SHARP

ENGLISH

SCIENTIFIC CALCULATOR

WriteView

MODEL **EL-W506T**

OPERATION MANUAL

INTRODUCTION

Thank you for purchasing the SHARP Scientific Calculator Model EL-W506T.
After reading this manual, store it in a convenient location for future reference.
Note:
- On the sheet with calculation examples is used english notation (with a decimal point).
- This product uses a period as a decimal point.

Operational Notes

- Do not carry the calculator around in your back pocket, as it may break when you sit down. The display is made of glass and is particularly fragile.
- Keep the calculator away from extreme heat such as on a car dashboard or near a heater, and avoid exposing it to excessively humid or dusty environments.
- Since this product is not waterproof, do not use it or store it where fluids, for example water, can splash onto it. Raindrops, water spray, juice, coffee, steam, perspiration, etc. will also cause malfunction.
- Clean with a soft, dry cloth. Do not use solvents or a wet cloth.
- Do not drop it or apply excessive force.
- Never dispose of batteries in a fire.
- Keep batteries out of the reach of children.
- For the sake of your health, try not to use this product for long periods of time. If you need to use the product for an extended period, be sure to allow your eyes, hands, arms, and body adequate rest periods (about 10–15 minutes every hour).
  If you experience any pain or fatigue while using this product, discontinue use immediately. If the discomfort continues, please consult a doctor.
- This product, including accessories, may change due to upgrading without prior notice.

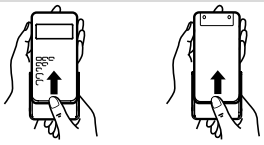
NOTICE

- SHARP strongly recommends that separate permanent written records be kept of all important data. Data may be lost or altered in virtually any electronic memory product under certain circumstances. Therefore, SHARP assumes no responsibility for data lost or otherwise rendered unusable whether as a result of improper use, repairs, defects, battery replacement, use after the specified battery life has expired, or any other cause.
- SHARP will not be liable nor responsible for any incidental or consequential economic or property damage caused by misuse and/or malfunctions of this product and its peripherals, unless such liability is acknowledged by law.

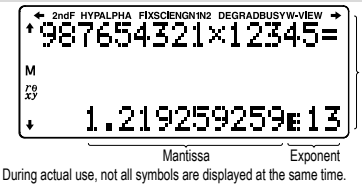
♦ Press the RESET switch (on the back), with the tip of a ball-point pen or similar object, only in the following cases:
- When using for the first time
- After replacing the battery
- To clear all memory contents
- When an abnormal condition occurs and all keys are inoperative.

Do not use an object with a breakable or sharp tip. Note that pressing the RESET switch erases all data stored in memory.
If service should be required on this calculator, use only a SHARP servicing dealer, SHARP approved service facility, or SHARP repair service where available.

Hard Case



DISPLAY



- During actual use, not all symbols are displayed at the same time.
- Certain inactive symbols may appear visible when viewed from a far off angle.
- Only the symbols required for the usage currently being explained are shown in the display and calculation examples in this manual.

←/→/↑/↓ : Indicates that some contents are hidden in the directions shown.
2ndF : Appears when 2ndF is pressed, indicating that the functions shown in same color are enabled.
HYP : Indicates that hyp has been pressed and the hyperbolic functions are enabled. If 2ndF arc hyp are pressed, the symbols "**2ndF HYP**" appear, indicating that inverse hyperbolic functions are enabled.
ALPHA : Indicates that ALPHA, STO or RCL has been pressed, and entry (recall) of memory contents and recall of statistics can be performed.
FIX / SCI / ENG / N1 / N2 : Indicates the notation used to display a value and changes by SET UP menu. **N1** is displayed on-screen as "NORM1", and **N2** as "NORM2".
DEG / RAD / GRAD : Indicates angular units and changes each time DRG is pressed.
BUSY : Appears during the execution of a calculation.
W-VIEW : Indicates that the WriteView editor is selected.
M : Indicates that a value is stored in the independent memory.
xy* / *rθ : Indicates the mode of expression for results in COMPLEX mode.

BEFORE USING THE CALCULATOR

Power On and Off

Press ON/C to turn the calculator on. The data that was on-screen when the power was turned off will appear on the display.
Press 2ndF OFF to turn the calculator off.

Key Notation Used in this Manual

e^x E	To specify e^x	: 2ndF e^x
ln	To specify ln	: ln
	To specify E	: ALPHA E

- Functions that are printed in orange above the key require 2ndF to be pressed first before the key. When you specify the memory, press ALPHA first. Numbers for input value are not shown as keys, but as ordinary numbers.
- Functions that are printed in gray adjacent to the keys are effective in specific modes.
- The multiplication operator "×" is differentiated from the letter "X" in this manual as follows:
  To specify the multiplication operator: ×
  To specify the letter "X": ALPHA x
- In certain calculation examples, where you see the **LINE** symbol, the key operations and calculation results are shown as they would appear in the Line editor.
- In each example, press ON/C to clear the display first. Unless otherwise specified, calculation examples are performed in the WriteView editor (2ndF SET UP 2 0 0) with the default display settings (2ndF M-CLR 0).

Clearing the Entry and Memories

Operation	Entry (Display)	A – F, M, X, Y	D1 – D3	ANS	STAT*1	matA–D vectA–D
ON/C	○	×	×	×	×	×
2ndF CA	○	×	×	○	○	○
Mode selection (MODE)	○	×	×	×	×*2	○
2ndF M-CLR 0	○	×	×	×	×	×
2ndF M-CLR 1 0	○	○	○	○	○	○
2ndF M-CLR 2 0 *3	○	○	○	○	○	○
RESET switch*3	○	○	○	○	○	○

○: Clear ×: Retain
*1 Statistical data (entered data)
*2 Cleared when changing between sub-modes in STAT mode
*3 The RESET operation will erase all data stored in memory and restore the calculator's default settings

Memory clear key

Press 2ndF M-CLR to display the menu.
- To initialize the display settings, press 0. The parameters are set as follows:
  - Angular unit: DEG
  - Display notation: NORM1
  - N-base: DEC
  - Recurring decimal: OFF

Mode Selection

NORMAL mode: MODE 0 (default)
Used to perform arithmetic operations and function calculations.

STAT mode: MODE 1
Used to perform statistical operations.

TABLE mode: MODE 2
Used to illustrate the changes in values of one or two functions in table format.

COMPLEX mode: MODE 3
Used to perform complex number calculations.

EQUATION mode: MODE 4
Used to solve equations.

MATRIX mode: MODE 5
Used to perform matrix calculations.

VECTOR mode: MODE 6
Used to perform vector calculations.

DISTRIBUTION mode: MODE 7
Used to perform distribution calculations.

DRILL mode: MODE 8
Used to practice math and multiplication table drills.

HOME Key

Press HOME to return to NORMAL mode from other modes.
Note: Equations and values currently being entered will disappear, in the same way as when the mode is changed.

SET UP menu

Press 2ndF SET UP to display the SET UP menu.
Press ON/C to exit the SET UP menu.
Note: You can press BS to return to the previously displayed parent menu.

Determination of the angular unit (degrees, radians, and grades)

DEG (°): 2ndF SET UP 0 0 (default)
RAD (rad): 2ndF SET UP 0 1
GRAD (g): 2ndF SET UP 0 2

Selecting the display notation and decimal place ❶

Two settings of Floating point (NORM1 and NORM2), Fixed decimal point (FIX), Scientific notation (SCI), and Engineering notation (ENG).
- When 2ndF SET UP 1 0 (FIX) or 2ndF SET UP 1 2 (ENG) is pressed, the number of decimal places (TAB) can be set to any value between 0 and 9.
- When 2ndF SET UP 1 1 (SCI) is pressed, the number of significant digits can be set to any value between 0 and 9. Entering 0 will set a 10-digit display.

Setting the floating point number system in scientific notation

NORM1 (the default) and NORM2. A number is automatically displayed in scientific notation outside a preset range:
- NORM1 (2ndF SET UP 1 3): $0.000000001 \le x \le 9{,}999{,}999{,}999$
- NORM2 (2ndF SET UP 1 4): $0.01 \le x \le 9{,}999{,}999{,}999$

Selecting the editor and setting the answer display ❷

This calculator has the following two editors in NORMAL mode: WriteView and Line. Set the display format for numerical calculation results in WriteView editor.

The WriteView editor (W-VIEW)
EXACT(a/b, √, π) 2ndF SET UP 2 0 0 (default)
APPROX. 2ndF SET UP 2 0 1

The Line editor (LINE) 2ndF SET UP 2 1

Notes:
- When "EXACT(a/b, √, π)" is set, results will appear in fraction format or irrational number format (including π and √) when display is possible.
- When "APPROX." is set, results will be decimal display or fraction display, and will be not shown in irrational number format (including π and √).
- Press CHANGE to change the calculation results to another format that can be displayed.

Adjusting the display contrast

Press 2ndF SET UP 3, then + or − to adjust the contrast. Press ON/C to exit.

Insert and overwrite entry methods

When using the Line editor, you can change the entry method from "INSERT" (the default) to "OVERWRITE".
After you switch to the overwrite method (by pressing 2ndF SET UP 4 1), the triangular cursor will change to a rectangular one, and the number or function underneath it will be overwritten as you make entries.

Setting the recurring decimal ❸

In NORMAL mode, calculation results can be shown in a recurring decimal format.
Recurring decimal is OFF: 2ndF SET UP 5 0 (default)
Recurring decimal is ON: 2ndF SET UP 5 1
- In the WriteView editor, the recurring part is indicated by "‾". In the Line editor, the recurring part is indicated in parentheses.
- If over 10 digits, including the recurring part, the result cannot be displayed in recurring decimal format.

Setting of the decimal point

You can show the decimal point in the calculation result as either a dot or a comma.
DOT: SET UP 6 0 (default)
COMMA: SET UP 6 1
- During entry, the decimal point is only shown as a dot.

Name display function

You can save a username in this calculator. When you turn the power off, the saved username is displayed momentarily.
Up to 32 characters may be saved, split over two lines.
Entering and editing the username:
1. Press 2ndF SET UP 7. The editing screen appears with a flashing cursor.
2. Use ▲ and ▼ to scroll through the available characters.
3. Pressing ◄ or ► moves the cursor to the left or right.
   To modify a character, use ◄ or ► to move the cursor to the character, then select another character using ▲ or ▼.
4. Repeat steps 2 and 3 above to continue entering characters.
5. Press = to save and quit.
   Note: Press 2ndF CA in the editing screen to clear all the characters.

ENTERING, DISPLAYING, AND EDITING THE EQUATION ❹

The WriteView Editor

Entry and display

In the WriteView editor, you can enter and display fractions or certain functions as you would write them.
- The WriteView editor can be used in NORMAL mode.

Displaying calculation results (when EXACT is selected)

When possible, calculation results will be displayed using fractions, √ and π.
When you press CHANGE, the display will cycle through the following display styles:
- Mixed fractions (with or without π) → improper fractions (with or without π) → decimal numbers
- Proper fractions (with or without π) → decimal numbers
- Irrational numbers (square roots, fractions made using square roots) → decimal numbers

Notes:
- In the following cases, calculation results may be displayed using √:
  - Arithmetic operations and memory calculations
  - Trigonometric calculations
- In trigonometric calculations, when entering values such as those in the table to the right, results may be shown using √.
- Improper/proper fractions will be converted to and displayed as decimal numbers if the number of digits used in their expression is greater than nine.
  In the case of mixed fractions, the maximum number of displayable digits (including integers) is eight.
- If the number of digits in the denominator of a fractional result that uses π is greater than three, the result is converted to and displayed as a decimal number.

	Entry value
DEG	multiples of 15
RAD	multiples of $\frac{1}{12}\pi$
GRAD	multiples of $\frac{50}{3}$

The Line Editor

Entry and display

In the Line editor, you can enter and display equations line by line.
Notes:
- Up to three lines of text may be viewed on the screen at one time.
- In the Line editor, calculation results are displayed in decimal form or line fraction notation if possible.
- Use CHANGE to switch the display format to fractional form or decimal form (if possible).

Editing the Equation

Just after obtaining an answer, pressing ◄ brings you to the end of the equation and pressing ► brings you to the beginning. Press ◄, ►, ▲ or ▼ to move the cursor. Press 2ndF ◄ or 2ndF ► to jump the cursor to the beginning or the end of the equation.

