ABACUS

SX-II MATRIXn

SCIENTIFIC CALCULATOR

User's manual

General Guide

■ Turning on or off

To turn the calculator on, press [ON]; To turn the calculator off, press [2nd] [OFF].

■ Battery replacement

SX-II MATRIXn is powered by one AAA-size (UM-4) battery. If the display becomes dim and difficult to read, the batteries should be replaced as soon as possible.

To replace batteries:

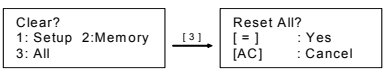
1) Unscrew the screws on the back of the calculator.
2) Insert a flat bladed screwdriver into the slot between the upper and lower case then carefully twist it to separate the case.
3) Remove the battery and dispose of them properly. Never allow children to play with batteries.
4) Wipe off the new batteries with a dry cloth to maintain good contact.
5) Insert the new battery, the plus terminals (+) should be on right.
6) Align the upper and lower cases then snap them to close together.
7) Tighten the screws.
8) Initialize the calculator: [ON] [2nd] [CLR] [3] [=].

■ Auto power-off function

This calculator automatically turns off when not operated for approximately 10 minutes. It can be reactivated by pressing [ON] key and the memory are cleared.

■ Reset operation

If the calculator is on but you get unexpected results, press [2nd] [CLR] in sequence. A message appears on the display to confirm whether you want to reset the calculator and clear memory contents after selecting [3].



To clear all variables, pending operations, statistical data, answers, all previous entries, and memory, please press [=]; To cancel the reset operation without clearing the calculator, please press [AC].

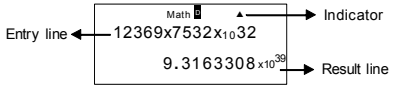
If the calculator is lock and further key operations becomes impossible, please press [ON] key to release the condition. It will return all settings to default settings.

■ Contrast adjustment

Pressing the [◄] or [►] following [2nd] [SET UP] [▼] [5] (◄CONT►) keys in sequence can make the contrast of the screen lighter or darker. Holding either key down will make the display become respectively lighter or darker. After finishing your setting, press [AC] to exit.

■ Display readout

The display comprises the entry line, the result line, and indicators.



Entry line SX-II MATRIXn displays an entry of up to 99 digits. Entries begin on the left; those with more than 15 digits scroll to the left. Press [►] and [◄] to move the cursor through an entry. However, whenever you input the 89th digit of any calculation, the cursor changes from "▌" to "█" to let you know memory is running low. If you still need to input more, you should divide your calculation into two or more parts.

Result line It displays a result of up to 10 digits, as well as a decimal, a negative sign, a " x10 " indicator, and a 2-digit positive or negative exponent.

Indicators The following indicators may appear on the display to indicate the current status of the calculator.

Indicator	Meaning
2nd	2nd set of function keys are active
A	Alphabetic keys are active
M	There is a number in the memory
STO	Storing variable mode is active
RCL	Recalling variable mode is active
STAT	Statistics mode is active
Math	Math style is selected as the Input/output format
D R G	Angle mode: Degrees, Radians, or Gradians
FIX	A fixed number of decimal places is in effect
SCI	A fixed number of Scientific notation is in effect
▼▲	There are earlier or later results that can be displayed
Disp	Displayed value is intermediate result when performing multi-statement function

Before Starting Calculation

■ Using [MODE] keys

Press [MODE] to display mode menus when specifying an operating mode (" 1: COMP ", " 2: STAT ", " 3: VERIF ").

COMP : Use this mode for basic calculations, including scientific calculations. (the default)

STAT : Use this mode to perform single–variable and paired–variable statistical calculations and regression calculations.

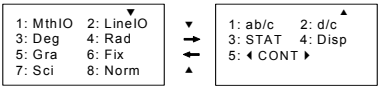
VERIF: Use this mode to verify whether an input equality or inequality is true or false.

Give " 2: STAT " as an example:

Method : Press [MODE] and then key in directly the number of the mode, [2] , to enter the desired mode immediately.

■ Using [SET UP] keys

[2nd][SET UP] display the setup menu that enables you to specify the input /output format, the angle mode, the numeric notation, the statistical setting or the contrast adjustment. The setup menu consist of two screens which you can jump between by using [▼] and [▲].



MthIO : Math mode displays inputs and outputs (MathO; LineO) in textbook format. (MathI/LineO is the default)

LineIO : Linear mode displays inputs and outputs in a single line.

Deg : Deg mode sets the angle unit to degrees (the default)

Rad : Rad mode sets the angle unit to radians

Gra : Gra mode sets the angle unit to gradians.

Fix : Fix decimal setting (0 through 9)

Sci : Scientific notation (0 through 9)

Norm : Norm specifies the range (Norm1, Norm2) in which the results are to be displayed in exponential format or in non-exponential format (Norm2 is the default)

ab/c : ab/c displays the fraction in mixed number format

d/c : d/c displays the fraction in improper format (the default)

STAT : STAT sets the Statistical Data Editor Screen to show or hide the FREQ column

Disp : Disp sets the decimal point to Dot (.) or Comma (,) (Dot is the default)

◀CONT▶ : Contrast Adjustment

■ Using Math Mode

Press [2nd] [SET UP] [1] to enter Math mode. While in math mode, the values for functions such as $\frac{d}{e}$, $A\frac{b}{c}$, Abs, 10^x, e^x, $\sqrt{\ }$, $\sqrt[3]{\ }$, x^2 , x^3 , x^{-1} , x^y , $\sqrt[x]{\ }$ ....can be entered and displayed in a mathematically written way. By default, SX-II MATRIXn is in Math mode. <u>See Example 1~2.</u>

■ Using [2nd] [ALPHA] Keys

When you press [2nd], the " 2nd " indicator shown on the display indicates that you will be selecting the second function of the next key you press. If you press [2nd] by mistake, simply press [2nd] again to remove the " 2nd " indicator.

