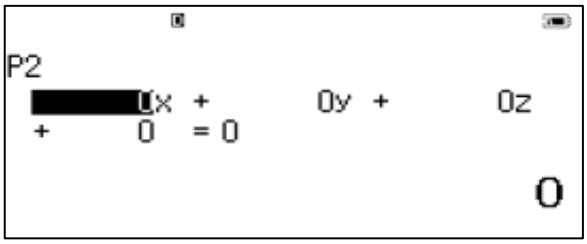
Keys press operation	Function
OPTN 1(Define Plane)	Select a Plane (P1, P2 or P3)
OPTN 2(Edit Plane)	Select a Plane (P1, P2 or P3 and edit.
OPTN 3(P1)	Call Plane P1
OPTN 4(P2)	Call Plane P2
OPTN 5(P3)	Call Plane P3

Example: Input the Plane equation P2: $3x - 2y + 3z = 5$

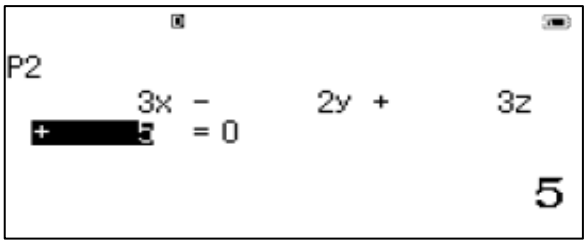
Press AC



OPTN 1(Define Plane) 2 (Plane P2)



3 = (−) 2 = 3 = 5 =



You have completed input the Plane equation P2.

Calculation involves Circle (CIRCLE MODE)

The circle equation has the following format: (C) $(x-a)^2 + (y-b)^2 = R^2$.

To enter the circle equation into the calculator, you can key press operation as follows: MENU sin [D] 4(Circle) or SHIFT OPTN 1 (Geometry type) 4(Circle) if you are in another geometry mode.

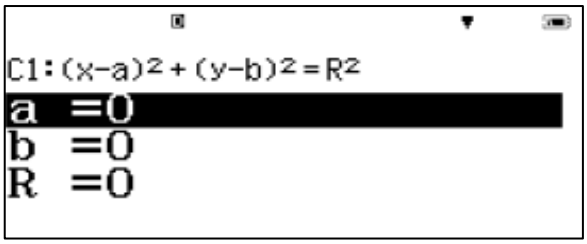
The calculator screen will display the following:

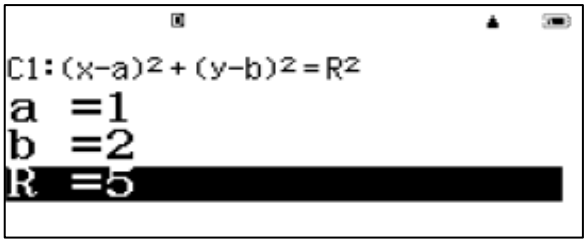
Keys press operation	Function
OPTN 1 (Define Circle)	Select a Circle (C1, C2 or C3)
OPTN 2 (Edit Circle)	Select a Circle (C1, C2 or C3 and edit.
OPTN 3 (C1)	Call Circle C1
OPTN 4 (C2)	Call Circle C2
OPTN 5 (C3)	Call Circle C3
OPTN 5 (Area)	Calculate the area of Circle

Example: Input the Circle equation C1 with center I (1,2) and radius R=5

AC OPTN 1 (Define Circle) 1 (Circle C1)

1 = 2 = 5 =



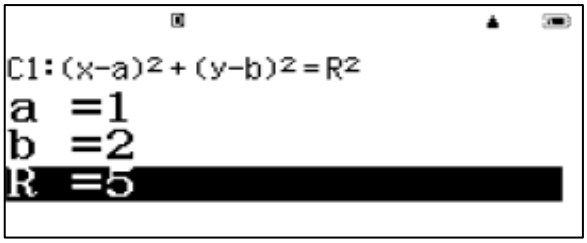


You have completed inputting the Circle equation C1.

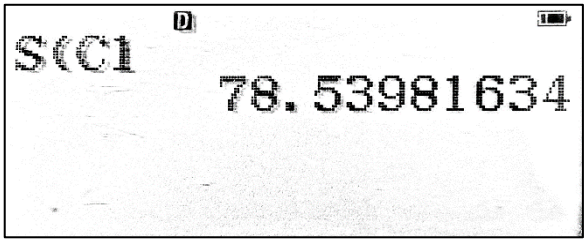
Calculate the Area of a Circle.

Example: Calculate the area of a C1 with center I (1,2) and radius R=5

AC OPTN 1 (Define Circle) 1 (Circle C1) 1 = 2 = 5 =



OPTN 6 (Area) OPTN 3 (Circle C1) =



Calculation involves Sphere (SPHERE MODE).

