CITIZEN

SR-281 / SR-282

Scientific Calculator

General Guide

Turning on or off

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

Battery replacement

SR-281 is powered by two alkaline batteries (GP76A or LR44).

SR-282 is powered two AA-size (UM-3) batteries. If the display becomes dim and difficult to read, the batteries should be replaced as soon as possible.

To replace batteries :

1) Slide the battery compartment cover in the direction indicated by the arrow and remove it.
2) Remove the old batteries and install new ones with polarity in correct directions, then replace the battery compartment cover and press [ON/C].

Auto power-off function

This calculator automatically turns it off when not operated for approximately 6~9 minutes. It can be reactivated by pressing [ON/C] key and the display, memory, settings are retained.

Reset operation

If the calculator is on but you get unexpected results, press [MODE] [4] (RESET) in sequence. A message appears on the display to confirm whether you want to reset the calculator and clear memory contents.

RESET : N Y

Move the cursor to " Y " by [→], then press [ENTER] to clear all variables, pending operations, statistical data, answers, all previous entries, and memory; To cancel the reset operation without clearing the calculator, please choose " N ".

If the calculator is lock and further key operations becomes impossible, please press [0] [CE] at the same time to release the condition. It will return all settings to default settings.

Contrast adjustment

Pressing the [–] or [+] following [MODE] key can make the contrast of the screen lighter or darker. Holding either key down will make the display become respectively lighter or darker.

Display readout

The display comprises two lines and indicators. The upper line is a dot display up to 128 characters. The lower line is capable of displaying a result of up to 12 digits, as well as 2-digits positive or negative exponent.

When formulas are input and executed the calculation by [ENTER], they are displayed on the upper line, and then results are shown on the lower line.

The following indictors appear on the display to indicate you the current status of the calculator.

Indicator	Meaning
M	Running memory
–	Result is negative
E	Error
STO	Storing variable mode is active
RCL	Recalling variable mode is active
2nd	2nd set of function keys are active
HYP	Hyperbolic-trig function will be calculated
ENG	Engineering symbol notation
CPLX	Complex number mode is active
CONST	Display physics constants
DEGRAD	Angle mode : DEGrees, GRADs, or RADs
BIN	Binary base
OCT	Octal base
HEX	Hexadecimal base
( )	Open parentheses
TAB	Number of decimal places displayed is fixed
STAT	Statistics mode is active
REG	Regression mode is active
EDIT	Statistics data is being edited
CPK	CPK : Process capability CP : Precision capability
USL	Set upper specification limit
LSL	Setting lower specification limit
i	Imaginary part
↶	Allow to use undo function

Before Starting Calculation

Using " MODE " keys

Press [MODE] to display mode menus when specifying an operating mode (" 1 MAIN ", " 2 STAT ", " 3 CPLX ", " 4 RESET ") or the engineering symbol notation (" 5 ENG ").

1 MAIN : Use this mode for basic calculations, including scientific calculations and Base–n calculations.

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

3 CPLX : Use this mode to perform complex number calculation.

4 RESET : Use this mode to perform reset operation.

5 ENG : Use this mode to allow engineering calculations utilizing engineering symbol.

Give " 2 STAT " as an example :

Method 1 : Press [MODE] and then scroll through the menus using [→] or [2nd] [↶] until " 2 STAT " is underlined, then enter the desired mode by pressing [ENTER].

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

Using " 2nd " Keys

When you press [2nd], the " 2nd " indicator shown in the display is to tell you 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.

Corrections

If you have made a mistake when entering a number (but you have not yet pressed an arithmetic operator key), just press [CE] to clear the last entry then input it again, or delete individual digits by the backspace key [→], or clear all entry by [ON/C].

After making corrections, input of the formula is complete, the answer can be obtained by pressing [ENTER]. You can also press [ON/C] to clear the immediate results completely (except clearing memory). If you press the wrong arithmetic operation key, just press the correct key to replace it.

Undo function

The unit offers an undo function which allows you to undo some of the errors you just have made.

When a character which is just deleted by [→], an entry which is just cleared [CE], or which is just cleared by [ON/C], the " ↶ " indicator shown in the display is to tell you that you can press [2nd] [↶] to cancel the operation.

Replay function

This function stores operations that just have been executed. After execution is completed, pressing [→] or [2nd] [↶] key will display the operation executed. Pressing [→] will display the operation from the beginning, with the cursor located under the first character. Pressing [2nd] [↶] will display the operation from the end, with the cursor located at the space following the last character. You can continue moving the cursor by [→] or [2nd] [↶] and editing values or commands for subsequent execution.

Memory calculation

Memory variable

The calculator has nine 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.