When you press [ALPHA], the "A" indicator shown on the display indicates that you will be selecting the alphabetic function of the next key you press. If you press [ALPHA] by mistake, simply press [ALPHA] again to remove the " A" indicator.

■ Making corrections during Input

The vertical blinking cursor "▌" means the calculator is in insert mode. The horizontal blinking cursor "▂" means the calculator is in overwrite mode.

By default, the calculator is in insert mode. In linear format, you can press [2nd] [INS] to switch between the two modes, whereas in Math format, you can use only the insert mode.

In insert mode, the character in front of the cursor "▌" will be deleted or inserted after you press [DEL] or enter a new character

In overwrite mode, the character at the cursor "▂" will be deleted by [DEL] key or replaced by any new character you enter.

To clear all characters, simply press [AC] in either mode.

■ Error Position Display Function

When a mathematically illegal calculation performed causes an error and an error message (See < Error conditions >) appears, press [◀] [▶] and then the error position display function will tell you with the cursor where the error is. In that case, please make necessary corrections before executing the calculation again. <u>See Example 3.</u>

■ Replay function

This function stores operations that just have been executed in COMP mode and VERIF mode. After execution is completed, pressing [▼] or [▲] key will display the operation executed.

You can continue moving the cursor by [◀] or [▶] to display previous input steps and editing values or commands for subsequent execution. <u>See Example 4.</u>

The operation records in Memory are cleared each time when you turn off the calculator, press [ON] key, perform a “reset”, change display format or calculation mode.

When the memory is full, the oldest calculation records are deleted automatically to make room for the new ones.

■ Memory calculation

Memory variable

The calculator has seven memory variables for repeated use -- A, B, C, D, E, F, M, X, Y. You can store a real number in any of the nine memory variables. See Example 5.

- [2nd] [STO] + [A] ~ [F], [M], [X] ~ [Y] lets you store values to variables.
- [RCL] + [A] ~ [F], [M], [X] ~ [Y] recalls the value of the variable.
- [0] [2nd] [STO] + [A] ~ [F], [M], [X] ~ [Y] clears the content to a specified memory variable.
- [ALPHA] + " memory variable " lets you insert the applicable variables in a calculation.
- [2nd] [CLR] [2] [=] clears all variables.

Running memory

You should keep the following rules in mind when using running memory. See Example 6.

- Press [M+] to add a result to running memory and the " M " indicator appears when a number is stored in the memory. Press [RCL] [M] to recall the content of running memory.
- Recalling from running memory by pressing [RCL] [M] key does not affect its contents .
- Running memory is not available when you are in statistics mode.
- The memory variable M and running memory utilize the same memory area.
- In order to replace the content of the memory with the displayed number, please press [2nd] [STO] [M] key.
- To clear the content of running memory, you can press [0] [2nd] [STO] [M] in sequence.

(Note) : Besides pressing [2nd] [STO] [M] key to store a value, you can also assign values to memory variable M by [M+]. However, when [2nd] [STO] [M] is used, previous memory contents stored in variable M are cleared and replaced with the newly assigned value. When [M+] is used, values is added to present sum in memory.

■ Order of operations

Each calculation is performed from left to right and in the following order of precedence:

1) Expression inside parentheses.
2) Functions with parentheses:
   P→R, R→P

sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$, $\tanh^{-1}$,

log, ln, $\sqrt{\ }$, $\sqrt[3]{\ }$, 10^{x}, e^{x}, Abs, RND, GCD, LCM

3) Functions preceded by values, powers, power roots, for example, x^{2}, x^{3}, x^{-1}, x!, DMS, °, r, g, x^{y}, $\sqrt[x]{\ }$, %
4) Fractions
5) Negations (–)
6) Statistical estimated value calculation: $\hat{x}$, $\hat{y}$, $\hat{x}1$, $\hat{x}2$
7) Multiplication sign omitted immediately before π, ***e***, variable, and function with parentheses: for example, 3π, 5B, Asin(30)
8) nPr, nCr
9) ×, ÷
10) +, –

■ Accuracy and Capacity

Output digits : Up to 10 digits.

Calculating digits : Up to 18 digits

In general, every reasonable calculation is displayed up to 10 digits mantissa, or 10-digit mantissa plus 2-digit exponent up to $10^{\pm 99}$.

Numbers used as input must be within the range of the given function as follows:

Functions	Input range
sin x cos x	Deg : $0 \leqq \lvert x \rvert < 9 \times 10^{9}$ Rad : $0 \leqq \lvert x \rvert < 157079632.7$ Grad : $0 \leqq \lvert x \rvert < 1 \times 10^{10}$
tan x	Same as sin x, except when Deg : $\lvert x \rvert = 90\ (2n-1)$ Rad : $\lvert x \rvert = \frac{\pi}{2}\ (2n-1)$ Grad : $\lvert x \rvert = 100\ (2n-1)$
$\sin^{-1} x$, $\cos^{-1} x$	$0 \leqq \lvert x \rvert \leqq 1$
$\tan^{-1} x$	$0 \leqq \lvert x \rvert < 1 \times 10^{100}$
sinh x, cosh x	$0 \leqq \lvert x \rvert \leqq 230.2585092$
tanh x	$0 \leqq \lvert x \rvert < 1 \times 10^{100}$
$\sinh^{-1} x$	$0 \leqq \lvert x \rvert < 5 \times 10^{99}$
$\cosh^{-1} x$	$1 \leqq x < 5 \times 10^{99}$
$\tanh^{-1} x$	$0 \leqq \lvert x \rvert < 1$
log x, ln x	$0 < x < 1 \times 10^{100}$
10^{x}	$-1 \times 10^{100} < x < 100$