The Sphere equation has the following format: (C) $(x-a)^2+(y-b)^2+(z-c)^2=R^2$

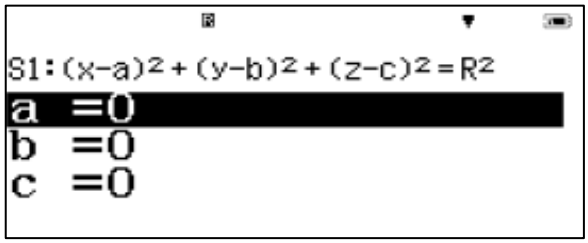
To enter the Sphere equation into the calculator, you can key press operation as follows: MENU sin [D] 5 (Sphere) or SHIFT OPTN 1 (Geometry type) 5 (Sphere) if you are in another geometry mode.

The calculator screen will display the following:

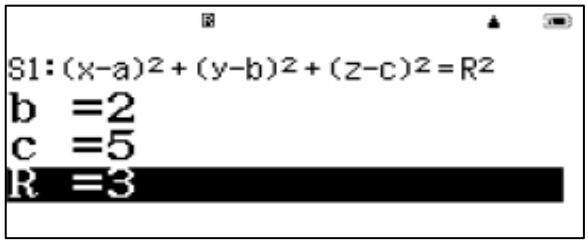
Keys press operation	Function
OPTN 1 (Define Sphere)	Select a Sphere (S1, S2 or S3)
OPTN 2 (Edit Sphere)	Select a Sphere (S1, S2 or S3) and edit.
OPTN 3 (S1)	Call Sphere S1
OPTN 4 (S2)	Call Sphere S2
OPTN 5 (S3)	Call Sphere S3
OPTN 6 (Area)	Calculate the Area of Sphere
OPTN 7 (Volume)	Calculate the Volume of Sphere

Example: Input the Sphere equation S1 with center I (1,2,5) and radius R=3

AC OPTN 1 (Define Sphere) 1 (Sphere S1)



1 = 2 = 5 = 3 =

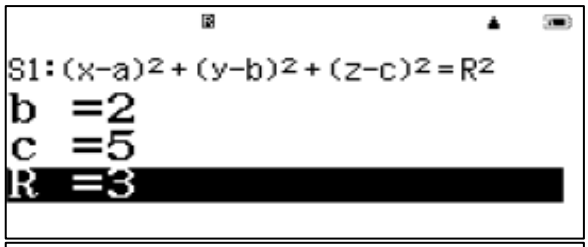


You have completed inputting the Sphere equation S1.

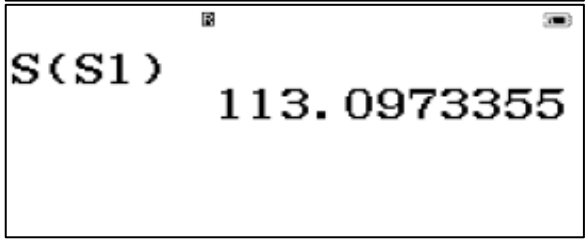
Calculate the Area of a sphere.

Example: Calculate the area of a S1 with center I (1,2,5) and radius R=3

AC OPTN 1 (Define Sphere) 1 (Sphere S1) 1 = 2 = 5 = 3 =



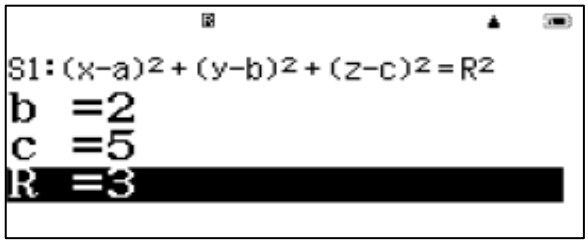
OPTN 6 (Area) OPTN 3 (Sphere S1) =



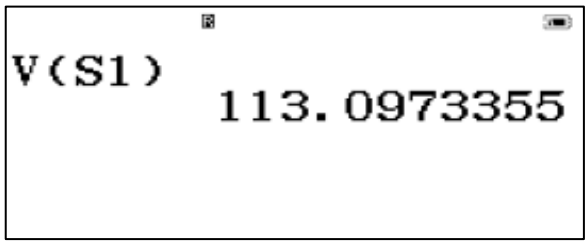
Calculate the Volume of a sphere.

Example: Calculate the area of a S1 with center I (1,2,5) and radius R=3

AC OPTN 1 (Define Sphere) 1 (Sphere S1) 1 = 2 = 5 = 3 =



OPTN 7 (Volume) OPTN 3 (Sphere S1) =

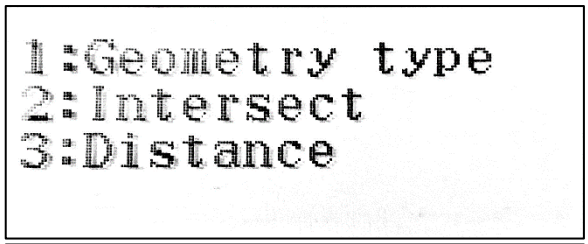


Intersect between Geometric type.