Back space and delete key

To delete a number or function, move the cursor to the right of it, then press BS.
You can also delete a number or function that the cursor is directly over by pressing 2ndF DEL.
Note: In a multi-level menu, you can press BS to back to the previous menu level.

MATH Menu

Other functions may be available on this calculator besides those printed on the key pad. These functions are accessed using the MATH menu. The MATH menu has different contents for each mode.
Press MATH to display the MATH menu.
Note: The MATH key cannot be used in the simulation calculations and solver functions of NORMAL mode, or in the item and value input screens of other modes.

Multi-line Playback Function ❺

This calculator is equipped with a function to recall previous equations and answers in NORMAL or COMPLEX modes. Pressing ▲ will display the previous equation. The number of characters that can be saved is limited. When the memory is full, stored equations will be deleted to make room, starting with the oldest.
- To edit an equation after recalling it, press ◄ or ►.
- The multi-line memory will be cleared by the following operations: 2ndF CA, mode change, RESET, N-base conversion, angular unit conversion, editor change (2ndF SET UP 2 0 0, 2ndF SET UP 2 0 1 or 2ndF SET UP 2 1), and memory clear (2ndF M-CLR 1 0).

Priority Levels in Calculation

Operations are performed according to the following priority:
① Fractions (1r4, etc.) ② ∠, engineering prefixes ③ Functions preceded by their argument (x^{-1}, x^2, n!, etc.) ④ y^x, $\sqrt[x]{}$ ⑤ Implied multiplication of a memory value (2Y, etc.) ⑥ Functions followed by their argument (sin, cos, etc.) ⑦ Implied multiplication of a function (2sin30, etc.) ⑧ nCr, nPr ⑨ ×, ÷ ⑩ +, − ⑪ AND ⑫ OR, XOR, XNOR ⑬ =, M+, M−, ⇒M, ▶DEG, ▶RAD, ▶GRAD, DATA, CD, →$r\theta$, →xy and other calculation ending instructions
- If parentheses are used, parenthesized calculations have precedence over any other calculations.

SCIENTIFIC CALCULATIONS

Arithmetic Operations ❻

- The closing parenthesis) just before = or M+ may be omitted.

Constant Calculations 7

- In constant calculations, the addend becomes a constant. Subtraction and division are performed in the same manner. For multiplication, the multiplicand becomes a constant.
- In the constants calculations, constants will be displayed as K.
- Constant calculations can be performed in NORMAL or STAT modes.

Conversion to Engineering notation 8

You can use [ALPHA] [<ENG] or [ALPHA] [ENG>] to convert the calculation result to engineering notation

- Press [ALPHA] [<ENG] to decrease the exponent. Press [ALPHA] [ENG>] to increase the exponent.
- The settings (FSE) in the SET UP menu do not change.

Functions 9

- Refer to the calculation examples of each function.
- In the Line editor, the following symbols are used:
  - $\blacksquare^{\blacksquare}$ to indicate an expression's power ([y^x], [2ndF] [e^x], [2ndF] [10^x])
  - $\blacksquare_{\blacksquare}$ to separate integers, numerators, and denominators ([a/b], [2ndF] [$a\frac{b}{c}$])
- When using [2ndF] [$\log_a x$] or [2ndF] [abs] in the Line editor, values are entered in the following way:
  - logn (*base*, *value*)
  - abs *value*

Differential/Integral Functions 10

Integral and differential calculations can be performed in NORMAL mode.

Note: Since integral and differential calculations are performed based on the following equations, correct results may not be obtained, in certain rare cases, when performing special calculations that contain discontinuous points.

Integral calculation (Simpson's rule):

$$S=\frac{1}{3}h\{f(a)+4\{f(a+h)+f(a+3h)+\cdots+f(a+(N-1)h)\}+2\{f(a+2h)+f(a+4h)+\cdots+f(a+(N-2)h)\}+f(b)\}\quad\left|\begin{array}{l}h=\dfrac{b-a}{N}\\ N=2n\\ a\le x\le b\end{array}\right.$$

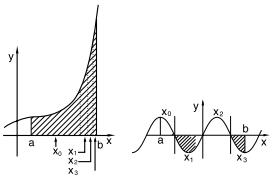
Differential calculation: $f'(x)=\dfrac{f(x+\frac{dx}{2})-f(x-\frac{dx}{2})}{dx}$

Performing integral calculations

1. Press [ALPHA] [$\int dx$].
2. Specify the following parameters: range of integral (initial value (a), end value (b)), function with variable x, and number of subintervals (n).
   You do not need to specify the number of subintervals. If the number of subintervals is not specified, the default value of n = 100 will be used.
3. Press [=].

Notes:

- Parameters are entered in the following way:
  WriteView editor: $\int_a^b$ *function[, subintervals]dx*
  Line editor: $\int$ (*function*, *a*, *b*[, *subintervals*])
- Integral calculations, depending on the integrands and subintervals included, require longer calculation time. During calculation, the BUSY symbol will be displayed. To cancel calculation, press [ON/C].
  Note that there will be greater integral errors when there are large fluctuations in the integral values during minute shifting of the integral range and for periodic functions, etc., where positive and negative integral values exist depending on the interval.
  For the former case, divide integral intervals as small as possible.
  For the latter case, separate the positive and negative values.
  Following these tips will allow you to obtain results from calculations with greater accuracy and will also shorten the calculation time.



Performing differential calculations

1. Press [ALPHA] [$\frac{d}{dx}$].
2. Specify the following parameters: function with variable x, value of x, and minute interval (dx).
   You do not need to specify the minute interval. If the minute interval is not specified, it will automatically be set to 10^{-5} (while $x = 0$), or $|x| \times 10^{-5}$ (while $x \neq 0$).
3. Press [=].

Note: Parameters are entered in the following way:

WriteView editor: $\frac{d(function)}{dx}\Big|_{x\ =\ value\ of\ x[,\ minute\ interval]}$

Line editor: *dldx* (*function*, *value of x*[, *minute interval*])

Σ Function 11

The Σ function returns the cumulative sum of a given expression from an initial value to an end value in NORMAL mode.

Performing Σ calculations

1. Press [ALPHA] [Σ].
2. Specify the following parameters: initial value, end value, function with variable x, and increment (n).
   You do not need to specify the increment. If the increment is not specified, the default value of n = 1 will be used.
3. Press [=].

Note: Parameters are entered in the following way:

WriteView editor: $\sum_{x\ =\ initial\ value}^{end\ value}(function[,\ increment])$

Line editor: Σ(*function*, *initial value*, *end value*[, *increment*])

Π Function 12

The Π function returns the product of a given expression from an initial value to an end value in NORMAL mode.

Performing Π calculations

1. Press [ALPHA] [Π].
2. Specify the following parameters: initial value, end value, function with variable x, and increment (n).
   You do not need to specify the increment. If the increment is not specified, the default value of n = 1 will be used.
3. Press [=].

Note: Parameters are entered in the following way:

WriteView editor: $\prod_{x\ =\ initial\ value}^{end\ value}(function[,\ increment])$

Line editor: Π(*function*, *initial value*, *end value*[, *increment*])

Random Function

The random function has four settings. (This function cannot be selected while using the N-base function.) To generate further random numbers in succession, press [ENTER]. Press [ON/C] to exit.

Random numbers

A pseudo-random number, with three significant digits from 0 up to 0.999, can be generated by pressing [2ndF] [RANDOM] [0] [ENTER].

Note: In the WriteView editor, if the result is not 0 it can be shown as a fraction or decimal using [CHANGE].

Random dice

To simulate a die-rolling, a random integer between 1 and 6 can be generated by pressing [2ndF] [RANDOM] [1] [ENTER].

Random coin

To simulate a coin flip, 0 (heads) or 1 (tails) can be randomly generated by pressing [2ndF] [RANDOM] [2] [ENTER].

Random integer

You can specify a range for the random integer with "R.Int(" only.

R.Int(*minimum value*, *maximum value*)

For example, if you enter [2ndF] [RANDOM] [3] 1 [(-),(,)] 99 [)] [ENTER], a random integer from 1 to 99 will be generated.

Angular Unit Conversions 13

Each time [2ndF] [DRG▶] are pressed, the angular unit changes in sequence.

Memory Calculations 14

Temporary memories (A – F, X and Y)

Press [STO] and a variable key to store a value in memory.
Press [RCL] and a variable key to recall the value from that memory.
To place a variable in an equation, press [ALPHA] and a variable key.

Independent memory (M)

In addition to all the features of temporary memories, a value can be added to or subtracted from an existing memory value.
Press [ON/C] [STO] [M] to clear the independent memory (M).

Last answer memory (ANS)

The calculation result obtained by pressing [=] or any other calculation ending instruction is automatically stored in the last answer memory. When the calculation result is in matrix or vector form, the full matrix or vector is not stored into ANS memory. Only the value of the element covered by the cursor is stored.

Notes:

- Calculation results from the functions indicated below are automatically stored in the X or Y memories replacing any existing values.
  - $\rightarrow r\theta$, $\rightarrow xy$: X memory (r or x), Y memory (θ or y)
  - Two x ' values from a quadratic regression calculation in STAT mode: X memory (1:), Y memory (2:)
- Use of [RCL] or [ALPHA] will recall the value stored in memory using up to 14 digits.
- A – F, X and Y memory cannot be used in COMPLEX mode.

Definable memories (D1 – D3)

You can store functions or operations in definable memories (D1 – D3).

- To store a function or operation, press [STO], followed by a definable memory key ([D1], [D2] or [D3]), followed by the operation you want to store. Menu-related operations, such as [2ndF] [SET UP], cannot be stored. Press [ON/C] to return to the previous display.
- To call a stored function or operation, press the corresponding memory key. Calling a stored function will not work if the function that is called would be unusable in the current context.
- Any functions or operations that are stored in a definable memory will be replaced when you save a new one into that memory.
- Functions cannot be saved in a definable memory from the simulation calculations and solver functions of NORMAL mode, or from the item and value input screens of other modes.

Memory List

Press [ALPHA] [MEMORY] to display a list of the values saved in memory. The values are shown in a 9-character range.

Applicable memories: A, B, C, D, E, F, X, Y, M.

- In COMPLEX mode, only M memory is displayed.

Chain Calculations 15

The previous calculation result can be used in the subsequent calculation. However, it cannot be recalled after entering multiple instructions.

Fraction Calculations 16

Arithmetic operations and memory calculations can be performed using fractions. In NORMAL mode, conversion between a decimal number and a fraction can be performed by pressing [CHANGE].

Notes:

- Improper/proper fractions will be converted to and displayed as decimal numbers if the number of digits used in their expression is greater than nine. In the case of mixed fractions, the maximum number of displayable digits (including integers) is eight.
- To convert a sexagesimal value to a fraction, first convert it by pressing [2ndF] [↔DEG].

Binary, Pental, Octal, Decimal, and Hexadecimal Operations (N-base) 17

Conversions can be performed between N-base numbers in NORMAL mode. The four basic arithmetic operations, calculations with parentheses, and memory calculations can also be performed, along with the logical operations AND, OR, NOT, NEG, XOR, and XNOR on binary, pental, octal, and hexadecimal numbers.

Note: The hexadecimal numbers A – F are entered by pressing [A] [y^x], [B] [$\sqrt{\ }$], [C] [x^2], [D] [log], [E] [ln] and [F] [(-),(,)].

In the binary, pental, octal, and hexadecimal systems, fractional parts cannot be entered. When a decimal number having a fractional part is converted into a binary, pental, octal, or hexadecimal number, the fractional part will be truncated. Likewise, when the result of a binary, pental, octal, or hexadecimal calculation includes a fractional part, the fractional part will be truncated. In the binary, pental, octal, and hexadecimal systems, negative numbers are displayed as a complement.

Time, Decimal, and Sexagesimal Calculations 18

You can convert between decimal and sexagesimal numbers, and from sexagesimal numbers to seconds or minutes. In addition, the four basic arithmetic operations and memory calculations can be performed using the sexagesimal system.