e^x	$-1 \times 10^{100} < x \leqq 230.2585092$
$\sqrt{x}$	$0 \leqq x < 1 \times 10^{100}$
x^2	$\lvert x \rvert < 1 \times 10^{50}$
x^3	$\lvert x \rvert \leqq 2.15443469003 \times 10^{33}$
x^{-1}	$\lvert x \rvert < 1 \times 10^{100}$, $x \neq 0$
$\sqrt[3]{x}$	$\lvert x \rvert < 1 \times 10^{100}$
x !	$0 \leqq x \leqq 69$ (x is an integer)
nPr	$0 \leqq r \leqq n$, $0 \leqq n < 1 \times 10^{10}$ (n, r are integers) $1 \leqq \{n!/(n-r)!\} < 1 \times 10^{100}$
nCr	$0 \leqq r \leqq n$, $0 \leqq n < 1 \times 10^{10}$ (n, r are integers) $1 \leqq n!/r! < 1 \times 10^{100}$ or $1 \leqq \{n!/(n-r)!\} < 1 \times 10^{100}$
R→P	$\lvert x \rvert$, $\lvert y \rvert < 1 \times 10^{100}$ $\sqrt{x^2 + y^2} < 1 \times 10^{100}$
P→R	$0 \leqq r < 1 \times 10^{100}$ θ : same as sin x
DMS	$\lvert D \rvert$, M, S $< 1 \times 10^{100}$, $0 \leqq$ M, S
◀DMS	$\lvert x \rvert < 1 \times 10^{100}$ Decimal ↔ Sexagesimal Conversions $0^{\circ}0'0'' \leqq \lvert x \rvert \leqq 9999999^{\circ}59'59''$
x^y	$x > 0$: $-1 \times 10^{100} < y \log x < 100$ $x = 0$: $y > 0$ $x < 0$: $y = n$, $m/(2n+1)$ (m, n are integers) but $-1 \times 10^{100} < y \log \lvert x \rvert < 100$
$\sqrt[x]{y}$	$y > 0$: $x \neq 0$, $-1 \times 10^{100} < \frac{1}{x} \log y < 100$ $y = 0$: $x > 0$ $y < 0$: $x = 2n+1$, $(2n+1)/m$ ($m \neq 0$, m, n are integers) but $-1 \times 10^{100} < \frac{1}{x} \log \lvert y \rvert < 100$
$A\ b/c$	Total of integer, numerator and denominator must be within 10 digits (includes division marks)
RANDI(a,b)	$a < b$; $\lvert a \rvert$, $\lvert b \rvert < 1 \times 10^{10}$; $b-a < 1 \times 10^{10}$
STAT	**1–VAR :** a. $n \leqq 80$ lines (when **FREQ** column is OFF) b. $n \leqq 40$ lines (when **FREQ** column is ON) **2–VAR :** a. $n \leqq 40$ lines (when **FREQ** column is OFF) b. $n \leqq 26$ lines (when **FREQ** column is ON)

■ Error conditions

Error message will appear on the display and further calculation becomes impossible when any of the following conditions occur.

Indicator	Meanings
Math ERROR	(1) You attempted to divide by 0 (2) When allowable input range of function calculations exceeds the range specified (3) When result of function calculations exceeds the range specified (4) When specifying an argument to a function outside the valid range
Syntax ERROR	(1) Input errors are made, ex. improper syntax (2) When improper arguments are used in commands or functions
Stack ERROR	When a calculation expression exceeds the capacity of the numeric stack or command stack, ex. When the [( ] key is used more than 25 levels in a single expression in linear mode
Argument ERROR	A non-integer argument was input for the random integer number function.

To release the above errors, please press [◀] [▶] to correct your error, or press [AC] key to cancel your calculation, or simply press [ON] key to reinitialize the calculator.

Basic Calculations

Use COMP ([MODE] 1 (COMP)) mode for basic calculations.

■ Arithmetic calculation

Arithmetic operations are performed by pressing the keys in the same sequence as in the expression. See Example 7.

For negative values, press [(–)] before entering the value.; You can enter a number in mantissa and exponent form by [x10^{x}] key. See Example 8.

Results equal to or greater than 10^{10} or results less than 10^{-9} are displayed in exponential form. See Example 9.

■ Parentheses calculations

Operations inside parentheses are always executed first. SX-II MATRIXn can use up to 24 levels of consecutive parentheses in a single calculation.

Closed parentheses occurring immediately after operation of the [ )] key may be omitted, no matter how many are required. See Example 10.

(Note) : A multiplication sign " x " occurring immediately before an open parenthesis can be omitted.

The correct result cannot be derived by entering [( ] 2 [+] 3 [ )] [$x10^x$] 2. Be sure to enter [x] between the [ )] and [$x10^x$] in Example 11.

■ Percentage calculation

[2nd] [%] divides the number in the display by 100. You can use this key sequence to calculate percentages, add-ons, discounts, and percentage ratios. See Example 12~13.

■ Display notations

The calculator has the following display notations for the display value. See Example 14.

Fixed Decimal Point Notation

To specify the number of decimal places, press [2nd] [SET UP] [6] and then a value indicating the number of places (0~9). Values are displayed rounded off to the place specified.

Scientific Notation

Scientific notation expresses numbers with one digit to the left of the decimal and the appropriate power of 10.

To select scientific notation, press [2nd] [SET UP] [7], and then a value (0~9) to specify the number of decimal digits. Values are displayed rounded off to the place specified.

Norm Notation

Press [2nd] [SET UP] [8] and then select Norm1 or Norm2 (the default) to determine the range to display the result in non-exponential format (within the range) or in exponential format (out of the range).

Norm1: $|x| < 10^{-2}$, $|x| \geqq 10^{10}$

Norm2: $|x| < 10^{-9}$, $|x| \geqq 10^{10}$

Engineering Notation

Pressing [ENG] or [2nd] [◄ENG] will cause the exponent display for the number being displayed to change in multiples of 3.

■ Answer Function

Answer function stores the most recently calculated result. It is retained even after the power is turned off. Once a numeric value or numeric expression is entered and [M+], [2nd] [M–], [2nd] [STO] or [=] is pressed, the result is stored by this function. See Example 15.

(Note) : Even if execution of a calculation results in an error, however, Answer memory retains its current value.