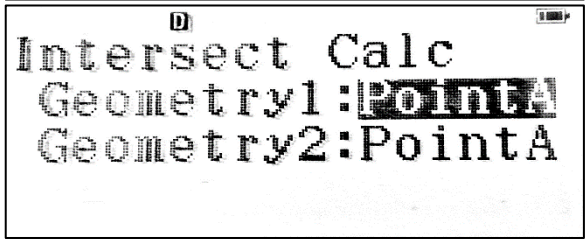
With the function of Intersect between Geometric type. We will find the intersection of the following Geometric type: Line and Line, Plane and Plane, Circle and Circle, Sphere and Sphere, Line and Plane, Line and Circle, Line and Sphere, Circle and Sphere.

On any screen of Geometry Mode, pressing SHIFT OPTN 2 (Intersect) the calculator screen will display the following:

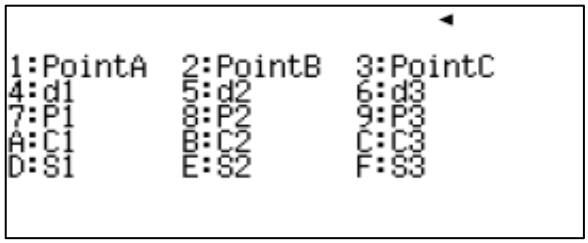
SHIFT OPTN



2 (Intersect)



OPTN

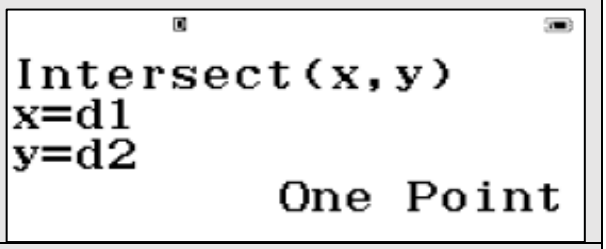
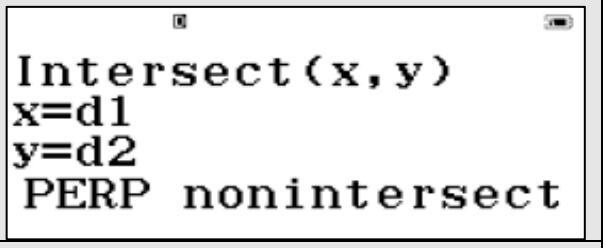


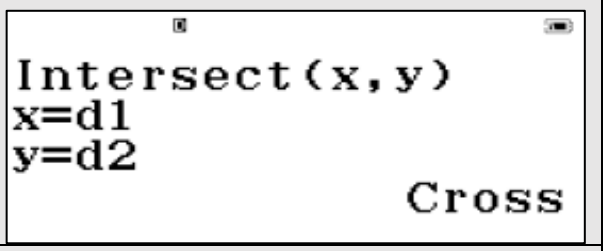
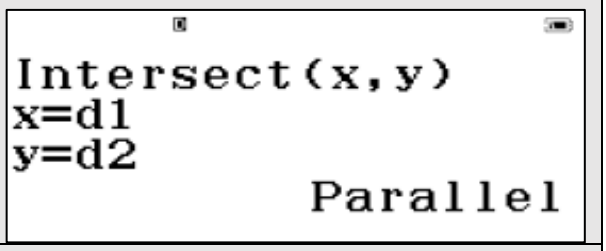
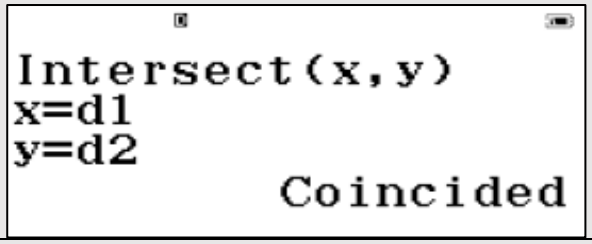
On the displayed list, key press operation as in the table below to select the Intersect Geometric mode:

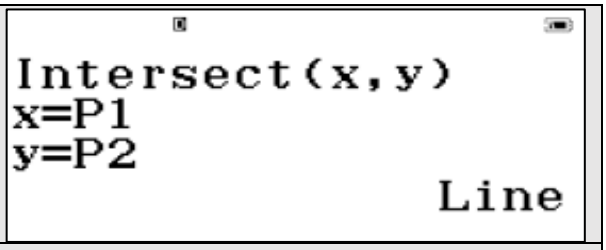
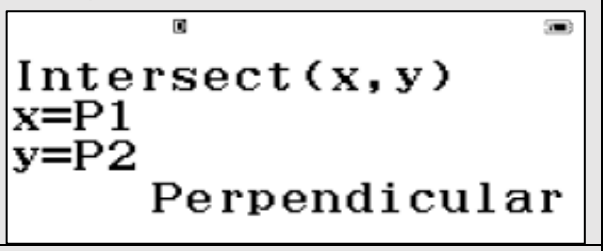
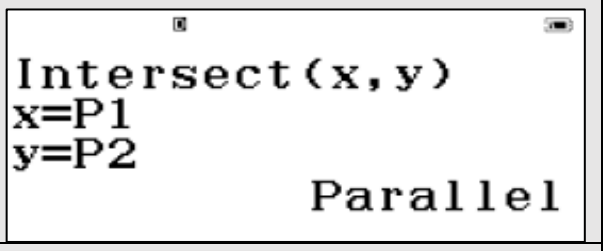
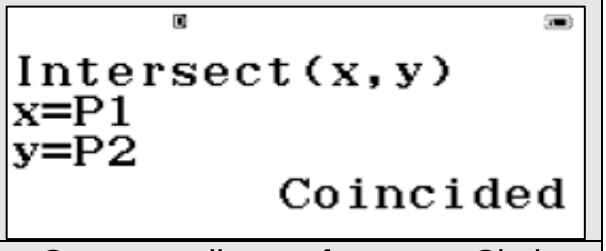
Key	Meaning	Key	Meaning
1 (PointA)	Point A	9 (P3)	Plane P3
2 (PointB)	Point B	(−) (C1)	Circle C1