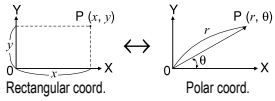
Notation for sexagesimal is as follows:

12°34'56.78"

degree — minute — second

Coordinate Conversions 19

- Before performing a calculation, select the angular unit.
- The results of coordinate conversions will be displayed as decimal numbers even in the WriteView editor.



Rectangular coord. ↔ Polar coord.

Physical Constants and Metric Conversions 20

Calculations using physical constants

To recall a constant, press [ALPHA] [CNST], then select a physical constant from the list.

- To scroll up or down the list of constants, press [▲] ([◀]) or [▼] ([▶]). Use [2ndF] [▲] ([◀]) or [2ndF] [▼] ([▶]) to jump to the first or last page.
- Enter the first digit of the 2-digit item number to jump to the page containing the number that begins with that digit.
- When you enter the second digit, the constant is displayed automatically according to the display and decimal placement settings.
- Physical constants can be recalled in NORMAL (excluding N-base), STAT, COMPLEX, MATRIX, VECTOR and EQUATION modes.

Note: Physical constants and metric conversions are based either on the 2014 CODATA recommended values or 2008 Edition of the "Guide for the Use of the International System of Units (SI)" released by NIST (National Institute of Standards and Technology) or on ISO specifications.

No.	Constant	No.	Constant
01	Speed of light in vacuum	28	Avogadro constant
02	Newtonian constant of gravitation	29	Molar volume of ideal gas (273.15 K, 101.325 kPa)
03	Standard acceleration of gravity		
04	Electron mass	30	Molar gas constant
05	Proton mass	31	Faraday constant
06	Neutron mass	32	Von Klitzing constant
07	Muon mass	33	Electron charge to mass quotient
08	Atomic mass unit-kilogram relationship	34	Quantum of circulation
		35	Proton gyromagnetic ratio
09	Elementary charge	36	Josephson constant
10	Planck constant	37	Electron volt
11	Boltzmann constant	38	Celsius Temperature
12	Magnetic constant	39	Astronomical unit
13	Electric constant	40	Parsec
14	Classical electron radius	41	Molar mass of carbon-12
15	Fine-structure constant	42	Planck constant over 2 pi
16	Bohr radius	43	Hartree energy
17	Rydberg constant	44	Conductance quantum
18	Magnetic flux quantum	45	Inverse fine-structure constant
19	Bohr magneton	46	Proton-electron mass ratio
20	Electron magnetic moment	47	Molar mass constant
21	Nuclear magneton	48	Neutron Compton wavelength
22	Proton magnetic moment	49	First radiation constant
23	Neutron magnetic moment	50	Second radiation constant
24	Muon magnetic moment	51	Characteristic impedance of vacuum
25	Compton wavelength	52	Standard atmosphere
26	Proton Compton wavelength		
27	Stefan-Boltzmann constant		

Metric conversions

Enter a value to be converted, then press [ALPHA] [CONV], and select a metric conversion by entering its 2-digit number.

- The metric conversion list is used in the same manner as the list of physical constants.
- Unit conversions can be performed in NORMAL (excluding N-base), STAT, MATRIX, VECTOR, and EQUATION modes.

No.	Remarks		No.	Remarks	
01	in	: inch	23	fl oz (US)	: fluid ounce(US)
02	cm	: centimeter	24	mL	: milliliter
03	ft	: foot	25	fl oz (UK)	: fluid ounce(UK)
04	m	: meter	26	mL	: milliliter
05	yd	: yard	27	J	: Joule
06	m	: meter	28	cal	: calorie
07	mile	: mile	29	J	: Joule
08	km	: kilometer	30	cal_{15}	: Calorie (15n°C)
09	n mile	: nautical mile	31	J	: Joule
10	m	: meter	32	cal_{IT}	: I.T. calorie
11	acre	: acre	33	hp	: horsepower
12	m^2	: square meter	34	W	: watt
13	oz	: ounce	35	ps	: French horsepower
14	g	: gram	36	W	: watt
15	lb	: pound	37	(kgf/cm^2)	
16	kg	: kilogram	38	Pa	: Pascal
17	°F	: Degree Fahrenheit	39	atm	: atmosphere
18	°C	: Degree Celsius	40	Pa	: Pascal
19	gal (US)	: gallon (US)	41	(1 mmHg = 1 Torr)	
20	L	: liter	42	Pa	: Pascal
21	gal (UK)	: gallon (UK)	43	(kgf·m)	
22	L	: liter	44	N·m	: Newtonmeter

Calculations Using Engineering Prefixes 21

Calculation can be executed in NORMAL mode (excluding N-base) using the following 9 types of prefixes.

Prefix	Operation	Unit	Prefix	Operation	Unit
k (kilo)	[MATH] [1] [0]	10^3	μ (micro)	[MATH] [1] [5]	10^{-6}
M (Mega)	[MATH] [1] [1]	10^6	n (nano)	[MATH] [1] [6]	10^{-9}
G (Giga)	[MATH] [1] [2]	10^9	p (pico)	[MATH] [1] [7]	10^{-12}
T (Tera)	[MATH] [1] [3]	10^{12}	f (femto)	[MATH] [1] [8]	10^{-15}
m (mili)	[MATH] [1] [4]	10^{-3}			

Modify Function 22

Decimal calculation results are internally obtained in scientific notation, with up to 14 digits in the mantissa. However, since calculation results are displayed in the form designated by the display notation and the number of decimal places indicated, the internal calculation result may differ from that shown in the display. By using the modify function ([2ndF] [MDF]) the internal value is converted to match that of the display, so that the displayed value can be used without change in subsequent operations.

- When using the WriteView editor, if the calculation result is displayed using fractions or irrational numbers, press [CHANGE] to convert it to decimal form first.
- The modify function can be used in NORMAL, STAT, MATRIX, or VECTOR modes.

Various functions

• Refer to the calculation examples for each function.

GCD (the Greatest Common Divisor)

What is the GCD of 24 and 36? [ON/C] 24 [2ndF] [GCD] 36 [=] 12.

LCM (the Least Common Multiple)

What is the LCM of 15 and 9? [ON/C] 15 [2ndF] [LCM] 9 [=] 45.

int÷

• "Q" indicates "Quotient", and "R" indicates "Remainder".
• Pressing [2ndF] [int÷] cannot be followed by pressing a key for another operation such as +, −, ×, ÷, otherwise an error will result.
• The quotient and remainder are shown in "NORM1" format. If not all digits can be displayed in "NORM1" format, normal division is performed.

ipart

Returns only the integer part of a decimal number.

fpart

Returns only the fraction part of a decimal number.

int

Returns the highest integer value that does not exceed the value specified.

(%)

When specified immediately after a value, the value is treated as a percentage.
Note: For calculation using [2ndF] [%], refer to the calculation examples (No. 9).
You can use [2ndF] [%] to perform premium, discount, and other calculations.

Prime Factorization

In NORMAL mode, the calculation result can be shown as a product of prime numbers.
• A positive integer greater than 2 and no more than 10 digits can be factored into primes.
• A number that cannot be factored into a prime number with 3 digits or shorter is shown in parentheses.
• The calculation result of prime factorization is displayed according to the editor setting (W-VIEW or LINE).
• The calculation result of prime factorization may extend off the edges of the screen. You can see those parts by pressing [◄] or [►]. To jump to the left end or right end, press [2ndF] [◄] or [2ndF] [►].

Simulation Calculation (ALGB)

If you have to find values consecutively using the same expression, such as plotting a curve line for $2x^2 + 1$, or finding the variable values for $2x + 2y = 14$, once you enter the expression, all you have to do is to specify the value for the variable in the equation.
Usable variables: A – F, M, X and Y
• Simulation calculations can only be executed in NORMAL mode.
• Calculation ending instructions other than [=] cannot be used.

Performing calculations

1. Press [MODE] [0].
2. Input an expression with at least one variable.
3. Press [2ndF] [ALGB].
4. The variable entry screen will appear. Enter a value, then press [ENTER] to confirm.

• After completing the calculation, press [2ndF] [ALGB] to perform calculations using the same equation.

Solver Function

The solver function finds the value for x that reduces the entered expression to zero.
• This function uses Newton's method to obtain an approximation. Depending on the function (e.g. periodic) or start value, an error may occur (ERROR 02) due to there being no convergence to the solution for the equation.
• The value obtained by this function may include a margin of error.
• Change the "Start" value (e.g. to a negative value) or dx value (e.g. to a smaller value) if:
  • no solution can be found (ERROR 02).
  • more than two solutions appear to be possible (e.g. a cubic equation).
  • to improve arithmetic precision.
• The calculation result is automatically stored in the X memory.
• Press [ON/C] to exit the solver function.

Performing solver function

1. Press [MODE] [0].
2. Input an expression with an x variable.
3. Press [2ndF] [SOLVER].
4. Enter a "Start" value and press [ENTER]. The default value is "0".
5. Enter a dx value (minute interval).
6. Press [ENTER].

STATISTICAL CALCULATIONS

Statistical calculations can be performed in STAT mode.
There are eight sub-modes within STAT mode. Press [MODE] [1], then press the number key that corresponds to your choice:

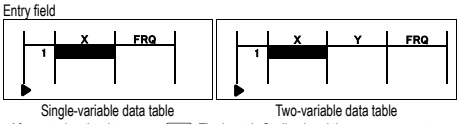
[0] (SD) : Single-variable statistics
[1] (a+bx) : Linear regression
[2] (a+bx+cx²) : Quadratic regression
[3] (a•e^bx) : Euler exponential regression
[4] (a+b•lnx) : Logarithmic regression
[5] (a•x^b) : Power regression
[6] (a+b/x) : Inverse regression
[7] (a•b^x) : General exponential regression

The statistical data input screen appears.
After entering statistical data from the input screen, press [DATA] or [ON/C] and close the input table. You can then check statistical values from the STAT menu ([ALPHA] [STAT]) and specify statistical variables.

Data Entry and Correction

Data entry

Entry field



Single-variable data table Two-variable data table

• After entering the data, press [ENTER]. The input is finalized and the cursor moves to the next line. If data was not entered in an x or y, 0 is entered, 1 is entered in FRQ (frequency), and the cursor moves to the next line.
• You can use [(x,y)] to enter X and FRQ (or X, Y, and FRQ) at once.
• In the input table, up to 6 digits are displayed for each value, including the sign and decimal point. Any values that exceed 6 digits in length are displayed in exponent notation.
• Up to 100 data items can be entered. With single-variable data, a data item with an assigned frequency of one is counted as one data item, while an item with an assigned frequency of 2 or higher is stored as a set of two data items. With two-variable data, a set of data items with an assigned frequency of one is counted as two data items, while a set of items with an assigned frequency of 2 or higher is stored as a set of three data items.
• To execute statistical calculation, press [DATA] or [ON/C] and close the input table.

Data correction

Use [◄], [►], [▲] or [▼] to move the cursor and select the desired data.
Press [2ndF] [▲] or [2ndF] [▼] to jump the cursor to the beginning or end of the data.

Data correction
Move the cursor to the data that you want to correct, enter the numeric value, and press [ENTER].

Data insertion
To insert a line in front of the cursor position, press [ALPHA] [INS-D]. The initial values entered in the inserted data are 0 in x and y, and 1 in FRQ.

Data deletion
To delete the entire line where cursor is positioned, press [2ndF] [DEL].

Notes:
• In STAT mode, all statistical data will be erased if the submode is changed or [2ndF] [CA] is pressed.
• In STAT mode, press [DATA] to display the input table.

Statistical Calculations and Variables

The following statistics can be obtained for each statistical calculation (refer to the table below):

Single-variable statistical calculation

Statistics of ①, ③ and the value of the normal probability function.

Linear regression calculation

Statistics of ①, ② and ④. In addition, the estimate of y for a given x (estimate y') and the estimate of x for a given y (estimate x').

Quadratic regression calculation

Statistics of ①, ② and ④. And coefficients a, b, c in the quadratic regression formula ($y = a + bx + cx^2$). (For quadratic regression calculations, no correlation coefficient (r) can be obtained.) When there are two x' values, each value will be displayed with "1:" or "2:", and stored separately in the X and Y memories.
You can also specify the 1st value ($x1'$) and the 2nd value ($x2'$) separately.