Scientific Function Calculations

Use COMP ([MODE] 1 (COMP)) mode for scientific function calculations.

■ Logarithmic and Exponential functions

The calculator can calculate common and natural logarithms, and exponentiation using [log], [ln], [2nd] [10^{x}], and [2nd] [e^{x}]. See Example 16~17.

■ Fraction calculation

Fraction value display is as follows:

	Improper Fraction	Mixed Fraction
Math format:	$\frac{12}{5}$	$56\frac{5}{12}$
Linear format:	12 ⌟ 5	56 ⌟ 5 ⌟ 12

(Note) : Values are automatically displayed in decimal format whenever the total number of digits of a fractional value (integer + numerator + denominator + separator marks) exceeds 10.

In Linear mode, to enter a mixed number, enter the integer part, press [d/e], enter the numerator, press [d/e], and enter the denominator; To enter an improper fraction, enter the numerator, press [d/e], and enter the denominator. See Example 18.

During a fraction calculation, if the figure is reducible, a figure is reduced to the lowest terms after pressing the [=] key. The initial default for a fraction result is improper fraction. By pressing [2nd] [A $b/c \blacklozenge d/e$], the displayed value will be converted to the mixed fraction and vice versa. To convert between a decimal and fractional result, press [F$\blacklozenge$D]. See Example 19.

Calculations containing both fractions and decimals are calculated in decimal format. See Example 20.

■ Angle unit conversions

The angle unit (**Deg**, **Rad**, **Grad**) is set by pressing [2nd] [SET UP] from Setup screen and results are displayed according to your setting.

The relation among the three angle units is:

$$180\ ^{\circ} = \pi \text{ rad} = 200 \text{ grad}$$

Angle unit conversions (See Example 21.):

1) Change the default setting (**Deg**) to the unit you want to convert to.
2) Enter the value of the unit to convert.
3) Press [2nd] [DRG$\blacktriangleright$] to display the menu. The units you can select are ° (**degrees**), r (**radians**), g (**gradians**).
4) Select the unit you are converting from, and press [=].

■ Sexagesimal ↔ Decimal transformation

You can use sexagesimal figure (degree, minute and second) to perform calculations and convert values between sexagesimal and decimal notation by using [DMS] key. See Example 22~23.

Sexagesimal figure value display is as follows:

125 ° 45 ' 30 ''	Represent 125 degrees (D), 45 minutes(M), 30 seconds(S)

■ Trigonometric / Inverse-Tri. functions

SX-II MATRIXn provides standard trigonometric functions and inverse trigonometric functions: sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$. See Example 24~26.

(Note) : When using those keys, make sure the calculator is set for the angle unit you want.

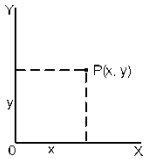
■ Hyperbolic / Inverse-Hyp. functions

SX-II MATRIXn uses [HYP] to calculate the hyperbolic functions and inverse-hyperbolic functions: sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$ and $\tanh^{-1}$. Press [HYP] to display the menu and then select the corresponding number to perform the function item. See Example 27~28.

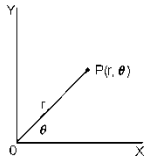
(Note) : When using those keys, make sure the calculator is set for the angle unit you want.

■ Coordinates transformation

Rectangular Coordinates



Polar Coordinates



$x + y\,i = r(\cos\theta + i\sin\theta)$

(Note) : When using those keys, make sure the calculator is set for the angle unit you want.

The calculator can perform the conversion between rectangular coordinates and polar coordinates by [2nd] [P→R] and [2nd] [R→P]. See Example 29~30.

■ Probability

This calculator provides the following probability functions (See Example 31~35.):

[nPr] Calculates the number of possible permutations of n item taken r at a time.

[nCr] Calculates the number of possible combinations of n items taken r at a time.

[x !] Calculates the factorial of a specified integer n, where n≦69.

[RAND] Generates a random real number between 0.000 and 0.999.

[RANDI] Generates a random integer number within the range of a to b.

■ Prime Factorization

The function just been executed in the COMP mode. You can factor a positive integer up to 10 digits into prime factors up to three digits. When the factor that is prime number with more than three digits, and that cannot be factored will be enclosed in parentheses on the display. See Example 36.

Exit prime factorization result display:

1) Pressing [2nd][FACT] or [=].
2) Changing display format use [ENG] or [DMS].
3) Changing the angle unit setting (Deg, Rad, Gra) or the display digits setting (Fix, Sci, Norm) by setup menu.

■ Other functions ($\sqrt{}$, $\sqrt[3]{}$, $\sqrt[]{}$, x^{-1}, x^2, x^3, x^y , Abs, RND, GCD, LCM)

The calculator also provides reciprocal ([x^{-1}]), square root ([$\sqrt{}$]), cubic root ([2nd] [$\sqrt[3]{}$]), universal root ([2nd] [$\sqrt[]{}$]), square ([x^2]), cubic ([x^3]), and exponentiation ([x^y]) functions. See Example 37~43.

Abs Generates the absolute value of a real number

RND Generates the rounding value of a given number

GCD Generates the greatest common divisor of two values

LCM Generates the least common multiple of two values

■ Multi-statement Function

A Multi-statement is a number of individual statements grouped together by display result commands (:) for sequential execution. When execution reaches the end of a statement followed by (:), execution stops and an intermediate result with a " Disp " icon appears on the display. You can resume execution by pressing [=]. " Disp " icon disappears when the last statement is being executed. See Example 44.

Statistical Calculations

Use STAT ([MODE] 2 (STAT)) mode for statistical calculations.