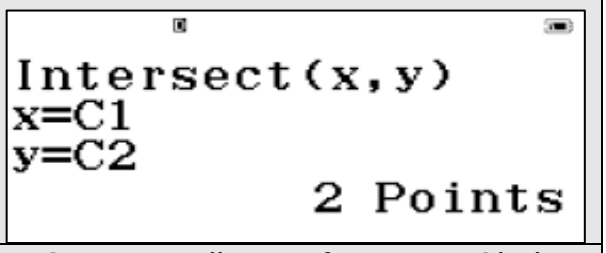
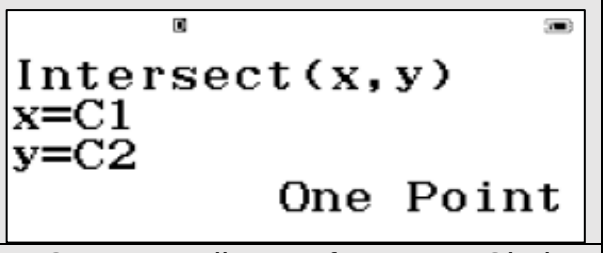
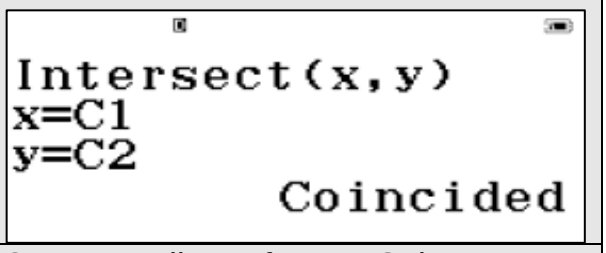
3 (PointC)	Point C	◦,,, (C2)	Circle C2
4 (d1)	Line d1	x^{-1} (C3)	Circle C3
5 (d2)	Line d2	sin (S1)	Sphere S1
6 (d3)	Line d3	cos (S2)	Sphere S2
7 (P1)	Plane P1	tan (S3)	Sphere S3
8 (P2)	Plane P2		

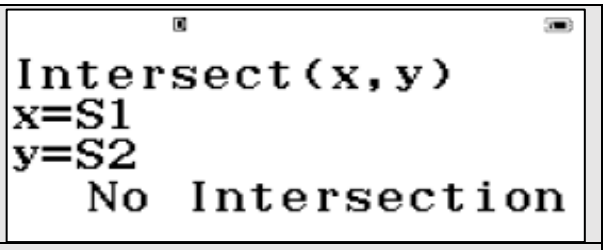
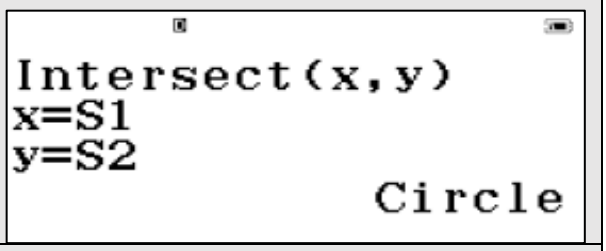
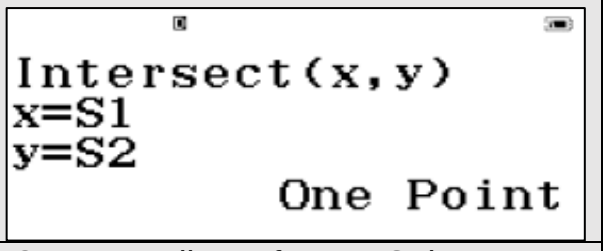
Below is a table of results for cases Intersect Geometric mode:

No.	Input	Case	Example
01	2 lines	Intersect at 1 point	In the Oxy coordinate for two lines: $d_1:\begin{cases}x=t\\y=1-2t\end{cases}; d_2:\begin{cases}x=-1+2t'\\y=2-3t'\end{cases}$. Determine the intersection of the line (d1) and the line (d2) **Result:** Intersect at 1 point 
		Perpendicu-lar	In the Oxyz coordinate for two lines: $d_1\begin{cases}x=1+1t\\y=2-3t\\z=3-5t\end{cases}$ and $d_2\begin{cases}x=2+2t\\y=-2-t\\z=3+t\end{cases}$ Determine the intersection of the line (d1) and the line (d2) **Result:** Perpendicular 
		Cross	In the Oxyz coordinate for two lines: $d_1:\begin{cases}x=1+t\\y=1-t\\z=-2-2t\end{cases}$ and $d_2:\begin{cases}x=2+t'\\y=1-t'.\\z=1\end{cases}$ Determine the intersection of the line (d1) and the line (d2)