Euler exponential regression, logarithmic regression, power regression, inverse regression, and general exponential regression calculations

Statistics of ①, ② and ④. In addition, the estimate of y for a given x and the estimate of x for a given y. (Since the calculator converts each formula into a linear regression formula before actual calculation takes place, it obtains all statistics, except coefficients a and b, from converted data rather than entered data.)

①	n	Number of samples
	$\overline{x}$	Mean of samples (x data)
	sx	Sample standard deviation (x data)
	s^2x	Sample variance (x data)
	σx	Population standard deviation (x data)
	σ^2x	Population variance (x data)
	Σx	Sum of samples (x data)
	Σx^2	Sum of squares of samples (x data)
	$xmin$	Minimum value of samples (x data)
	$xmax$	Maximum value of samples (x data)
②	$\overline{y}$	Mean of samples (y data)
	sy	Sample standard deviation (y data)
	s^2y	Sample variance (y data)
	σy	Population standard deviation (y data)
	σ^2y	Population variance (y data)
	Σy	Sum of samples (y data)
	Σy^2	Sum of squares of samples (y data)
	Σxy	Sum of products of samples (x, y)
	Σx^2y	Sum of products of samples (x^2, y)
	Σx^3	Sum of 3rd powers of samples (x data)
	Σx^4	Sum of 4th powers of samples (x data)
	$ymin$	Minimum value of samples (y data)
	$ymax$	Maximum value of samples (y data)
③	Q_1	First quartile of sample (x data)
	Med	Median of sample (x data)
	Q_3	Third quartile of sample (x data)
④	r	Correlation coefficient (Except Quadratic regression)
	a	Coefficient of regression equation
	b	Coefficient of regression equation
	c	Coefficient of quadratic regression equation
	R^2	Coefficient of determination (Quadratic regression)
	r^2	Coefficient of determination (Except Quadratic regression)

STAT Menu

After closing the input table, you can view statistical values, view regression coefficient values, and specify statistical variables from the STAT menu ([ALPHA] [STAT]).
[ALPHA] [STAT] [0]: Display statistical values
[ALPHA] [STAT] [1]: Display regression coefficient values
[ALPHA] [STAT] [2]: Specify statistical value variables
[ALPHA] [STAT] [3]: Specify statistical value (Σ related) variables
[ALPHA] [STAT] [4]: Specify max/min value variables
[ALPHA] [STAT] [5]: Specify regression coefficient variables

Notes:
• List display of regression coefficient values and specification of regression coefficient variables do not appear in single-variable statistical calculation.
• Estimated values x' and y' are specified with the keys ([2ndF] [x'], [2ndF] [y']). If there are two x' values, you can specify $x1'$ and $x2'$ from the STAT menu ([ALPHA] [STAT] [5]) to obtain the values separately.
• In the statistical value and regression coefficient value lists, you cannot return to the menu by pressing [BS].

Statistical Calculation Formulas

In the statistical calculation formulas, an error will occur when:
• The absolute value of the intermediate result or calculation result is equal to or greater than 1×10^{100}.
• The denominator is zero.
• An attempt is made to take the square root of a negative number.
• No solution exists in the quadratic regression calculation.

Normal Probability Calculations

In STAT mode, the three probability density functions can be accessed under the MATH menu, with a random number used as a normal distribution variable.
Notes:
• P(t), Q(t) and R(t) will always take positive values, even when $t < 0$, because these functions follow the same principle used when solving for an area.
• Values for P(t), Q(t) and R(t) are given to six decimal places.
• The standardization conversion formula is as follows:

$$t = \frac{x - \overline{x}}{\sigma x}$$

TABLE MODE

You can see the changes in values of one or two functions using TABLE mode.

Setting a table

1. Press [MODE] [2] to enter TABLE mode.
2. Enter a function (Function1), and press [ENTER].
3. If needed, enter the 2nd function (Function2) and press [ENTER].
4. Enter a starting value (X_Start:), and press [ENTER].
   The default starting value is 0.
5. Enter a step value (X_Step:). The default step value is 1.
   • You can use [▲] and [▼] to move the cursor between the starting value and step value.
6. Press [ENTER] when you finish entering a step value. A table with a variable X and the corresponding values (ANS column) appears, displaying 3 lines below the starting value.
   If you entered two functions, the ANS1 and ANS2 columns appear. You can use [▲] and [▼] to change the X value and see its corresponding values in table format.

• The table is for display only and you cannot edit the table.
• The values are displayed up to 7 digits, including signs and a decimal point.
• Press [◄] or [►] to move the cursor to ANS column (ANS1 and ANS2 columns if you entered two functions) or X column.
• Full digits of the value on the cursor are displayed on the bottom right.

Notes:
• In a function, only "X" can be used as a variable, and other variables are all regarded as numbers (stored into the variables).
• Irrational numbers such as $\sqrt{}$ and π can also be entered into a starting value or a step value. You cannot enter 0 or a negative number as a step value.
• You can use WriteView editor when inputting a function.
• The following features are not used in TABLE mode: coordinate conversions, conversion between decimal and sexagesimal numbers, and angular unit conversions.
• It may take time to make a table, or "-------" may be displayed, depending on the function entered or conditions specified for the variable X.
• Please note that when making a table, the values for variable X are rewritten.
• Press [2ndF] [CA] mode selection to return to the initial screen of the mode, and return to the default values for the starting value and step value.

COMPLEX NUMBER CALCULATIONS

To carry out addition, subtraction, multiplication, and division using complex numbers, press [MODE] [3] to select the complex number mode.
Results of complex number calculations are expressed in two modes:
① [2ndF] [→xy]: Rectangular coordinate mode (xy appears)
② [2ndF] [→rθ]: Polar coordinate mode ($r\theta$ appears)

Complex number entry

① Rectangular coordinates
x-coordinate [+] *y-coordinate* [i]
or *x-coordinate* [+] [i] *y-coordinate*
② Polar coordinates
r [∠] θ
r: absolute value θ: argument

• On selecting another mode, the imaginary part of any complex number stored in the independent memory (M) and the last answer memory (ANS) will be cleared.
• A complex number expressed in rectangular coordinates with the y-value equal to zero, or expressed in polar coordinates with the angle equal to zero, is treated as a real number.
• From the MATH menu, you can obtain the complex conjugate (conj( ), the argument of a complex number (arg( ), the real part of a complex number (real( ), and the imaginary part of a complex number (img( ).

EQUATION SOLVERS

The results obtained by these functions may include a margin of error.

Simultaneous Linear Equations

Simultaneous linear equations with two unknowns (2-VLE) or with three unknowns (3-VLE) may be solved using the following functions.
① 2-VLE: [MODE] [4] [0]

$$\begin{cases} a_1x + b_1y = c_1 \\ a_2x + b_2y = c_2 \end{cases} \qquad |D| = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}$$

② 3-VLE: [MODE] [4] [1]

$$\begin{cases} a_1x + b_1y + c_1z = d_1 \\ a_2x + b_2y + c_2z = d_2 \\ a_3x + b_3y + c_3z = d_3 \end{cases} \qquad |D| = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$

• If the determinant D = 0, an error occurs.
• If the absolute value of an intermediate result or calculation result is 1×10^{100} or more, an error occurs.

Solving simultaneous linear equations

1. Press [MODE] [4] [0] or [MODE] [4] [1].
2. Enter the value for each coefficient (a_1, etc.).
   • Coefficients can be entered using ordinary arithmetic operations.
   • To clear the entered coefficient, press [ON/C].
   • Press [▲] or [▼] to move the cursor up or down through the coefficients. Press [2ndF] [▲] or [2ndF] [▼] to jump to the first or last coefficient.
3. When all coefficients have been entered, press [ENTER] to solve the equation.
   • While the solution is displayed, press [ENTER] or [ON/C] to return to the coefficient entry display. To clear all the coefficients, press [2ndF] [CA].

Quadratic and Cubic Equations

Quadratic ($ax^2 + bx + c = 0$) or cubic ($ax^3 + bx^2 + cx + d = 0$) equations may be solved using the following functions:
① Quadratic equation solver: [MODE] [4] [2]
② Cubic equation solver: [MODE] [4] [3]

• If there are two or more solutions, those solutions are also shown.
• If calculable, you can also obtain the minimum value (when $a > 0$) and the maximum value (when $a < 0$) of a quadratic function ($y = ax^2 + bx + c$).

Solving quadratic and cubic equations

• Press [MODE] [4] [2] or [MODE] [4] [3].
• Coefficients for these equations can be entered in the same manner as those for simultaneous linear equations.

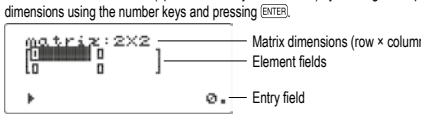
• When using the QUADRATIC equation solver, continue by pressing [ENTER] (or [▼]) to display the minimum value or maximum value. To return to the solution, press [▲] with the minimum value or maximum value displayed.
• To return to the coefficient entry screen when the solution (or minimum/maximum value) is displayed, press [ENTER] or [ON/C].
• To clear all the coefficients, press [2ndF] [CA].

MATRIX CALCULATIONS (34)

You can store and calculate up to four matrices.

Entering and Storing Matrices

1. Press [MODE] [5] to enter MATRIX mode.
2. Press [MATH] [1] to bring up the matrix entry screen.
   • Any matrix data remaining in the buffer, along with any previously entered, loaded, or calculated matrix data, will be displayed.
3. Define the matrix dimensions (up to four rows by four columns) by entering the required dimensions using the number keys and pressing [ENTER].



Matrix entry screen (example)

4. Enter each element in the matrix by entering a value in the entry field and pressing [ENTER].
   • Each matrix element can display up to seven digits (the decimal point counts as one digit). If an element exceeds seven digits in length, it may be displayed in exponent notation within the matrix.
   • A maximum of three rows by three columns can be displayed at one time. Use [▲], [▼], [◄] and [►] to move the cursor through the matrix.
5. When you have entered a value for each element, press [ON/C] to exit the matrix entry screen.
6. Press [MATH] [3] and select a memory (matA–matD) to store the newly-created matrix in.

Modifying a stored matrix

1. To load a stored matrix into the matrix entry screen, press [MATH] [2], then select the memory (matA–matD) that you wish to modify.
   • Loading new data into the screen will automatically replace any data that may already exist there.
2. Modify the values of elements in the matrix, and press [ENTER] after each one.
   • If you wish to modify the number of rows or columns, first press [ON/C] [MATH] [1]. You can then enter new values for the matrix dimensions.
3. When you have finished making changes, press [ON/C] to exit the matrix entry screen.
4. Press [MATH] [3] and select a memory (matA–matD) to store the newly-created matrix in.

Using Matrices in Calculations

Matrices stored in memories (matA–matD) can be used in arithmetic calculations (with the exception of division between matrices) and calculations that use x^3, x^2 and x^{-1}. You can also use the following matrix-specific functions that are available in the MATH menu.

det *matrix name*	Returns the determinant of a square matrix.
trans *matrix name*	Returns the matrix with the columns transposed to rows and the rows transposed to columns.
identity *value*	Returns the identity matrix with specified value of rows and columns.
dim (*matrix name*, *row*, *column*)	Returns a matrix with dimensions changed as specified.
fill (*value*, *row*, *column*)	Fills each element with a specified value.
rand_mat (*row*, *column*)	Returns a random matrix with specified values of rows and columns.
ref(*matrix name*)	Transform to row echelon form.
rref(*matrix name*)	Transform to reduced row echelon form.

Notes:
• When the matrix entry screen is displayed, you cannot perform matrix calculations because the MATH menu is not available.
• If the calculation result is a matrix, it will be displayed in the matrix entry screen (note that this replaces any existing data in the buffer).
To store the calculation result, first press [ON/C] to exit the matrix entry screen. Press [MATH] [3] and select a memory (matA–matD) to store the newly-created matrix in.
• When the calculation results are in matrix form, pressing neither [◄] or [►] will bring you back to the original expression.

VECTOR CALCULATIONS (35)

You can store and calculate up to four vectors of two or three dimension in VECTOR mode.

Entering and Storing Vectors

Before performing vector calculations, a vector must be created. Follow the steps below to enter and store vectors.