When you enter STAT mode, you are taken to the STAT menu with a choice of eight calculation types as follows:

Single–variable statistics

1: 1–VAR	Single-variable statistics	

Paired-variable / Regression statistics

2: A+BX	Linear Regression	$Y = A + BX$
3: _+CX^2	Quadratic Regression	$Y = A + BX + CX^2$
4: ln X	Logarithmic Regression	$Y = A + B \ln X$
5: *e*^X	*e* Exponential Regression	$Y = A \cdot e^{BX}$
6: A•B^X	ab Exponential Regression	$Y = A \cdot B^X$
7: A•X^B	Power Regression	$Y = A \cdot X^B$
8: 1/X	Inverse Regression	$Y = A + B / X$

■ To Enter data for statistical analysis

Before entering data, press [2nd] [SET UP] [▼] [3] in sequence to set Frequency column as On or Off. **FREQ** column enables you to enter the number of repeats for each of the same value occurred. See Example 45.

1. From the STAT menu, choose a calculation type. There will be two Data Editor formats (**1–VAR** or **2–VAR / regression Data)** depending on the type you select.
2. Enter an x - value and press [=].
3. Enter the frequency (**FREQ**) of the x-value (in **1–VAR** mode) or the corresponding y-value (in **2–VAR** mode) and press [=].
4. To enter more data, repeat from step 3.
5. To exit Data Editor mode to Result displaying mode, press [AC] and then [2nd] [STATVAR] to display STATVAR menu. (See table below)

■ To analyze data you have entered

Once you have entered your data, you can use the functions in STATVAR menu by pressing [2nd] [STATVAR]:

Single–variable statistics calculations

STATVAR Menu	Meaning
1: Type	Statistical calculation type menu, see the 8 types as previously mentioned in STAT menu
2: Data	The data editor screen
3: Sum	The summation sub-menu
4: Var	The statistical variable sub-menu
5: MinMax	The maximum/minimum sub-menu

For Paired-variable statistics / Regression calculations

STATVAR Menu	Meaning
5: Reg	The regression sub-menu
6: MinMax	The maximum/minimum sub-menu

Use options 1~2 to view or change data. Use options 3~6 to select the desired variable to analyze your data.

The values of the statistical variables depend on the data you input. You can recall them by the key operations shown in the below table.

Single–variable statistics calculations

Variables	Keys	Meaning
Σx^2	[3: Sum] [1]	Sum of all x^2 values
Σx	[3: Sum] [2]	Sum of all x values
n	[4: Var] [1]	Number of the x values entered
$\bar{x}$	[4: Var] [2]	Mean of the x values
σx	[4: Var] [3]	Population standard deviation of x values
sx	[4: Var] [4]	Sample standard deviation of x values
minX	[5: MinMax] [1]	Minimum of x-value
maxX	[5: MinMax] [2]	Maximum of x-value
Q1	[5: MinMax] [3]	First Quartile
med	[5: MinMax] [4]	Median
Q3	[5: MinMax] [5]	Third Quartile

Paired-variable statistics / Regression calculations

Variables	Keys	Meaning
Σx Σy	[3: Sum] [2] [3: Sum] [4]	Sum of all x values or y values
Σx^2 Σy^2	[3: Sum] [1] [3: Sum] [3]	Sum of all x^2 values or y^2 values
Σx^3 Σx^4	[3: Sum] [6] [3: Sum] [8]	Sum of all x^3 values or x^4 values
Σxy	[3: Sum] [5]	Sum of (x • y) for all x-y pairs
$\Sigma x^2 y$	[3: Sum] [7]	Sum of (x^2 • y) for all x-y pairs
n	[4: Var] [1]	Number of x-y pairs entered
$\bar{x}$ $\bar{y}$	[4: Var] [2] [4: Var] [5]	Mean of the x values or y values
σx σy	[4: Var] [3] [4: Var] [6]	Population standard deviation of x values or y values
sx sy	[4: Var] [4] [4: Var] [7]	Sample standard deviation of x values or y values

minX minY	[6: MinMax] [1] [6: MinMax] [3]	Minimum of x-value or y value
maxX maxY	[6: MinMax] [2] [6: MinMax] [4]	Maximum of x-value or y-value
A	[5: Reg] [1]	Regression coefficient constant term A
B	[5: Reg] [2]	Regression coefficient B

For non-Quadratic Regression :

r	[5: Reg] [3]	Correlation coefficient r
$\hat{x}$	[5: Reg] [4]	Estimated value of x
$\hat{y}$	[5: Reg] [5]	Estimated value of y

For Quadratic Regression (_+CX^2) only :

C	[5: Reg] [3]	Quadratic coefficient C of the regression coefficients
$\hat{x}1$	[5: Reg] [4]	Estimated value of x1
$\hat{x}2$	[5: Reg] [5]	Estimated value of x2
$\hat{y}$	[5: Reg] [6]	Estimated value of y

You also can add a new data anytime. The unit automatically recalculates statistics each time you press [=] and enter a new data value.

■ To view or change data

1. Press [2nd] [STATVAR] [2] to enter Editor Screen.
2. Press [▼] or [▲] to scroll through the data you have entered.
3. To ***change*** an entry, display it and enter the new data. The new data you enter overwrites the old entry. Press [=] to save the change.
4. To ***delete*** an entry, position the cursor on the line you want to delete, press [DEL].
5. To ***insert*** an entry, position the cursor on the line above where you want to insert, press [2nd] [STATVAR] [3] and then select [1] (Ins) to create a new blank entry, fill the new data in the blank and press [=].
6. To ***delete all*** entries, press [2nd] [STATVAR] [3] and then select [2] (Del-A) to clear all data on the Editor Screen.

(Note) : Statistical data and results are retained when the calculator is turned off, but are cleared when you change calculation types, FREQ setting or clear data by selecting Del-A command from STATVAR menu.

Verfiy Calculations

Use VERIF ([MODE] 3 (VERIF)) mode for compare of two values. See Example 46

You can enter the following expressions for check mode VERIFY.

1) Equalities or inequalities involving a relational operator

   $4 = \sqrt{16}$; $4 \neq 3$; $\pi > 3$; $1+2 \leqq 5$; $(3x6) < (2+6)x2$; etc.

2) Equalities or inequalities involving multiple relational operator

   $1 \leqq 1 < 1+1$; $3 < \pi < 4$; $2^2 = 2+2 = 4$; $2+2 = 4 < 6$;

   $2+3 = 5 \neq 2+5 = 8$; etc.