			Result: Cross 
		Parallel	In the Oxyz coordinate for two lines: $d: \begin{cases} x = 1 + t \\ y = 2 + t \\ z = 3 - t \end{cases}$ and $d': \begin{cases} x = 1 + 2u \\ y = -1 + 2u \\ z = 2 - 2u \end{cases}$ Determine the intersection of the line (d1) and the line (d2) **Result:** Parallel 
		Coincidence	In the Oxyz coordinate plane give two lines: $d_1: \begin{cases} x = 1 + 2t \\ y = 2 + 3t \\ z = 3 + 4t \end{cases}$ and $d_2: \begin{cases} x = 3 + 4t' \\ y = 5 + 6t' \\ z = 7 + 8t' \end{cases}$ Determine the intersection of the line (d1) and the line (d2) **Result:** Coincidence 
02	2 Planes	Intersect at 1 line	In the Oxyz coordinate for two Plane: (P1) $2x - 3y + z - 4 = 0$và (P2) $5x - 3y - 2z - 7 = 0$ Determine the intersection of the Plane (P1) and the Plane (P2) **Result:** Intersection at 1 line

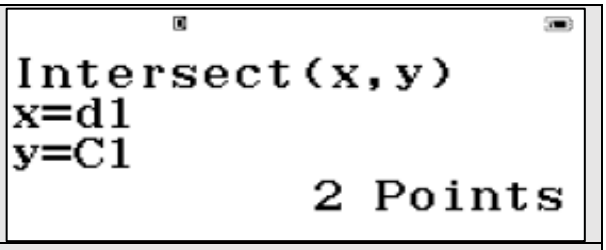
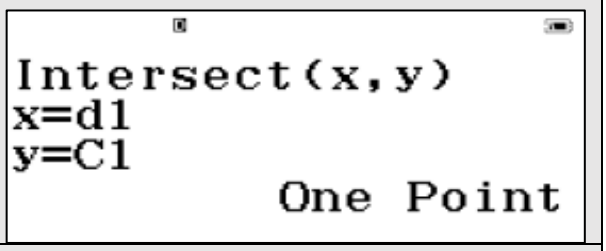
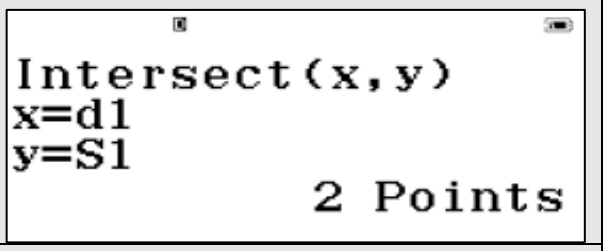
			
		Perpendicu-lar	In the Oxyz coordinate for two Planes: (P1) 3x-5y+6z-3 = 0 và (P2) x+3y+2z+5 = 0 Determine the intersection of the Plane (P1) and the Plane (P2) **Result:** Perpendicular 
		Parallel	In the Oxyz coordinate for two Planes: (P1) 2x+2y-z+12 =0 và (P2) 2x+2y-z-18=0 Determine the intersect of the Plane (P1) and the Plane (P2) **Result:** Parallel 
		Coincidence	In the Oxyz coordinate for two Planes $(P): x-y+2z-4=0$; $(Q): 10x-10y+20z-40=0$. Determine the intersection of the Plane (P) and the Plane (Q) **Result:** Coincidence 
03	2 Circles	Intersect at 2 points	In the Oxy coordinate for two Circles: $(C_1): x^2+(y-1)^2=10$

			$(C_2): (x-3)^2 + y^2 = 9$. Determine the intersection of the Circles(C1) and the Circles(C2). **Result:** Intersection at 2 Points. 
		Tangency at 1 point	In the Oxy coordinate for two Circles: $(C_1): (x-1)^2 + (y-2)^2 = 5$ $(C_2): (x+2)^2 + (y+4)^2 = 20$. Determine the intersection of the Circles(C1) and the Circles(C2). **Result:** Tangency at 1 point 
		Coincidence	In the Oxy coordinate for two Circles $(C_1): (x-1)^2 + (y-2)^2 = 5$ $(C2): (x-1)^2 + (y-2)^2 = 5$. Determine the intersection of the Circles(C1) and the Circles(C2). **Result:** Coincidence 
04	2 Spheres	No Intersection	In the Oxyz coordinate for two Sphere (S1): $(x-1)^2 + (y-1)^2 + (z-1)^2 = 1$ (S2): $(x-3)^2 + (y-3)^2 + (z-3)^2 = 1$. Determine the intersection of the Sphere(S1) and the Sphere(S2). **Result:** No Intersection