- [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] [STO] + [A] ~ [F], [M], [X] ~ [Y] clears the content to a specified memory variable.

➢ (1) Put the value 30 into variable A

30 [STO] [A]	DEG 3 0 → A 3 0 .

➢ (2) Multiple 5 to variable A, then put the result into variable B

5 [x] [RCL] [A] [ENTER]	DEG 5 ∗ A = 1 5 0 .
[STO] [B]	DEG 1 5 0 → B 1 5 0 .

➢ (3) Clear the value of variable B

0 [STO] [B]	DEG 0 → B 0 .

[RCL] [B] [ENTER]	DEG B = 0.

Running memory

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

- Press [M+] to add a result to running memory and the " M " indicator appears when a number is stored in the memory. Press [MR] to recall the content of running memory.
- Recalling from running memory by pressing [MR] 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 [X→M] key.
- To clear the content of running memory, you can press [0] [X→M], [CE] [X→M] or [0] [STO] [M] in sequence.

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

0 [X→M]	DEG 0.
3 [x] 5 [M+] 56 [÷] 7 [M+] 74 [–] 8 [x] 7 [M+]	DEG 7 4 – 8 ∗ 7 M + M 1 8.
[MR]	DEG M M 4 1.
0 [X→M]	DEG 0.

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

Order of operations

Each calculation is performed in the following order of precedence:

1) Fractions
2) Expression inside parentheses.
3) Coordinates transformation (P→R , R→P)
4) Type A functions which are required entering values before pressing the function key, for example, x^2,1/x, π, x!, %, RND, ENG, ○,,,→ , →○,,,, x ', y ' .
5) x^y, $\sqrt[x]{\ }$
6) Type B functions which are required pressing the function key before entering, for example, sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$, $\tanh^{-1}$, log, ln, FRAC, INT, $\sqrt{\ }$, $\sqrt[3]{\ }$, 10^x, e^x, NOT, EXP, DATA in STAT mode.
7) + / –, NEG
8) nPr, nCr
9) x ,÷
10) +, –
11) AND, NAND –--- only Base–n mode
12) OR, XOR, XNOR --- only Base–n mode

Accuracy and Capacity

Output digits : Up to 12 digits.

Calculating digits : Up to 14 digits

In general, every reasonable calculation is displayed up to 12 digits mantissa, or 12-digits mantissa plus 2-digits exponent up to $10^{\pm 99}$.

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

Functions	Input range
sin x cos x tan x	Deg : $\lvert x \rvert < 4.5 \times 10^{10}$ deg Rad : $\lvert x \rvert < 2.5 \times 10^{8} \pi$ rad Grad : $\lvert x \rvert < 5 \times 10^{10}$ grad however, for tan x Deg : $\lvert x \rvert \neq 90\ (2n+1)$ Rad : $\lvert x \rvert \neq \frac{\pi}{2}\ (2n+1)$ Grad : $\lvert x \rvert \neq 100\ (2n+1)$, (n is an integer)
$\sin^{-1} x$, $\cos^{-1} x$	$\lvert x \rvert \leqq 1$
$\tan^{-1} x$	$\lvert x \rvert < 1 \times 10^{100}$
sinh x, cosh x	$\lvert x \rvert \leqq 230.2585092$

$\tanh x$	$\lvert x \rvert < 1 \times 10^{100}$
$\sinh^{-1} x$	$\lvert x \rvert < 5 \times 10^{99}$
$\cosh^{-1} x$	$1 \leqq x < 5 \times 10^{99}$
$\tanh^{-1} x$	$\lvert x \rvert < 1$
$\log x$, $\ln x$	$1 \times 10^{-99} \leqq x < 1 \times 10^{100}$
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	$\lvert x \rvert < 2.15443469003 \times 10^{33}$
$1/x$	$\lvert x \rvert < 1 \times 10^{100}$, $x \neq 0$
$\sqrt[3]{x}$	$\lvert x \rvert < 1 \times 10^{100}$
X !	$0 \leqq x \leqq 69$, x is an integer.
R→P	$\sqrt{x^2 + y^2} < 1 \times 10^{100}$
P→R	$0 \leqq r < 1 \times 10^{100}$ Deg : $\lvert \theta \rvert < 4.5 \times 10^{10}$ deg Rad : $\lvert \theta \rvert < 2.5 \times 10^{8} \pi$ rad Grad : $\lvert \theta \rvert < 5 \times 10^{10}$ grad however, for tan x Deg : $\lvert \theta \rvert \neq 90\ (2n+1)$ Rad : $\lvert \theta \rvert \neq \frac{\pi}{2}\ (2n+1)$ Grad : $\lvert \theta \rvert \neq 100\ (2n+1)$, (n is an integer)
→°′″	$\lvert D \rvert$, M, S $< 1 \times 10^{100}$, $0 \leqq$ M, S
°′″→	$\lvert x \rvert < 1 \times 10^{100}$
x^y	$x > 0$: $-1 \times 10^{100} < y \log x < 100$ $x = 0$: $y > 0$ $x < 0$: y = n, 1/(2n+1), n is an integer. 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, l/n, n is an integer.($n \neq 0$)