Pressing the [2nd][VERIFY] key displays a menu of functions. Press the number key that corresponds to the function you want to input.

[2nd][VERIFY]

1: =	2: ≠
3: >	4: <
5: ≥	6: ≤

Example

Example 1

➢ 【Math】: $1\frac{2}{3}+\frac{5}{6}=\frac{5}{2}$

1 [2nd] [A b/c] 2 [▼] 3 [▶] [+] [d/c] 5 [▼] 6 [▶] [=]	Math ▲

Example 2

➢ 【Math】: $(1+\sqrt{2})^2 \times 2 = 11.65685425$

[(] 1 [+] [√] 2 [▶] [)] [x^2] [x] 2 [=]	Math ▲ $(1+\sqrt{2})^2 \times 2$ 11.65685425

Example 3

➢ 【Math】:14÷0 x 2.3 mistakenly input instead of 14÷10 x 2.3

14 [÷] 0 [x] 2.3 [=]	Math ▲ Math ERROR [AC] :Cancel [◀] [▶] :Goto
[◀] [◀] 1 [=]	Math ▲ 14÷10x2.3 3.22

Example 4

➢ 【Math】: Change 123 x 456 as 12 x 457

123 [x] 456 [=]	Math ▲ 123x456 56088
[▶] [▶] [▶] [▶] [DEL]	Math ▲ 12▌x456
[▶] [▶] [▶] [▶] [DEL] 7	Math ▲ 12x457▌

[=]	Math ▲ 1 2 x 4 5 7 5 4 8 4

Example 5

➢ (1) 【Math】: Put the value 30 into variable A

30 [2nd] [STO] [A]	Math ▲ 3 0 → A 3 0

➢ (2) 【Math】: Multiply 5 to variable A, then put the result into variable B

5 [x] [RCL] [A] [=]	Math ▲ 5 x A 1 5 0
[2nd] [STO] [B]	Math ▲ A n s → B 1 5 0

➢ (3) 【Math】: Clear the value of variable B

0 [2nd] [STO] [B]	Math ▲ 0 → B 0
[RCL] [B]	Math ▲ B 0

Example 6

➢ 【Math】: [(3 x 5) + (56 ÷ 7) + (74 – 8 x 7)] = 41

0 [2nd] [STO] [M]	Math ▲ 0 → M
3 [x] 5 [M+] 56 [÷] 7 [M+] 74 [–] 8 [x] 7 [M+]	M Math ▲ 7 4 – 8 x 7 M + 1 8
[RCL] [M]	M Math ▲ M 4 1
0 [2nd] [STO] [M]	Math ▲ 0 → M 0

Example 7

➢ 【Math】: 7 + 5 x 4 = 27

7 [+] 5 [x] 4 [=]	Math ▲ 7 + 5 x 4 27

Example 8

➢ 【Math】: 2.75 x 10^{-5} = 0.0000275

2.75 [x10^{x}] [(–)] 5 [=]	Math ▲ 2.75 x 10 - 5 0.0000275
[F⇕D]	Math ▲ 2.75 x 10 - 5 $\frac{11}{400000}$

➢ 【Line】: 2.75 x 10^{-5} = 0.0000275

[2nd] [SET UP] [2] (LineIO) 2.75 [x10^{x}] [(–)] 5 [=]	▲ 2.75 x 10 - 5 0.0000275
[2nd] [SET UP] [8] [1] (NORM 1)	▲ 2.75 x 10 - 5 2.75 x 10^{-5}

Example 9

➢ 【Line】: 10000 x 10000 x 100 = 10,000,000,000 = 1 x 10^{10}

10000 [x] 10000 [x] 100 [=]	▲ 10000 x 10000 x 100 1 x 10^{10}

Example 10

➢ 【Math】: 2 x { 7 + 6 x (5 + 4) } = 122

[2nd] [SET UP] [1] (MthIO) [1] (MathO) 2 [( ] 7 [+] 6 [( ] 5 [+] 4 [=]	Math ▲ 2 (7 + 6 (5 + 4 122

Example 11

➢ 【Math】: (2 + 3) x 10^{2} = 500

[( ] 2 [+] 3 [ )] [x] [x10ˣ] 2 [=]	Math ▲ (2 + 3) x 10 2 5 0 0

Example 12

➢ 【Math】: 120 x 30 % = 36

120 [x] 30 [2nd] [%] [=]	Math ▲ 1 2 0 x 3 0 % 3 6

Example 13

➢ 【Math】: 88 ÷ 55 % = 160

88 [÷] 55 [2nd] [%] [=]	Math ▲ 8 8 ÷ 5 5 % 1 6 0

Example 14

➢ 【Line】: 6 ÷ 7 = 0.8571428571…

[2nd] [SET UP] [2] (LineIO) 6 [÷] 7 [=]	▲ 6 ÷ 7 0.8 5 7 1 4 2 8 5 7 1
[2nd] [SET UP] [6] [4] (Fix 4)	FIX ▲ 6 ÷ 7 0.8 5 7 1
[2nd] [SET UP] [6] [2] (Fix 2)	FIX ▲ 6 ÷ 7 0.8 6
[2nd] [SET UP] [7] [5] (Sci 5)	SCI ▲ 6 ÷ 7 8.5 7 1 4 x 10 $^{-1}$
[2nd] [SET UP] [8] [2] (Norm 2)	▲ 6 ÷ 7 0.8 5 7 1 4 2 8 5 7 1

[ENG]	D ▲ 6 ÷ 7 8 5 7.1 4 2 8 5 7 1 x 1 0 $^{-3}$
[2nd] [◄ENG] [2nd] [◄ENG]	D ▲ 6 ÷ 7 0.0 0 0 8 5 7 1 4 2 x 1 0 ^{3}
[F⇔D]	D ▲ 6 ÷ 7 6 ⌟ 7