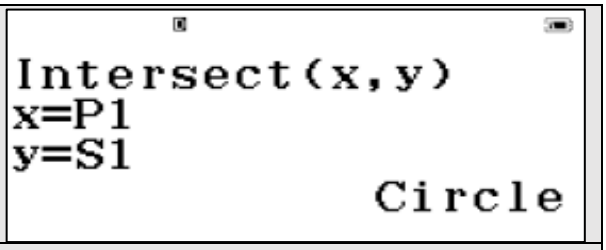
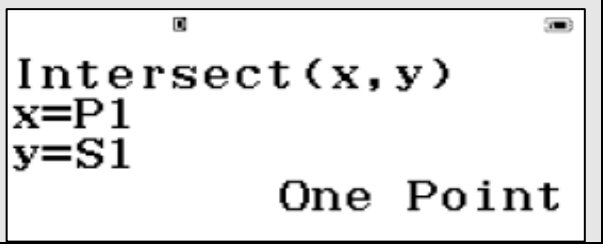
			
		Intersect at 1 Circle	In the Oxyz coordinate for two Sphere: (S1): $x^2+y^2+z^2+2x-2y-2z-7=0$ (S2): $x^2+y^2+z^2+2x+2y+4z+5=0$. Determine the intersection of the Sphere(S1) and the Sphere(S2). **Result**: Intersect at 1 Circle 
		Tangency at 1 point	In the Oxyz coordinate for two Spheres: (S1): $(x-1)^2+(y-1)^2+(z-1)^2=3$ (S2): $(x+3)^2+(y+3)^2+(z+3)^2=27$ Determine the intersection of the Sphere(S1) and the Sphere(S2). **Result:** Tangency at 1 point 
		Coincidence	In the Oxyz coordinate for two Spheres: (S1): $(x-1)^2+(y-1)^2+(z-1)^2=3$ (S2): $(x-1)^2+(y-1)^2+(z-1)^2=3$. Determine the intersection of the Sphere(S1) and the Sphere(S2). **Result:** Coincidence

			Intersect(x,y) x=S1 y=S2 Coincided
05	(Line-Plane)	Intersect at 1 Point	In the Oxyz coordinate for the Plane $P1: x + 3y + 2z - 1$ and line. $d1: \begin{cases} x = -1 + 2t \\ y = 3 + t \\ z = 1 - t \end{cases}$ Determine the intersection of the Plane (P1) and the Line (d1) **Result:** Intersect at 1 Point. Intersect(x,y) x=d1 y=P1 One Point
		Perpendicu-lar	In the Oxyz coordinate for the Plane (P1): 2x+y-z-4=0 and the line $d_1 \begin{cases} x = -1 + 2t \\ y = t \\ z = 1 - 1t \end{cases}$ Determine the intersection of the Plane (P1) and the Line (d1) **Result: Perpendicular** Intersect(x,y) x=d1 y=P1 Perpendicular
		Parallel	In the Oxyz coordinate for the Plane $P1: 2x + y + 3z + 1 = 0$ and the Line. $d1: \begin{cases} x = 1 - t \\ y = 2 + 2t \\ z = 1 \end{cases}$ Determine the intersection of the Plane (P1) and the Line (d1) **Result: Parallel.**

			Intersect(x,y) x=d1 y=P1 Parallel
		Line Belong Plane	In the Oxyz coordinate for the Plane $P1: 2x + y + 3z + 1 = 0$ and the line $.d1: \begin{cases} x = -3 + t \\ y = 2 - 2t \\ z = 1 \end{cases}$ Determine the intersection of the Plane (P1) and the Line (d1) **Result:** Line Belong Plane Intersect(x,y) x=d1 y=P1 d BelongP
06	(Line – Circle)	No intersec-tion	In the Oxy coordinate for the line $(d): \begin{cases} x = 3 + 2t \\ y = -t \end{cases}$ and Circle $(C): (x+1)^2 + (y+1)^2 = 2$. Determine the intersection of the Line (d) and the sphere (S). **Result:** No Intersection. Intersect(x,y) x=d1 y=C1 No Intersection
		Intersection at 2 Points	In the Oxy coordinate for the line $(d): \begin{cases} x = t \\ y = 1 + t \end{cases}$ and Circle $(C): x^2 + y^2 = 5$. Determine the intersection of the Line (d) and the sphere (S). **Result:** Intersection at 2 Points

			
		Tangency at 1 point	In the Oxy coordinate for the line $(d): x-y+2=0$ and Circle $(C):(x+1)^2+(y+1)^2=2$. Determine the intersection of the Line (d) and the sphere (S). **Result:** Tangency at 1 point 
07	(Line – Sphere)	Intersection at 2 Points	In the Oxyz coordinate for the line $d_1\begin{cases}x=1+2t\\y=t\\z=2+2t\end{cases}$ and Sphere (S1): $(x-2)^2+(y-5)^2+(z-3)^2=49$. Determine the intersection of the Line (d) and the sphere (S). **Result:** Intersection at 2 Points 
		No intersec-tion	In the Oxyz coordinate for the line $d_1\begin{cases}x=-1+2t\\y=2+t\\z=-3-t\end{cases}$ and Sphere (S1): $(x+1)^2+(y+1)^2+(z+1)^2=2$. Determine the intersection of the Line (d) and the sphere (S). **Result:** No intersection