1. Press [MODE] [6] to enter VECTOR mode.
2. Press [MATH] [1] to bring up the vector entry screen.
   • Any vector data remaining in the buffer, along with any previously entered, loaded, or calculated vector data, will be displayed.
3. Define the vector dimensions (2 dimensions or 3 dimensions) by using the number keys and pressing [ENTER].
4. Enter each element in the vector by entering a value in the entry field and pressing [ENTER].
   • Each vector element can display up to seven digits (the decimal point counts as one digit). If an element exceeds seven digits in length, it may be displayed in exponent notation within the vector.
5. When you have finished entering a value for each element, press [ON/C] to exit the vector entry screen.
6. Press [MATH] [3] and select a memory (vectA–vectD) to store the newly-created vector in.

Modifying a stored vector

1. To load a stored vector into the vector entry screen, press [MATH] [2], then select the memory (vectA–vectD) that you wish to modify.
   • Loading new data into the screen will automatically replace any data that may already exist in the vector entry screen.
2. Modify the values of elements in the vector, and press [ENTER] after each one.
   • If you wish to modify the number of dimensions, first press [ON/C] [MATH] [1]. You can then enter new values for the vector dimensions.
3. When you have finished making changes, press [ON/C] to exit the vector entry screen.
4. Press [MATH] [3] and select a memory (vectA–vectD) to store the newly-created vector in.

Using Vectors in Calculations

Vectors stored in memories (vectA–vectD) can be used in arithmetic calculations (with the exception of division between vectors). You can also use the following vector-specific functions that are available in the MATH menu.

DotPro(*vector name*, *vector name*)	Returns the dot product.
CrossPro(*vector name*, *vector name*)	Returns the cross product.
Angl(*vector name*, *vector name*)	Returns the angle.
Unit(*vector name*)	Returns the unit vector.

Notes:
• You can use "abs" function (abs vector name) for the absolute value.
• When multiplying vectors, the cross product is calculated.
• When the vector entry screen is displayed, press j and then you perform vector calculations.
• If the calculation result is a vector, it will be displayed in the vector entry screen. To store the calculation result, first press [ON/C] to exit the vector entry screen. Press [MATH] [3] and select a memory (vectA–vectD) to store the newly-created vector in.
• When the calculation results are in vector form, pressing neither [◄] or [►] will bring you back to the original expression.

DISTRIBUTION FUNCTIONS

The calculator has distribution features to find statistical calculations. Press [MODE] [7], and select the type (NORMAL, BINOMINAL, POISSON), and then select the desired distribution function.
Note: Calculation results are stored in ANS memory.

Normal Distribution

Normal pdf

Calculates the probability density of the specified value x for the normal distribution with the specified mean (μ) and standard deviation (σ).

Normal cdf

Calculates the probability of a specified intervals $x1 – x2$ for the normal distribution with the specified mean (μ) and standard deviation (σ).

Inverse Normal

Calculates the inverse cumulative normal distribution function for a given area (a) under the normal distribution curve specified by mean (μ) and standard deviation (σ).

Binomial Distribution

Binomial pdf

Calculates a probability density at x for the discrete binomial distribution with the specified trial number (n) and probability of success (p) on each trial.

Binomial cdf

Calculates a cumulative probability at x for the discrete binomial distribution with the specified trial number (n) and probability of success (p) on each trial.

Poisson Distribution

Poisson pdf

Calculates a probability at x for the Poisson distribution with the specified mean (μ).

Poisson cdf

Calculates a cumulative probability at x for the Poisson distribution with the specified mean (μ).

Find the nominal distribution probability density for x = 65 when the normal distribution of the test score averages is 60 with a standard deviation of 6.	[MODE] [7] [0] [0] 65 [ENTER] 60 [ENTER] 6 [ENTER]	Normal pdf x : 65. μ : 60. σ : 6 ANS = 0.046985312
Calculate the probability of range x = 54 to 66 in the above sample.	[MODE] [7] [0] [1] 54 [ENTER] 66 [ENTER] 60 [ENTER] 6 [ENTER]	Normal cdf $x1$: 54. $x2$: 66. μ : 60. σ : 6 ANS = 0.68268949
Find the value of x for the probability of 0.8 in the above sample.	[MODE] [7] [0] [2] 0.8 [ENTER] 60 [ENTER] 6 [ENTER]	Inverse Normal a : 0.8 μ : 60. σ : 6 ANS = 65.0497274
Find the probability density for 15 trials with x = 7, for the binomial distribution with success probability of 30%.	[MODE] [7] [1] [0] 7 [ENTER] 15 [ENTER] 0.3 [ENTER]	Binomial pdf x : 7. n : 15. p : 0.3 ANS = 0.081130033
Calculate the probability of range up to x = 7 (success number) in the above sample.	[MODE] [7] [1] [1] 7 [ENTER] 15 [ENTER] 0.3 [ENTER]	Binomial cdf x : 7. n : 15. p : 0.3 ANS = 0.949987459
Find the probability density of x = 4, for the mean of a Poisson distribution of 3.6.	[MODE] [7] [2] [0] 4 [ENTER] 3.6 [ENTER]	Poisson pdf x : 4. μ : 3.6 ANS = 0.191222339
Find the probability within the range up to x = 4.	[MODE] [7] [2] [1] 4 [ENTER] 3.6 [ENTER]	Poisson cdf x : 4. μ : 3.6 ANS = 0.706438449

DRILL MODE

Math Drill: [MODE] [8] [0]
Math operation questions with positive integers and 0 are displayed randomly.
It is possible to select the number of questions and operator type.

Multiplication Table (× Table): [MODE] [8] [1]
Questions from each row of the multiplication table (1 to 12) are displayed serially or randomly.

To exit DRILL mode, press [MODE] and select another mode.

Using Math Drill and × Table

1. Press [MODE] [8] [0] for Math Drill or [MODE] [8] [1] for × Table.
2. **Math Drill**: Use [▲] and [▼] to select the number of questions (25, 50, or 100).
   × Table: Use [▲] and [▼] to select a row in the multiplication table (1 to 12).
3. **Math Drill**: Use [◄] and [►] to select the operator type for questions (+, –, ×, ÷ or +–×÷).
   × Table: Use [◄] and [►] to select the order type ("Serial" or "Random").
4. Press [ENTER] to start.
   When using Math Drill or × Table (random order only), questions are randomly selected and will not repeat except by chance.
5. Enter your answer. If you make a mistake, press [ON/C] or [BS] to clear any entered numbers, and enter your answer again.
6. Press [ENTER].
   • If the answer is correct, "✓" appears and the next question is displayed.
   • If the answer is wrong, "✗" appears and the same question is displayed. This will be counted as an incorrect answer.
   • If you press [ENTER] without entering an answer, the correct answer is displayed and then the next question is displayed. This will be counted as an incorrect answer.
7. Continue answering the series of questions by entering the answer and pressing [ENTER].
8. After you finish, press [ENTER] and the number and percentage of correct answers are displayed.
9. Press [ENTER] to return to the initial screen for your current drill.

Ranges of Math Drill Questions

The range of questions for each operator type is as follows:
+ **Addition operator**: "0 + 0" to "20 + 20"
– **Subtraction operator**: "0 – 0" to "20 – 20"; answers are positive integers and 0
× **Multiplication operator**: "1 × 0" or "0 × 1" to "12 × 12"
÷ **Division operator**: "0 ÷ 1" to "144 ÷ 12"; answers are positive integers from 1 to 12 and 0, dividends of up to 144, and divisors of up to 12
+–×÷ **Mixed operators**: Questions within all the above ranges are displayed

ERROR AND CALCULATION RANGES

Errors

An error will occur if an operation exceeds the calculation ranges, or if a mathematically illegal operation is attempted. When an error occurs, pressing [◄] (or [►]) automatically moves the cursor back to the place in the equation where the error occurred. Edit the equation or press [ON/C] to clear the equation.

Error Codes and Error Types

ERROR 01: Syntax error
• An attempt was made to perform an invalid operation.
Example: 2 [+] [–] 5 [=]

ERROR 02: Calculation error
• The absolute value of an intermediate or final calculation result equals or exceeds 10^{100}.
• An attempt was made to divide by zero (or an intermediate calculation resulted in zero).
• The calculation ranges were exceeded while performing calculations.
• 0 or a negative number was entered as a step value in TABLE mode. The absolute value of a starting value or a step value equals or exceeds 10^{100} in TABLE mode.
• When the number to be factored into primes is greater than 2 and other than a 10-digit positive integer, or when the result of prime factorization is a negative number, decimal, fraction, $\sqrt{}$ or π.

ERROR 03: Nesting error
• The available number of buffers was exceeded. (There are 10 buffers* for numeric values and 64 buffers for calculation instructions.)
* 5 buffers in COMPLEX mode, and 1 buffer for matrix/vector data

ERROR 04: Data over error
• Data items exceeded 100 in STAT mode.

ERROR 07: Definition error
• Matrix definition error or the attempted entering of an invalid value.

ERROR 08: DIM unmatched error
• Matrix/vector dimensions inconsistent while calculating.

ERROR 10: Undefined error
• Undefined matrix/vector used in calculation.

Alert Messages

Cannot delete!
• The selected item cannot be deleted by pressing [BS] or [2ndF] [DEL] in the WriteView editor.
Example: [√‾] 5 [►] [x²] [◄] [BS]
In this example, delete the exponent before attempting to delete the parentheses.

Cannot call!
• The function or operation stored in definable memory (D1 – D3) cannot be called.
Ex. An attempt was made to recall a statistical variable from within NORMAL mode.

Buffer full!
• The equation (including any calculation ending instructions) exceeded its maximum input buffer (159 characters in the WriteView editor or 161 characters in the Line editor). An equation may not exceed its maximum input buffer.

Calculation Ranges (36)

• Within the ranges specified, this calculator is accurate to ±1 of the least significant digit of the mantissa. However, a calculation error increases in continuous calculations due to accumulation of each calculation error. (This is the same for y^x, $\sqrt[x]{}$, $n!$, e^x, ln, Matrix/Vector calculations, Π, etc., where continuous calculations are performed internally.)
Additionally, a calculation error will accumulate and become larger in the vicinity of inflection points and singular points of functions.
• Calculation ranges:
$\pm 10^{-99} \sim \pm 9.999999999 \times 10^{99}$ and 0.
If the absolute value of an entry or a final or intermediate result of a calculation is less than 10^{-99}, the value is considered to be 0 in calculations and in the display.

Display of results using √ (when EXACT is selected)

Calculation results may be displayed using $\sqrt{}$ when all of the following conditions are met:
• When intermediate and final calculation results are displayed in the following form:
$\pm \frac{a\sqrt{b}}{e} \pm \frac{c\sqrt{d}}{f}$
• When each coefficient falls into the following ranges:
$1 \le a < 100$; $1 < b < 1.000$; $0 \le c < 100$;
$1 \le d < 1.000$; $1 \le e < 100$; $1 \le f < 100$
• When the number of terms in the intermediate and final calculation results is one or two.
Note: The result of two fractional terms that include $\sqrt{}$ will be reduced to a common denominator.

BATTERY REPLACEMENT

Notes on Battery Replacement

Improper handling of batteries can cause electrolyte leakage or explosion. Be sure to observe the following handling rules:
• Make sure the new battery is the correct type.
• When installing, orient the battery properly as indicated in the calculator.
• The battery is factory-installed before shipment, and may be exhausted before it reaches the service life stated in the specifications.

Notes on erasure of memory contents
When the battery is replaced, the memory contents are erased. Erasure can also occur if the calculator is defective or when it is repaired. Make a note of all important memory contents in case accidental erasure occurs.

When to Replace the Battery

If the display has poor contrast or nothing appears on the display even when [ON/C] is pressed in dim lighting, it is time to replace the batteries.

Cautions

- An exhausted battery left in the calculator may leak and damage the calculator.
- Fluid from a leaking battery accidentally entering an eye could result in serious injury. Should this occur, wash with clean water and immediately consult a doctor.
- Should fluid from a leaking battery come in contact with your skin or clothes, immediately wash with clean water.
- If the product is not to be used for some time, to avoid damage to the unit from leaking batteries, remove them and store in a safe place.
- Do not leave exhausted batteries inside the product.
- Keep batteries out of the reach of children.
- Explosion risk may be caused by incorrect handling.
- Do not throw batteries into a fire as they may explode.