Example 15

➢ 【Math】: 123 + 456 = 579 → 789 – 579 = 210

[2nd] [SET UP] [1] (MthIO) [2] (LineO) 123 [+] 456 [=]	Math D ▲ 1 2 3 + 4 5 6 5 7 9
789 [–] [ANS] [=]	Math D ▲ 7 8 9 – A n s 2 1 0

Example 16

➢ 【Math】: ln 7 + log 100 = 3.945910149

[ln] 7 [ )] [+] [log] 100 [=]	Math D ▲ l n (7) + l o g (1 0 0 3.9 4 5 9 1 0 1 4 9

Example 17

➢ 【Math】: $10^{2} + e^{-5}$ = 100.0067379

[2nd] [10^{X}] 2 [▶] [+] [2nd] [e^{X}] [(–)] 5 [=]	Math D ▲ $10^{2} + e^{-5}$ 1 0 0.0 0 6 7 3 7 9

Example 18

➢ 【Line】: $7\frac{2}{3} + 14\frac{5}{7} = \frac{470}{21}$

[2nd] [SET UP] [2] (LineIO) 7 [d/e] 2 [d/e] 3 [+] 14 [d/e] 5 [d/e] 7 [=]	D ▲ 7 ⌟ 2 ⌟ 3 + 1 4 ⌟ 5 ⌟ 7 4 7 0 ⌟ 2 1

Example 19

➢ 【Line】: $4\frac{2}{4}=\frac{9}{2}=4\frac{1}{2}=4.5$

4 [d/e] 2 [d/e] 4 [=]	D ▲ 4 ⌟ 2 ⌟ 4 9 ⌟ 2
[2nd] [A b/c ◆▶ d/e]	D ▲ 4 ⌟ 2 ⌟ 4 4 ⌟ 1 ⌟ 2
[F◆▶D]	D ▲ 4 ⌟ 2 ⌟ 4 4.5
[F◆▶D]	D ▲ 4 ⌟ 2 ⌟ 4 9 ⌟ 2

Example 20

➢ 【Line】: $8\frac{4}{5}+3.75=12.55$

8 [d/e] 4 [d/e] 5 [+] 3.75 [=]	D ▲ 8 ⌟ 4 ⌟ 5 + 3 . 7 5 1 2.5 5

Example 21

➢ 【Line】: 90 deg. = 1.57079632679 rad. = 100 grad.

[2nd] [SET UP]	. . . . . ▼ 3 : D e g 4 : R a d 5 : G r a . . . . .
[4] (Rad) 90 [2nd] [DRG▶]	1 : ° 2 : r 3 : g
[1] (°) [=]	R ▲ 9 0 ° 1.5 7 0 7 9 6 3 2 7
[2nd] [SET UP] [5] (Gra) [=]	G ▲ 9 0 ° 1 0 0

Example 22

➢ 【Line】: 12.755 = 12 ° 45 ’ 18 ”

[2nd] [SET UP] [3] (Deg) 12.755 [=]	D ▲ 12.755 12.755
[DMS]	D ▲ 12.755 12°45’18”

Example 23

➢ 【Line】: 2 ° 45 ’ 10.5 ” + 25 ’ 30 ” = 3 ° 10 ’ 40.5 ”

2 [DMS] 45 [DMS] 10.5 [DMS] [+] 0 [DMS] 25 [DMS] 30 [DMS] [=]	D ▲ 2□45□10.5□+0□25▷ 3°10’40.5”

Example 24

➢ 【Math】: sin 30 deg.= 0.5

[2nd] [SET UP] [1] (MthIO) [2] (LineO) [SIN] 30 [=]	Math D ▲ sin(30 0.5

Example 25

➢ 【Math】: 3 cos ($\frac{2}{3}\pi$ rad) = -1.5

[2nd] [SET UP] [4] (Rad) 3 [COS] 2 [÷] 3 [x] [2nd] [π] [=]	Math R ▲ 3cos(2÷3xπ -1.5

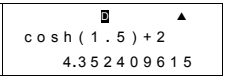
Example 26

➢ 【Math】: 3 $\sin^{-1}$ 0.5 = 90 deg

[2nd] [SET UP] [3] (Deg) 3 [2nd] [$\sin^{-1}$] 0.5 [=]	Math D ▲ 3sin^{-1}(0.5 90

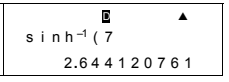
Example 27

➢ 【Line】: cosh 1.5 + 2 = 4.352409615

[2nd] [SET UP] [2] (LineIO) [HYP] [2] (cosh) 1.5 [ )] [+] 2 [=]	

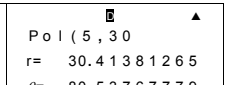
Example 28

➢ 【Line】: $\sinh^{-1} 7 = 2.644120761$

[HYP] [4] ($\sinh^{-1}$) 7 [=]	

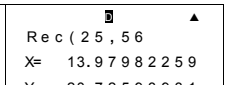
Example 29

➢ 【Line】: If x = 5, y = 30, what are r, θ ? Ans : r = 30.41381265, θ = 80.53767779 °

[2nd] [SET UP] [2] (LineIO) [2nd] [R↔P] 5 [2nd] ['] 30 [=]	

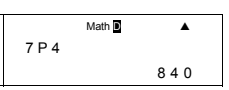
Example 30

➢ 【Line】: If r = 25, θ = 56 ° what are x , y ? Ans : x = 13.97982259, y = 20.72593931

[AC] [2nd] [P→R] 25 [2nd] ['] 56 [=]	

Example 31

➢ 【Math】: $\frac{7!}{[(7-4)]!} = 840$

[2nd] [SET UP] [1] (MthIO) [2] (LineO) 7 [2nd] [nPr] 4 [=]	