			Intersect(x,y) x=d1 y=S1 No Intersection
		Tangency at 1 point	In the Oxyz coordinate for the line $d_1\begin{cases} x=-1+2t \\ y=2+t \\ z=-3-t \end{cases}$ và Sphere (S1): $(x-1)^2+(y+2)^2+(z-3)^2=50$. Determine the intersection of the line (d1) and the sphere (S1). **Result:** Tangency at 1 point Intersect(x,y) x=d1 y=S1 One Point
08	Plane – Sphere)	No Intersection	In the Oxyz coordinate for the Plane: $(P): x+2y+2z+1=0$ and Sphere $(S): (x-1)^2+(y-2)^2+(z-3)^2=4$. Determine the intersection of the Plane (P) and the sphere (S). **Result:** No Intersection Intersect(x,y) x=d1 y=S1 No Intersection
		Intersection at Circle	In the Oxyz coordinate for the Plane: $(P): 2x+y-z=0$ and Sphere $(S): x^2+(y-1)^2+(z+2)^2=9$. Determine the intersection of the Plane (P) and the sphere (S). **Result:** Intersection at Circle

			
		Tangency at 1 point	In the Oxyz coordinate for the Plane: $(P): x+2y+2z+1=0$ and Sphere $(S):(x-1)^2+(y-2)^2+(z-3)^2=16$. Determine the intersection of the Plane (P) and the sphere (S). **Result :** Tangency at 1 point 

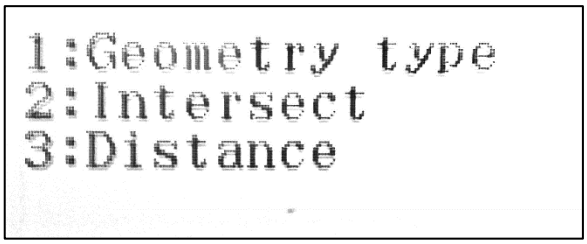
Calculate distance

The calculator distance is can calculate the distance of geometric format as shown below:

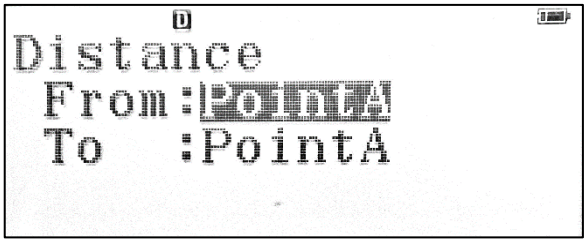
- Two Points
- Plane and Point
- Points and Lines

On any screen of geometry mode, pressing SHIFT OPTN 3 (Distance) the calculator screen will display the following:

SHIFT OPTN

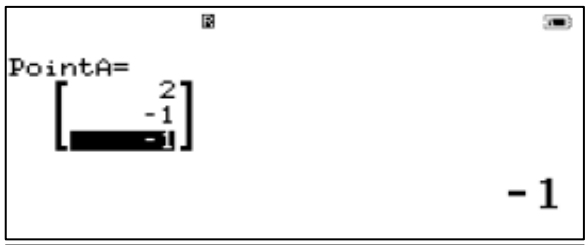


3 (Distance)

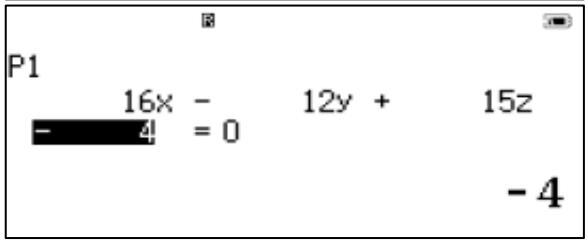


Example: Calculate distance of Point M($2,-1,-1$) and Plane P: $16x-12y+15z-4=0$

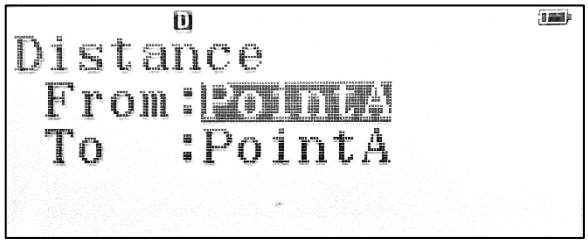
MENU sin [D] 1 (Point) 1 (PointA) 3 (Oxyz coordinate)



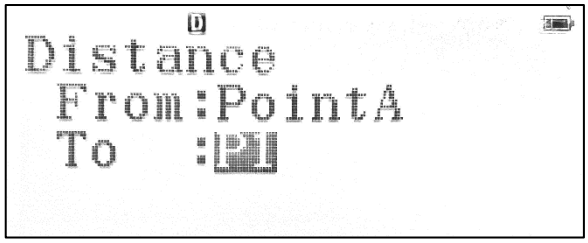
AC SHIFT OPTN 1 3 OPTN 1 1 1 6 = (−)
1 2 = 1 5 = (−) 4 =



SHIFT OPTN 3 (Distance)



OPTN 1 (PonitA) ▼ OPTN 7 (P1)



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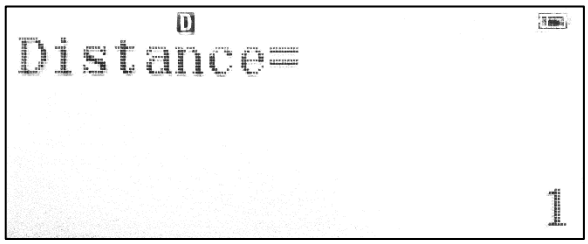


The distance from Point M to Plane (P) is 1.