Replacement Procedure

1. Turn the power off by pressing [2ndF] [OFF].
2. Remove the screws. (Fig. 1)
3. Lift the battery cover to remove.
4. Remove the used battery by prying it out with a ball-point pen or other similar pointed device. (Fig. 2)
5. Install new battery. Make sure the "+" side is facing up.
6. Replace the cover and screws.
7. Press the RESET switch with the tip of a ball-point pen or similar object.
8. Adjust the display contrast. See "Adjusting the display contrast". And then press [ON/C].

- Make sure that the display appears as shown below. If the display does not appear as shown, remove the battery, reinstall it, and check the display once again.

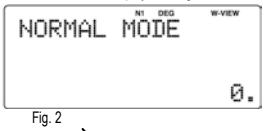


Fig. 1

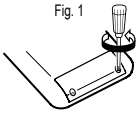
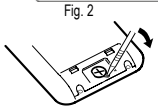


Fig. 2



Automatic Power Off Function

This calculator will turn itself off to save battery power if no key is pressed for approximately 10 minutes.

SPECIFICATIONS

Display:	96 × 32 dot matrix liquid crystal display
Display of calculation results:	
	Mantissa: 10 digits
	Exponent: 2 digits
Internal calculations:	Mantissas of up to 14 digits
Pending operations:	64 calculations, 10 numeric values (5 numeric values in COMPLEX mode, and 1 numeric value for Matrix/Vector data)
Power source:	Built-in solar cells
	1,5V ⎓ (DC): Alkaline batterie (LR44 or equivalent) × 1
Operating time:	Approx. 3,000 hours when continuously displaying 55555 at 25°C (77°F) (varies according to use and other factors)
Operating temperature:	
	0°C – 40°C (32°F – 104°F)
Dimensions:	80 mm × 166 mm × 15 mm
Weight:	Approx. 108 g (with batteries)
Accessories:	Battery × 1 (installed), operation manual and hard case

FOR MORE INFORMATION ABOUT SHARP CALCULATORS VISIT:

http://www.sharp-calculators.com

CALCULATION EXAMPLES

1 [SET UP] (FSE)

100000 ÷ 3 =

[NORM1]	[ON/C] 100000 [÷] 3 [=] [CHANGE] [CHANGE]	33'333.33333
→ [FIX: TAB 2]	[2ndF] [SET UP] [1] [0] 2	33'333.33
→ [SCI: SIG 2]	[2ndF] [SET UP] [1] [1] 2	3.3E04
→ [ENG: TAB 2]	[2ndF] [SET UP] [1] [2] 2	33.33E03
→ [NORM1]	[2ndF] [SET UP] [1] [3]	33'333.33333

2 [SET UP] (EDITOR)

→ [APPROX.]	[ON/C] [2ndF] [SET UP] [2] [0] [1]	0.
1 ÷ 2 =	1 [÷] 2 [=]	0.5
→ [EXACT(a/b,√,π)]	[ON/C] [2ndF] [SET UP] [2] [0] [0]	0.
1 ÷ 2 =	1 [÷] 2 [=]	$\frac{1}{2}$

3 [SET UP] (RECURRING DECIMAL)

→ [ON]	[ON/C] [2ndF] [SET UP] [5] [1]	0.
611 ÷ 495 =	611 [÷] 495 [=]	$1\frac{116}{495}$
	[CHANGE]	$\frac{611}{495}$
	[CHANGE]	$1.2\overline{34}$
	[CHANGE]	1.234343434
	[CHANGE]	$1\frac{116}{495}$
LINE	611 [÷] 495 [=]	1.2(34)
	[CHANGE]	1.234343434
	[CHANGE]	1r116r495
	[CHANGE]	611r495
	[CHANGE]	1.2(34)
→ [OFF]	[ON/C] [2ndF] [SET UP] [5] [0]	0.

4 [CHANGE]

$\frac{2}{5}+\frac{3}{4}=$	[ON/C] 2 [a/b] 5 [▶] [+] [a/b] 3 [▶] 4 [=]	$1\frac{3}{20}$
	[CHANGE]	$\frac{23}{20}$
	[CHANGE]	1.15
	[CHANGE]	$1\frac{3}{20}$
$\sqrt{3}\times\sqrt{5}=$	[√] 3 [▶] [×] [√] 5 [=]	$\sqrt{15}$
	[CHANGE]	3.872983346
sin 45 =	[sin] 45 [=]	$\frac{\sqrt{2}}{2}$
	[CHANGE]	0.707106781

5 [▲] [▼]

	[2ndF] [CA]	0.
① 3(5 + 2) =	3 [(] 5 [+] 2 [)] [=]	21.
② 3 × 5 + 2 =	3 [×] 5 [+] 2 [=]	17.
③ (5 + 3) × 2 =	[(] 5 [+] 3 [)] [×] 2 [=]	16.
→ ①	[2ndF] [▲]	21.
→ ②	[▼]	17.
→ ①	[▲]	21.
→ ③	[2ndF] [▼]	16.

6 [+] [−] [×] [÷] [(] [)] [(−)] [Exp]

45 + 285 ÷ 3 =	[ON/C] 45 [+] 285 [÷] 3 [=]	140.
(18 + 6) ÷ (15 − 8) =	[(] 18 [+] 6 [)] [÷] [(] 15 [−] 8 [=]	$3\frac{3}{7}$
42 × −5 + 120 =	42 [×] [(−)] 5 [+] 120 [=]	-90.
$(5\times10^3)\div(4\times10^{-3})=$	5 [Exp] 3 [÷] 4 [Exp] [(−)] 3 [=]	1'250'000.

7

34 + 57 =	34 [+] 57 [=]	91.
45 + 57 =	45 [=]	102.
68 × 25 =	68 [×] 25 [=]	1'700.
68 × 40 =	40 [=]	2'720.

8 [<ENG] [ENG>]

6789=	6789 [=]	6'789.
	[ALPHA] [ENG>]	6.789E03
	[ALPHA] [ENG>]	0.006789E06
	[ALPHA] [<ENG] [ALPHA] [<ENG]	6798.E00
	[ALPHA] [<ENG]	6789000.E-03

9 [sin] [cos] [tan] [sin⁻¹] [cos⁻¹] [tan⁻¹] [π] [hyp] [arc hyp] [ln] [log] [log$_a$x] [e^x] [e] [10^x] [x^{-1}] [x^2] [x^3] [√] [y^x] [$\sqrt[x]{}$] [$\sqrt[3]{}$] [n!] [$_nP_r$] [$_nC_r$] [%] [abs]

sin 60 [°] =	[ON/C] [2ndF] [SET UP] [0] [0] [sin] 60 [=]	$\frac{\sqrt{3}}{2}$
	[CHANGE]	0.866025403
$\cos\frac{\pi}{4}$ [rad] =	[2ndF] [SET UP] [0] [1] [cos] [π] [a/b] 4 [=]	$\frac{\sqrt{2}}{2}$
	[CHANGE]	0.707106781
$\tan^{-1}1$ [g] =	[2ndF] [SET UP] [0] [2] [2ndF] [tan⁻¹] 1 [=] [2ndF] [SET UP] [0] [0]	50.
$(\cosh1.5+\sinh1.5)^2=$	[ON/C] [(] [hyp] [cos] 1.5 [+] [hyp] [sin] 1.5 [)] [x^2] [=]	20.08553692
$\tanh^{-1}\frac{5}{7}=$	[2ndF] [arc hyp] [tan] [(] 5 [÷] 7 [)] [=]	0.895879734
ln 20 =	[ln] 20 [=]	2.995732274
log 50 =	[log] 50 [=]	1.698970004
$\log_2 16384=$	[2ndF] [log$_a$x] 2 [▶] 16384 [=]	14.
LINE	[2ndF] [log$_a$x] 2 [(x,y)] 16384 [)] [=]	14.
$e^3=$	[2ndF] [e^x] 3 [=]	20.08553692
1 ÷ e =	1 [÷] [ALPHA] [e] [=]	0.367879441
$10^{1.7}=$	[2ndF] [10^x] 1.7 [=]	50.11872336
$\frac{1}{6}+\frac{1}{7}=$	6 [2ndF] [x^{-1}] [+] 7 [2ndF] [x^{-1}] [=]	$\frac{13}{42}$
	[CHANGE]	0.309523809
$8^{-2}-3^4\times5^2=$	8 [y^x] [(−)] 2 [▶] [−] 3 [y^x] 4 [▶] [×] 5 [x^2] [=]	$-2024\frac{63}{64}$
	[CHANGE]	$-\frac{129599}{64}$
	[CHANGE]	-2'024.984375
LINE	8 [y^x] [(−)] 2 [−] 3 [y^x] 4 [×] 5 [x^2] [=]	-2'024.984375
	[CHANGE]	-2024r63r64
	[CHANGE]	-129599r64
$8^3=$	8 [2ndF] [x^3] [=]	512.
$\sqrt{49}-\sqrt[4]{81}=$	[√] 49 [▶] [−] 4 [2ndF] [$\sqrt[x]{}$] 81 [=]	4.
LINE	[√] 49 [−] 4 [2ndF] [$\sqrt[x]{}$] 81 [=]	4.
$\sqrt[3]{27}=$	[2ndF] [$\sqrt[3]{}$] 27 [=]	3.
4! =	4 [2ndF] [n!] [=]	24.
$_{10}P_3=$	10 [2ndF] [$_nP_r$] 3 [=]	720.
$_5C_2=$	5 [2ndF] [$_nC_r$] 2 [=]	10.
500 × 25% =	500 [×] 25 [2ndF] [%]	125.
120 ÷ 400 = ?%	120 [÷] 400 [2ndF] [%]	30.

$500 + (500 \times 25\%) =$	500 + 25 2ndF %	625.
$400 - (400 \times 30\%) =$	400 − 30 2ndF %	280.
$\lvert 5 - 9 \rvert =$	2ndF abs 5 − 9 =	4.

	$\theta = \sin^{-1}x,\ \theta = \tan^{-1}x$	$\theta = \cos^{-1}x$
DEG	$-90 \le \theta \le 90$	$0 \le \theta \le 180$
RAD	$-\frac{\pi}{2} \le \theta \le \frac{\pi}{2}$	$0 \le \theta \le \pi$
GRAD	$-100 \le \theta \le 100$	$0 \le \theta \le 200$

10 ∫dx d/dx

$\int_2^8 (x^2 - 5)dx$	ON/C ALPHA ∫dx 2 ▲ 8 ▶ ALPHA X x^2 − 5	
$n = 100$	=	138.
$n = 10$	◀ ◀ (x,y) 10 =	138.
$\frac{d(x^4 - 0.5x^3 + 6x^2)}{dx}$	ALPHA d/dx ALPHA X y^x 4 ▶ − 0.5 ALPHA X 2ndF x^3 + 6 ALPHA X x^2	
$\begin{cases} x = 2 \\ dx = 0.00002 \end{cases}$	▶ 2 =	50.

11 Σ

$\sum_{x=1}^{6} (x + 2)$	ON/C ALPHA Σ 1 ▶ 5 ▶ ALPHA X + 2	
$n = 1$	=	25.
$n = 2$	◀ ◀ (x,y) 2 =	15.

12 Π

$\prod_{x=1}^{5} (x + 2)$	ON/C ALPHA Π 1 ▶ 5 ▶ ALPHA X + 2	
$n = 1$	=	2'520.
$n = 2$	◀ ◀ (x,y) 2 =	105.

13 DRG▶

90° → [rad]	ON/C 90 2ndF DRG▶	$\frac{1}{2}\pi$
→ [g]	2ndF DRG▶	100.
→ [°]	2ndF DRG▶	90.

14 ALPHA RCL STO M+ M− ANS D1 D2 D3

$8 \times 2 \Rightarrow M$	ON/C 8 × 2 STO M	16.
$24 \div (8 \times 2) =$	24 ÷ ALPHA M =	$1\frac{1}{2}$
$(8 \times 2) \times 5 =$	ALPHA M × 5 =	80.
$0 \Rightarrow M$	ON/C STO M	0.
\$150 × 3 ⇒ M1	150 × 3 M+	450.
+) \$250: M1 + 250 ⇒ M2	250 M+	250.
−) M2 × 5%	RCL M × 5 2ndF % 2ndF M−	35.
M =	RCL M	665.
$\frac{24}{4+6} = 2\frac{2}{5}$…(A)	24 ÷ (4 + 6) =	$2\frac{2}{5}$
$3 \times (A) + 60 \div (A) =$	3 × ALPHA ANS + 60 ÷ ALPHA ANS =	$32\frac{1}{5}$
$\sinh^{-1} \Rightarrow D1$	STO D1 2ndF arc hyp sin	
$\sinh^{-1} 0.5 =$	D1 0.5 =	0.481211825

15

6 + 4 = ANS	ON/C 6 + 4 =	10.
ANS + 5 =	+ 5 =	15.
8 × 2 = ANS	8 × 2 =	16.
$ANS^2 =$	x^2 =	256.