Example 32

➢ 【Math】: $\frac{7!}{4![(7-4)]!} = 35$

7 [2nd] [nCr] 4 [=]	Math ▲ 7 C 4 3 5

Example 33

➢ 【Math】: 5 ! = 120

5 [x !] [=]	Math ▲ 5 ! 1 2 0

Example 34

➢ 【Line】: Generates a random number between 0.000 ~ 0.999

[2nd] [SET UP] [2] (LineIO) [2nd] [RAND] [=]	▲ R a n # 0.4 4 9

Example 35

➢ 【Line】: Generates a random integer number between 3 ~ 9

[ALPHA] [RANDI] 3 [2nd] [,] 9 [=]	▲ R a n I n t # (3 , 9 7

Example 36

➢ 【Line】: 65656 = 2^3 x 29 x 283

65656 [=] [2nd] [FACT]	▲ 6 5 6 5 6 2 ^ 3 x 2 9 x 2 8 3
[2nd] [FACT]	▲ 6 5 6 5 6 6 5 6 5 6

Example 37

➢ 【Line】: $\frac{1}{1.25} = 0.8$

1.25 [x^{-1}] [=]	D ▲ 1.25^{-1} 0.8

Example 38

➢ 【Line】: $2^2+\sqrt{4+21}+\sqrt[3]{125}+5^3=139$

2 [x^2] [+] [$\sqrt{\ }$] 4 [+] 21 [ )] [+] [2nd] [$\sqrt[3]{\ }$] 125 [ )] [+] 5 [x^3] [=]	D ▲ $2^2+\sqrt{}(4+21)+\sqrt[3]{}(1\triangleright$ 139

Example 39

➢ 【Line】: $7^5+\sqrt[4]{625}=16812$

7 [x^y] 5 [ )] [+] 4 [2nd] [$\sqrt[x]{\ }$] 625 [=]	D ▲ $7\wedge(5)+4\sqrt[x]{}(625$ 16812

Example 40

➢ 【Line】: $|2.5-9.8|=7.3$

[Abs] 2.5 [–] 9.8 [ )] [=]	D ▲ Abs (2.5 – 9.8) 7.3

Example 41

➢ 【Line】: 9 ÷ 7 = 1.285714286, RND (9 ÷ 7) = 1.286

[2nd] [SET UP]	▼ 5 : Gra 6 : Fix 7 : Sci 8 : Norm
[6] [3] (Fix 3) [2nd] [RND] 9 [÷] 7 [=]	D FIX ▲ Rnd (9 ÷ 7 1.286
[x] 7 [=]	D FIX ▲ Ans x 7 9.002
[2nd] [CLR] [1] (Clear Setup) [=] [AC]	Math D ▮

Example 42

➢ 【Math】: GCD(42,18) = 6

[ALPHA] [GCD] 42 [2nd] [,] 18 [=]	Math ▲ GCD(42,18 6

Example 43

➢ 【Math】: LCM(42,18) = 126

[ALPHA] [LCM] 42 [2nd] [,] 18 [=]	Math ▲ LCM(42,18 126

Example 44

➢ 【Math】: Use Multi-statement function to perform the two statements below: (B = 15)

$$\begin{cases} B \times 13 = 195 \\ 180 \div B = 12 \end{cases}$$

[2nd] [SET UP] [1] (MthIO) [2] (LineO) 15 [2nd] [STO] [B]	Math ▲ 15→B 15
[AC] [ALPHA] [B] [x] 13 [ALPHA] [:] 180 [÷] [ALPHA] [B]	Math ▲ Bx13:180÷B
[=]	Math ▲ Disp Bx13 195
[=]	Math ▲ 180÷B 12

Example 45

➢ Enter X and Y for the following data using linear regression (A+BX), then find out n= 8, $\bar{x}$ = 2.875, $\bar{y}$ = 6.875, σx = 1.053268722, sy = 1.125991626, maxX = 4. Σx^2 = 75, and A = 4 and estimate $\hat{x}$ = ? for y = -3 and $\hat{y}$ = ? for x = 2

X	1	2	3	4
Y	5	6	7	8
FREQ.	1	2	2	3

[2nd] [SET UP] [▼] [3] (STAT)	Frequency? 1:ON 2:OFF
[1] (ON)	Math ▌
[MODE] [2] (STAT)	1:1 - VAR 2:A + BX 3:_ + CX² 4:ln X 5:e ^ X 6:A•B ^ X 7:A•X ^ B 8:1 / X
[2] (A+BX) 1 [=] 2 [=] 3 [=] 4 [=] [▼] [▶] 5 [=] 6 [=] 7 [=] 8 [=] [▼] [▶] 1 [=] 2 [=] 2 [=] 3 [=]	STAT X Y FREQ 3 3 7 2 4 4 8 3 5
[AC]	STAT ▌ 0
[2nd] [STATVAR] [4] [1] [=]	STAT n 8
[2nd] [STATVAR] [4] [2] [=]	STAT $\bar{x}$ 2.875
[2nd] [STATVAR] [4] [5] [=]	STAT $\bar{y}$ 6.875
[2nd] [STATVAR] [4] [3] [=]	STAT σx 1.053268722
[2nd] [STATVAR] [4] [7] [=]	STAT sy 1.125991626
[2nd] [STATVAR] [6] [2] [=]	STAT maxX 4

[2nd] [STATVAR] [3] [1] [=]	STAT $\sum x^2$ 7 5
[2nd] [STATVAR] [5] [1] [=]	STAT A 4
[(-)] [3] [2nd] [STATVAR] [5] [4] [=]	STAT - 3 $\hat{x}$ - 7
[2] [2nd] [STATVAR] [5] [5] [=]	STAT 2 $\hat{y}$ 6

Example 46

➢ 【Math】: $6^2 = \sqrt{1296} < 48$

[MODE] 3 (VERIF)	Math ▌ TRUE / FALSE
6 [x^2] [2nd] [VERIFY]	1: = 2: ≠ 3: > 4: < 5: ≥ 6: ≤
[1] (=) [$\sqrt{\ }$] 1296 [▶] [2nd] [VERIFY] [4] (<) 48 [=]	Math ▲ $6^2 = \sqrt{1296} < 48$ TRUE

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