	but $-1 \times 10^{100} < \frac{1}{x}\log\ \lvert y \rvert < 100$
$a\ ^{b}/_{c}$	Input：Total of integer, numerator and denominator must be within 12 digits (includes division marks) Result：Result displayed as fraction for integer when integer, numerator and denominator are less than 1×10^{12}
nPr, nCr	$0 \leqq r \leqq n$, $n \leqq 10^{100}$, n,r are integers.
STAT	$\lvert x \rvert < 1 \times 10^{50}$, $\lvert y \rvert < 1 \times 10^{50}$ $\sigma x, \sigma y, \overline{x}, \overline{y}$, a, b, r : $n \neq 0$; Sx, Sy：$n \neq 0, 1$; $x_n = 50$; $y_n = 50$; Number of repeats ≤ 255, n is an integer.
→DEC	$-2147483648 \leqq X \leqq 2147483647$
→BIN	$0 \leqq X \leqq$ 01111111111111111111111111111111 (for zero or positive) 10000000000000000000000000000000 ≦ X ≦11111111111111111111111111111111 (for negative)
→OCT	$0 \leqq X \leqq$ 17777777777 (for zero or positive) 20000000000 ≦ X ≦ 37777777777 (for negative)
→HEX	$0 \leqq X \leqq$ 7FFFFFFF (for zero or positive) 80000000 ≦ X ≦ FFFFFFFF (for negative)

Error conditions

Error message " **E** " will appear on the display and further calculation becomes impossible when any of the following condition occur.

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 the [( ] key is used more than 13 levels in a single expression
5) When USL < LSL value

To release the above errors, please press [ON/C].

Basic Calculations

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

Arithmetic calculation

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

➢ 7 + 5 x 4 = 27

7 [+] 5 [x] 4 [ENTER]	DEG 7 + 5 × 4 = 27.

For negative values, press [+/–] after entering the value; You can enter a number in mantissa and exponent form by [EXP] key.

➢ 2.75 x 10^{-5} = 0.0000275

2.75 [EXP] 5 [+/–] [ENTER]	DEG 2.75E–05 = 0.0000275

Results greater than 10^{12} or less than 10^{-11} are displayed in exponential form.

➢ 12369 x 7532 x 74103 = 6903680612720
= 6.90368061272 x 10^{12}

12369 [x] 7532 [x] 74103 [ENTER]	DEG 12369 × 7532 × 7 6.90368061272 12

Parentheses calculations

Operations inside parentheses are always executed first. **SR-281** / **SR-282** can use up to 13 levels of consecutive parentheses in a single calculation.

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

➢ 2 x { 7 + 6 x (5 + 4) } = 122

2 [( ] 7 [+] 6 [( ] 5 [+] 4 [ENTER]	DEG 2 × (7 + 6 × (5 + 4 = 122.

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

The correct result cannot be derived by entering [( ] 2 [+] 3 [ )] [EXP] 2. Be sure to enter [x] between the [ )] and [EXP] in the below example.

➢ (2 + 3) x 10^{2} = 500

[( ] 2 [+] 3 [ )] [x] [EXP] 2 [ENTER]	DEG (2 + 3) × 1 E 0 2 = 5 0 0.

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.

➢ 120 x 30 % = 36

120 [x] 30 [2nd] [%] [ENTER]	DEG 1 2 0 × 3 0 % = 3 6.

➢ 88 ÷ 55 % = 160

88 [÷] 55 [2nd] [%] [ENTER]	DEG 8 8 ÷ 5 5 % = 1 6 0.

Display notations

The calculator has the following display notations for the display value.

Fixed-point / Floating Notations

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

Scientific Notation

To change the display mode between floating and scientific notation, press [F↔E].

Engineering Notation

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

➢ 6 ÷ 7 = 0.85714285714…

6 [÷] 7 [ENTER]	DEG 6 ÷ 7 = 0.8 5 7 1 4 2 8 5 7 1 4
[2nd] [TAB] 4	DEG TAB 6 ÷ 7 = 0.8 5 7 1

[2nd] [TAB] 2	DEG TAB 6 ÷ 7 = 0.86
[2nd] [TAB] [•]	DEG 6 ÷ 7 = 0.857142857143
[F↔E]	DEG 6 ÷ 7 = 8.571428571429
[ENG]	DEG –03 857.142857143
[2nd] [←] [2nd] [←]	DEG 03 0.000857142857

Engineering Symbol Notation

Each time you specify the ENG mode, a displayed result is automatically shown with the corresponding engineering symbol.