16 a/b a b/c

$3\frac{1}{2} + \frac{4}{3} =$	ON/C 3 2ndF a b/c 1 ▼ 2 ▶ + a/b 4 ▼ 3 =	$4\frac{5}{6}$
	CHANGE	$\frac{29}{6}$
	CHANGE	4.833333333
LINE	3 a/b 1 a/b 2 + 4 a/b 3 =	4r5r6*
	CHANGE	29r6
	CHANGE	4.833333333

* $4\text{r}5\text{r}6 = 4\frac{5}{6}$

17 BIN PEN OCT HEX DEC NEG NOT AND OR XOR XNOR

DEC (25) → BIN	ON/C 2ndF DEC 25 2ndF BIN	BIN	11001
HEX (1AC)	2ndF HEX 1AC		
→ BIN	2ndF BIN	BIN	110101100
→ PEN	2ndF PEN	PEN	3203
→ OCT	2ndF OCT	OCT	654
→ DEC	2ndF DEC		428.
BIN (111) → NEG	2ndF BIN NEG 111 =	BIN	1111111001
1011 AND 101 = [BIN]	2ndF BIN 1011 AND 101 =	BIN	1
5A OR C3 = [HEX]	2ndF HEX 5A OR C3 =	HEX	DB
NOT 10110 = [BIN]	2ndF BIN NOT 10110 =	BIN	1111101001
24 XOR 4 = [OCT]	2ndF OCT 24 XOR 4 =	OCT	20
B3 XNOR 2D = [HEX]	2ndF HEX B3 XNOR 2D =	HEX	FFFFFFF61
→ DEC	2ndF DEC		-159.

18 D°M'S ↔DEG

7°31'49.44" → [10]	ON/C 7 D°M'S 31 D°M'S 49.44 2ndF ↔DEG	$7\frac{663}{1250}$
123.678 → [60]	123.678 2ndF ↔DEG	123°40'40.8"
3h 30m 45s + 6h 45m 36s = [60]	3 D°M'S 30 D°M'S 45 + 6 D°M'S 45 D°M'S 36 =	10°16'21."
1234°56'12" + 0°0'34.567" = [60]	1234 D°M'S 56 D°M'S 12 + 0 D°M'S 0 D°M'S 34.567 =	1234°56'47."
3h 45m − 1.69h = [60]	3 D°M'S 45 − 1.69 = 2ndF ↔DEG	2°3'36."
sin 62°12'24" = [10]	sin 62 D°M'S 12 D°M'S 24 =	0.884635235
24° → ["]	24 D°M'S MATH 1	86'400.
1500" → [']	0 D°M'S 0 D°M'S 1500 MATH 2	25.

19 →rθ →xy (x,y)

$\begin{cases} x = 6 \\ y = 4 \end{cases} \rightarrow \begin{cases} r = \\ \theta = [°] \end{cases}$	ON/C 6 (x,y) 4 2ndF →rθ	r: θ:	7.211102551 33.69006753
$\begin{cases} r = 14 \\ \theta = 36\ [°] \end{cases} \rightarrow \begin{cases} x = \\ y = \end{cases}$	14 (x,y) 36 2ndF →xy	X: Y:	11.32623792 8.228993532

20 CONST CONV

$V_0 = 15.3$ m/s, $t = 10$ s, $V_0 t + \frac{1}{2}gt^2 = ?$ m	ON/C 15.3 × 10 + 2 2ndF x^{-1} × ALPHA CONST 03 × 10 x^2 = CHANGE	643.3325
125 yd = ? m	ON/C 125 ALPHA CONV 05 = CHANGE CHANGE	114.3

21 MATH (ENG.SYMBOL)

100 m × 10 k = ?	100 MATH 0 4 × 10 MATH 0 0 =	1'000.

22 MDF

→ [FIX, TAB = 1]	ON/C 2ndF SET UP 1 0 1	0.0
5 ÷ 9 = ANS	5 ÷ 9 =	$\frac{5}{9}$
	CHANGE	0.6
ANS × 9 =	× 9 = *1	5.0
	5 ÷ 9 =	$\frac{5}{9}$
	CHANGE	0.6
→ [MDF]	2ndF MDF	$\frac{3}{5}$
ANS × 9 =	× 9 = *2	$5\frac{2}{5}$
	CHANGE CHANGE	5.4
→ [NORM1]	2ndF SET UP 1 3	5.4

*1 $\frac{5}{9} \times 9 = 5.5555555555555 \times 10^{-1} \times 9$

*2 $\frac{3}{5} \times 9 = 0.6 \times 9$

23 int÷ MATH (ipart, fpart, int, (%))

23 ÷ 5	ON/C 23 2ndF int÷ 5 =	Q: R:	4. 3.
9.5 ÷ 4	9.5 2ndF int÷ 4 =	Q: R:	2. 1.5
-32 ÷ (-5)	(−) 32 2ndF int÷ (−) 5 =	Q: R:	6. −2.
42.195 → [ipart]	MATH 3 42.195 =		42.
$\sqrt{2}$ → [fpart]	MATH 4 √ 2 =		0.414213562
-34.5 → [int]	MATH 5 (−) 34.5 =		-35.
50 × 8(%) + 200	50 × 8 MATH 6 + 200 =		204.

24 P.FACT

12210 =	ON/C 12210 =	12'210.
	2ndF P.FACT	2×3×5×11×37
	2ndF P.FACT	12'210.
1234567 =	1234567 =	1'234'567.
	2ndF P.FACT	127×(9721)

25 ALGB (ALGB)

$f(x) = x^3 - 3x^2 + 2$	ON/C ALPHA X 2ndF x^3 − 3 ALPHA X x^2 + 2	
$x = -1$	2ndF ALGB (−) 1 ENTER	-2.
$x = -0.5$	2ndF ALGB (−) 0.5 ENTER	$1\frac{1}{8}$
$\sqrt{A^2 + B^2}$	√ ALPHA A x^2 + ALPHA B x^2	
A = 2, B = 3	2ndF ALGB 2 ENTER 3 ENTER	$\sqrt{13}$
A = 2, B = 5	2ndF ALGB ENTER 5 ENTER	$\sqrt{29}$

26 SOLVER (SOLVER)

$\sin x - 0.5$	ON/C sin ALPHA X − 0.5	
Start = 0	2ndF SOLVER 0 ENTER ENTER	30.
Start = 180	ENTER 180 ENTER ENTER	150.

27 MODE (STAT) INS-D

DATA
20
30
40
40
50

MODE 1 0

X	FRQ
1	

20 ENTER 30 ENTER 40 (x,y) 2 ENTER 50 ENTER

X	FRQ
3 40	2
4 50	1
5	

DATA
30
40
40
45
45
45
60

2ndF ▲ 2ndF DEL ▼ ▼ ALPHA INS-D
45 (x,y) 3 ENTER 60 ENTER

X	FRQ
3 45	3
4 60	1
5	

28 MODE (STAT) DATA STAT x′ y′

DATA
95
80
80
75
75
75
50

MODE 1 0 2ndF CA DATA
95 ENTER 80 (x,y) 2 ENTER 75 (x,y) 3 ENTER 50 ENTER

X	FRQ
3 75	3
4 50	1
5	

DATA — Stat 0 [SD] 0.

ALPHA STAT 0

n =	7.
$\overline{x}$ =	75.7142857
sx =	13.3630621
↓ s^2x =	178.571429

▼

↑ σx =	12.3717915
$\sigma^2 x$ =	153.061224
Σx =	530.
↓ Σx^2 =	41'200.

▼

↑ $xmin$ =	50.
Q_1 =	75.
med =	75.
↓ Q_3 =	80.

▼

↑ $xmax$ =	95.

$\frac{(95-\overline{x})}{sx}\times 10+50=$

ON/C (95 −
ALPHA STAT 2 1
) ÷
ALPHA STAT 2 2
× 10 + 50 = — 64.43210706

DATA	
x	y
2	5
2	5
12	24
21	40
21	40
21	40
15	25

MODE 1 1 2 (x,y) 5 (x,y) 2 ENTER
12 (x,y) 24 ENTER 21 (x,y) 40 (x,y) 3 ENTER 15 (x,y) 25 ENTER

X	Y	FRQ
3 21	40	3
4 15	25	1
5		

DATA — Stat 1[a+bx] 0.

ALPHA STAT 1

$a+bx$

a =	1.050261097
b =	1.826044386
↓ r =	0.995176343

ON/C ALPHA STAT 0 ▼ ▼ ▼ ▼ ▼

↑ Σx^4 =	654'836.
$ymin$ =	5.
$ymax$ =	40.

$x=3\rightarrow y'=?$ — ON/C 3 2ndF y′ — $3y'$ — 6.528394256

$y=46\rightarrow x'=?$ — 46 2ndF x′ — $46x'$ — 24.61590706

DATA	
x	y
12	41
8	13
5	2
23	200
15	71

MODE 1 2 12 (x,y) 41 ENTER
8 (x,y) 13 ENTER 5 (x,y) 2 ENTER
23 (x,y) 200 ENTER 15 (x,y) 71 ENTER

X	Y	FRQ
4 23	200	1
5 15	71	1
6		

DATA — Stat 2[a+bx+cx²] 0.

ALPHA STAT 1

$a+bx+cx^2$

a =	5.357506761
b =	-3.120289663
↓ c =	0.503334057

▼

↑ $a+bx+cx^2$	
R^2 =	0.99994896

$x=10\rightarrow y'=?$ — ON/C 10 2ndF y′ — $10y'$ — 24.4880159

$y=22\rightarrow x'=?$ — 22 2ndF x′ — $22x'$

1:	9.63201409
2:	-3.432772026

22 ALPHA STAT 5 5 — -3.432772026

29

$\overline{x}=\frac{\Sigma x}{n}$ $\quad \sigma x=\sqrt{\frac{\Sigma x^2-n\overline{x}^2}{n}}$

$sx=\sqrt{\frac{\Sigma x^2-n\overline{x}^2}{n-1}}$

$\overline{y}=\frac{\Sigma y}{n}$ $\quad \sigma y=\sqrt{\frac{\Sigma y^2-n\overline{y}^2}{n-1}}$

$sy=\sqrt{\frac{\Sigma y^2-n\overline{y}^2}{n-1}}$

30 MATH (→t, P(, Q(, R()

$P(t)=\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{t} e^{-\frac{x^2}{2}}dx$ — (t ≥ 0) — (t < 0)

$Q(t)=\frac{1}{\sqrt{2\pi}}\int_{t}^{\infty} e^{-\frac{x^2}{2}}dx$ — (t ≥ 0) — (t < 0)

$R(t)=\frac{1}{\sqrt{2\pi}}\int_{t}^{\infty} e^{-\frac{x^2}{2}}dx$ — (t ≥ 0) — (t < 0)

DATA	
x	FRQ
20	1
30	3
40	5
50	8
60	13
70	10
80	7
90	3

MODE 1 0 20 (x,y) 1 ENTER
30 (x,y) 3 ENTER 40 (x,y) 5 ENTER
50 (x,y) 8 ENTER 60 (x,y) 13 ENTER
70 (x,y) 10 ENTER 80 (x,y) 7 ENTER
90 (x,y) 3 ENTER

X	FRQ
7 80	7
8 90	3
9	

DATA — Stat 0[SD] 0.