🕮 FUNCTION SHORTCUT

Calculator have a new function is "Shortcuts", with this function you will:

+ Assign and quickly call a function.
+ Save 1 sequence of operations (maximum 6 key press steps).

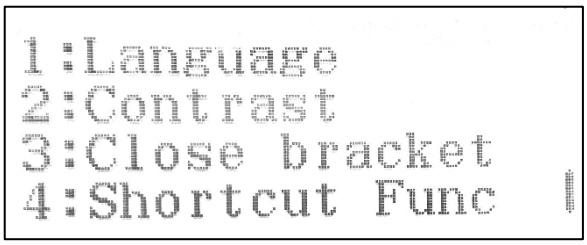
Some information about the Shortcut function:

- Shortcuts function only be used in Comp and CMPLX modes.
- The calculator has two Shortcut keys on the top and sides of the screen.
- Two keys will be distinguished with the names "Left button" and "Right button"
- Each button can be assigned a different sequence of operations.
- When saving a new operation sequence, the previously saved operation

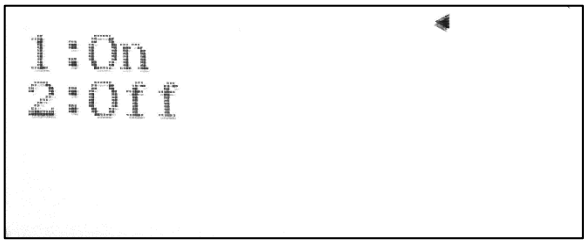
sequence will be deleted.

Method Turn On/Turn Off Shortcut function.

SHIFT MENU ▲



4 (Shortcut Func) 1 (Turn On Function*)* or 2 (Turn On Function*)*



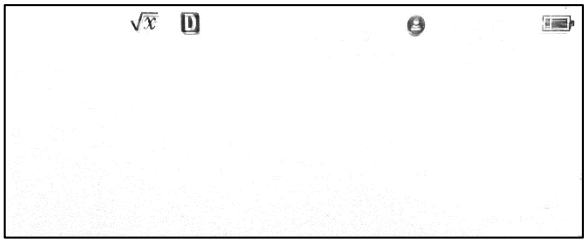
Using Shortcut function.

Press key SHIFT 5 1 (If you want to save the Left button*)* or 2 (If you want to save the Right button)

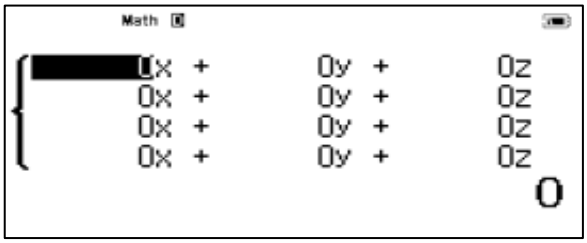
Example: To assign a **System of equations with 4 unknowns** to the Shortcut on the Left, proceed as follows:

Press key SHIFT 5

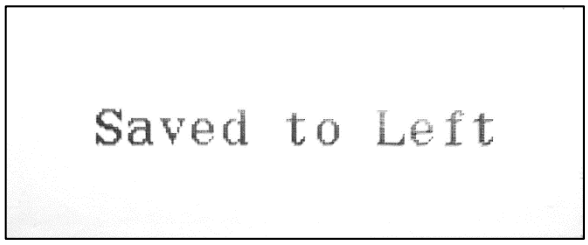
1 (Left button)



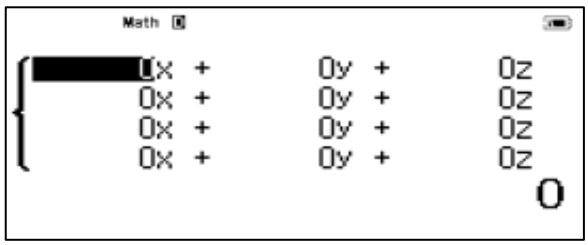
MENU 9 (Equation/Func*)* 1 (Simul Equation*)* 4 (4 Unknowns)



SHIFT 5 (to save to Shortcut on the Left)



To quickly call up the saved **System of equations with 4 unknowns**, press and hold the left shortcut key for about 1 second. The screen will appear as follows:



Note:

- When press all 6 operations, the calculator will automatically save the previous operations to the selected Shortcut key without having to perform the operation SHIFT 5

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https://flexoffice.com.vn

Designed by Thien Long – ID Patent No.25252