$\overline{x}=$ — ALPHA STAT 2 1 = — $\overline{x}=$ 60.4

$\sigma x=$ — ALPHA STAT 2 4 = — $\sigma x=$ 16.48757108

$x=35\rightarrow P(t)?$ — MATH 1 35 MATH 0) = — 0.061713

$x=75\rightarrow Q(t)?$ — MATH 2 75 MATH 0) = — 0.312061

$x=85\rightarrow R(t)?$ — MATH 3 85 MATH 0) = — 0.067845

$t=1.5\rightarrow R(t)?$ — MATH 3 1.5) = — 0.066807

31 MODE (TABLE)

x^2+1 — MODE 2 ALPHA x x² + 1 ENTER ENTER

X_Start: -2 (−) 2 ENTER
X_Step: 1 1 ENTER

X	ANS
-2	5
-1	2
0	1

-2.

▼ ▼ ▼ ▼

X	ANS
0	1
1	2
2	5

2.

x^2+1 — MODE 2 ALPHA x x² + 1 ENTER

$x+5$ — ALPHA x + 5 ENTER

X_Start: 1 1 ENTER
X_Step: 1 1 ENTER

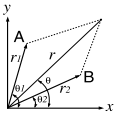
X	ANS1	ANS2
1	2	6
2	5	7
3	10	8

1.

32 MODE (COMPLEX)

$(12-6i)+(7+15i)-(11+4i)=$ — MODE 3
12 (−) 6 i + 7 + 15 i (−) (11 + 4 i) =

8.
+5.i



2ndF →rθ 8 2ndF ∠ 70 + 12 2ndF ∠ 25 =

18.5408873
∠42.76427608

$r1=8,\ \theta1=70°$
$r2=12,\ \theta2=25°$
$\rightarrow r=?,\ \theta=?°$

$1+i$ — $\rightarrow r=?,\ \theta=?°$ — 2ndF →xy 1 + i =

1.
+1.i

2ndF →rθ — 1.414213562 ∠45.

conj(5 + 2i) = — 2ndF →xy MATH 0 5 + 2 i) =

5.
-2.i

arg(2 + 3i) — MATH 1 2 + 3 i) = — 56.30993247

real(15 ∠ 30) — MATH 2 15 2ndF ∠ 30) = — 12.99038106

img(15 ∠ 30) — MATH 3 15 2ndF ∠ 30) = — 7.5

33 MODE (2-VLE, 3-VLE, QUAD, CUBIC)

$\begin{cases}2x+3y=4\\5x+6y=7\end{cases}$ — MODE 4 0
2 ENTER 3 ENTER 4 ENTER
5 ENTER 6 ENTER 7

$x=?$ — ENTER — X: -1.
$y=?$ — Y: 2.
$\det(D)=?$ — D: -3.

$\begin{cases}x+y-z=9\\6x+6y-z=17\\14x-7y+2z=42\end{cases}$ — MODE 4 1
1 ENTER 1 ENTER (−) 1 ENTER 9 ENTER
6 ENTER 6 ENTER (−) 1 ENTER 17 ENTER
14 ENTER (−) 7 ENTER 2 ENTER 42

$x=?$ — ENTER — X: 3.238095238
$y=?$ — Y: -1.638095238
$z=?$ — Z: -7.4
$\det(D)=?$ — D: 105.

$3x^2+4x-95=0$ — MODE 4 2
3 ENTER 4 ENTER (−) 95

$x=?$ — ENTER — X= ↓
1: 5.
2: -6.333333333

ENTER — X-Value: ↑
-0.666666666

Ymin: -96.33333333

$5x^3+4x^2+3x+7=0$ — MODE 4 3
5 ENTER 4 ENTER 3 ENTER 7

$x=?$ — ENTER — X=
1: -1.233600307
2: 0.216800153 ±1.043018296i

34 MODE (MATRIX)

$\begin{bmatrix}1&2\\3&4\end{bmatrix} \Rightarrow$ matA

MODE 5
MATH 1 2 2 ENTER
1 ENTER 2 ENTER 3 ENTER 4 ENTER
ON/C MATH 3 0

$\begin{bmatrix}3&1\\2&6\end{bmatrix} \Rightarrow$ matB

MATH 1 ENTER
3 ENTER 1 ENTER 2 ENTER 6 ENTER
ON/C MATH 3 1

matA × matB =

ON/C MATH 0 0 × MATH 0 1 =

$\begin{bmatrix}7&13\\17&27\end{bmatrix}$

dim (matA, 3, 3) =

ON/C MATH 7 MATH 0 0 (x,y) 3 (x,y) 3) =

$\begin{bmatrix}1&2&0\\3&4&0\\0&0&0\end{bmatrix}$

35 MODE (VECTOR)

$\begin{bmatrix}5\\6\end{bmatrix} \Rightarrow$ vectA

MODE 6
MATH 1 2 ENTER
5 ENTER 6 ENTER
ON/C MATH 3 0

$\begin{bmatrix}7\\8\end{bmatrix} \Rightarrow$ vectB

MATH 1 2 ENTER
7 ENTER 8 ENTER
ON/C MATH 3 1

vectA + vectB =

ON/C MATH 0 0 + MATH 0 1 =

$\begin{bmatrix}12\\14\end{bmatrix}$

DotPro (vectA, vectB) =

ON/C MATH 4 MATH 0 0 (x,y) MATH 0 1) =

83.

36

Function	Dynamic range
$\sin x$, $\cos x$, $\tan x$	DEG: $\lvert x\rvert < 10^{10}$ $(\tan x\text{: } \lvert x\rvert \neq 90(2n-1))^*$ RAD: $\lvert x\rvert < \frac{\pi}{180} \times 10^{10}$ $(\tan x\text{: } \lvert x\rvert \neq \frac{\pi}{2}(2n-1))^*$ GRAD: $\lvert x\rvert < \frac{10}{9} \times 10^{10}$ $(\tan x\text{: } \lvert x\rvert \neq 100(2n-1))^*$
$\sin^{-1}x$, $\cos^{-1}x$	$\lvert x\rvert \leq 1$
$\tan^{-1}x$, $\sqrt[3]{x}$	$\lvert x\rvert < 10^{100}$
$\ln x$, $\log x$, $\log_a x$	$10^{-99} \leq x < 10^{100}$, $10^{-99} \leq a < 10^{100}$ $(a \neq 1)$
y^x	• $y > 0$: $-10^{100} < x\log y < 100$ • $y = 0$: $0 < x < 10^{100}$ • $y < 0$: $x = n$ $(0 < \lvert x\rvert < 1\text{: } \frac{1}{x} = 2n-1,\ x \neq 0)^*$, $-10^{100} < x\log\lvert y\rvert < 100$
$\sqrt[x]{y}$	• $y > 0$: $-10^{100} < \frac{1}{x}\log y < 100$ $(x \neq 0)$ • $y = 0$: $0 < x < 10^{100}$ • $y < 0$: $x = 2n-1$ $(0 < \lvert x\rvert < 1\text{: } \frac{1}{x} = n,\ x \neq 0)^*$, $-10^{100} < \frac{1}{x}\log\lvert y\rvert < 100$
e^x	$-10^{100} < x \leq 230.2585092$
10^x	$-10^{100} < x < 100$
$\sinh x$, $\cosh x$, $\tanh x$	$\lvert x\rvert \leq 230.2585092$
$\sinh^{-1}x$	$\lvert x\rvert < 10^{50}$
$\cosh^{-1}x$	$1 \leq x < 10^{50}$
$\tanh^{-1}x$	$\lvert x\rvert < 1$
x^2	$\lvert x\rvert < 10^{50}$
x^3	$\lvert x\rvert < 2.15443469 \times 10^{33}$
$\sqrt{x}$	$0 \leq x < 10^{100}$
x^{-1}	$\lvert x\rvert < 10^{100}$ $(x \neq 0)$
n!	$0 \leq n \leq 69^*$
${}_nP_r$	$0 \leq r \leq n \leq 9999999999^*$ $\frac{n!}{(n-r)!} < 10^{100}$
${}_nC_r$	$0 \leq r \leq n \leq 9999999999^*$ $0 \leq r \leq 69$ $\frac{n!}{(n-r)!} < 10^{100}$
↔DEG, D°M'S	$0°0'0.00001'' \leq \lvert x\rvert < 10000°$
$x, y \rightarrow r, \theta$	$\sqrt{x^2+y^2} < 10^{100}$
$r, \theta \rightarrow x, y$	$0 \leq r < 10^{100}$ DEG: $\lvert\theta\rvert < 10^{10}$ RAD: $\lvert\theta\rvert < \frac{\pi}{180} \times 10^{10}$ GRAD: $\lvert\theta\rvert < \frac{10}{9} \times 10^{10}$
DRG►	DEG → RAD, GRAD → DEG: $\lvert x\rvert < 10^{100}$ RAD → GRAD: $\lvert x\rvert < \frac{\pi}{2} \times 10^{98}$
${}_nGCD_n$, ${}_nLCM_n$	$0 < n < 10^{10}$ *
R.Int(n, m)	$n \leq \lvert 9999999999\rvert^*$ $m \leq \lvert 9999999999\rvert^*$ $n < m$, $m - n < 10^{10}$
$(A + Bi) + (C + Di)$	$\lvert A + C\rvert < 10^{100}$, $\lvert B + D\rvert < 10^{100}$
$(A + Bi) - (C + Di)$	$\lvert A - C\rvert < 10^{100}$, $\lvert B - D\rvert < 10^{100}$
$(A + Bi) \times (C + Di)$	$(AC - BD) < 10^{100}$ $(AD + BC) < 10^{100}$
$(A + Bi) \div (C + Di)$	$\frac{AC + BD}{C^2 + D^2} < 10^{100}$ $\frac{BC - AD}{C^2 + D^2} < 10^{100}$ $C^2 + D^2 \neq 0$
→ DEC → BIN → PEN → OCT → HEX AND OR XOR XNOR	DEC: $\lvert x\rvert \leq 9999999999$ BIN: $1000000000 \leq x \leq 1111111111$ $0 \leq x \leq 111111111$ PEN: $2222222223 \leq x \leq 4444444444$ $0 \leq x \leq 2222222222$ OCT: $4000000000 \leq x \leq 7777777777$ $0 \leq x \leq 3777777777$ HEX: FDABF41C01 $\leq x \leq$ FFFFFFFFFF $0 \leq x \leq$ 2540BE3FF
NOT	BIN: $1000000000 \leq x \leq 1111111111$ $0 \leq x \leq 111111111$ PEN: $2222222223 \leq x \leq 4444444444$ $0 \leq x \leq 2222222221$ OCT: $4000000000 \leq x \leq 7777777777$ $0 \leq x \leq 3777777777$ HEX: FDABF41C01 $\leq x \leq$ FFFFFFFFFF $0 \leq x \leq$ 2540BE3FE
NEG	BIN: $1000000001 \leq x \leq 1111111111$ $0 \leq x \leq 111111111$ PEN: $2222222223 \leq x \leq 4444444444$ $0 \leq x \leq 2222222222$ OCT: $4000000001 \leq x \leq 7777777777$ $0 \leq x \leq 3777777777$ HEX: FDABF41C01 $\leq x \leq$ FFFFFFFFFF $0 \leq x \leq$ 2540BE3FF
Normal pdf Normal cdf	$0 < \sigma$
Inverse Normal	$0 < a < 1$ $0 < \sigma$
Binomial pdf Binomial cdf	$0 < n$ $0 \leq p \leq 1$
Poisson pdf Poisson cdf	$0 \leq x$ (integer) $0 < \mu$

* n, m, r: integer

ENGLISH

Attention:
Your product is marked with this symbol. It means that used electrical and electronic products should not be mixed with general household waste. There is a separate collection system for these products.

Information on the Disposal of this Equipment and its Batteries

1. In the European Union

Attention: If you want to dispose of this equipment, please do not use the ordinary dust bin!
Used electrical and electronic equipment must be treated separately and in accordance with legislation that requires proper treatment, recovery and recycling of used electrical and electronic equipment. Following the implementation by member states, private households within the EU states may return their used electrical and electronic equipment to designated collection facilities free of charge*. In some countries* your local retailer may also take back your old product free of charge if you purchase a similar new one.
*) Please contact your local authority for further details.
If your used electrical or electronic equipment has batteries or accumulators, please dispose of these separately beforehand according to local requirements.
By disposing of this product correctly you will help ensure that the waste undergoes the necessary treatment, recovery and recycling and thus prevent potential negative effects on the environment and human health which could otherwise arise due to inappropriate waste handling.

2. In other Countries outside the EU

If you wish to discard this product, please contact your local authorities and ask for the correct method of disposal.

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