$\overset{\text{yotta}}{\text{Y}} = 10^{24}$, $\overset{\text{zetta}}{\text{Z}} = 10^{21}$, $\overset{\text{exa}}{\text{E}} = 10^{18}$, $\overset{\text{peta}}{\text{P}} = 10^{15}$, $\overset{\text{tera}}{\text{T}} = 10^{12}$, $\overset{\text{giga}}{\text{G}} = 10^{9}$, $\overset{\text{mega}}{\text{M}} = 10^{6}$, $\overset{\text{kilo}}{\text{K}} = 10^{3}$, $\overset{\text{milli}}{\text{m}} = 10^{-3}$, $\overset{\text{micro}}{\mu} = 10^{-6}$, $\overset{\text{nano}}{\text{n}} = 10^{-9}$, $\overset{\text{pico}}{\text{p}} = 10^{-12}$, $\overset{\text{femto}}{\text{f}} = 10^{-15}$, $\overset{\text{atto}}{\text{a}} = 10^{-18}$, $\overset{\text{zepto}}{\text{z}} = 10^{-21}$, $\overset{\text{yocto}}{\text{y}} = 10^{-24}$

Perform the following operation to specify engineering symbol notation.

[MODE] 5 (ENG)

To exit from this mode, press [MODE] 5 once again.

➢ 6 ÷ 7 = 0.85714285714…

[MODE] 5	ENG DEG 0.
6 [÷] 7 [$\overset{\text{ENTER}}{=}$]	ENG DEG 6 ÷ 7 = m 857.142857143
[ENG]	ENG DEG μ 857142.857143

[2nd] [←] [2nd] [←] [2nd] [←]	ENG DEG K 0.000857142857

Scientific Functional Calculations

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

Logarithms and Antilogarithms

The calculator can calculate common and natural logarithms and anti-logarithms using [log], [ln], [2nd] [10^x], and [2nd] [e^x].

➢ ln 7 + log 100 = 3.94591014906

[ln] 7 [+] [log] 100 [ENTER]	DEG ln 7 + log 100 3.945910149060

➢ $10^2 + e^{-5}$ = 100.006737947

[2nd] [10^x] 2 [+] [2nd] [e^x] 5 [+/–] [ENTER]	DEG 10 ^ 2 + e ^ – 5 = 100.006737947

Fraction calculation

Fraction value display is as follow :

5 ⌟ 12	Display of $\frac{5}{12}$	56 ∪ 5 ⌟ 12	Display of $56\frac{5}{12}$

(Note): Values are automatically displayed in decimal format whenever the total number of digits of a fractional values (integer + numerator + denominator + separator marks) exceeds 12.

To enter a mixed number, enter the integer part, press [$a^{b/c}$], enter the numerator, press [$a^{b/c}$], and enter the denominator ; To enter an improper fraction, enter the numerator, press [$a^{b/c}$], and enter the denominator.

➢ $7\frac{2}{3}+14\frac{5}{7}=22\frac{8}{21}$

7 [$a^{b/c}$] 2 [$a^{b/c}$] 3 [+] 14 [$a^{b/c}$] 5 [$a^{b/c}$] 7 [ENTER]	DEG 7 ⌟ 2 ⌟ 3 + 14 ⌟ 5 ⌟ 7 22 ⌟ 8 ⌟ 21.

During a fraction calculation, if the figure is reducible, a figure is reduced to the lowest terms after pressing a function command key ([+], [–], [x] or [÷]) or the [ENTER] key. By pressing [2nd]

[$\rightarrow d/e$], the displayed value will be converted to the improper fraction and vice versa. To convert between a decimal and fractional result, press [$a\ b/c$].

➢ $4\frac{2}{4} = 4\frac{1}{2} = 4.5 = \frac{9}{2}$

4 [$a\ b/c$] 2 [$a\ b/c$] 4 [ENTER]	DEG 4 ⌴ 2 ⌟ 4 = 4 ⌴ 1 ⌟ 2.
[$a\ b/c$]	DEG 4 ⌴ 2 ⌟ 4 = 4.5
[2nd] [$\rightarrow d/e$]	DEG 4 ⌴ 2 ⌟ 4 = 9 ⌟ 2.
[2nd] [$\rightarrow d/e$]	DEG 4 ⌴ 2 ⌟ 4 = 4 ⌴ 1 ⌟ 2.

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

➢ $8\frac{4}{5} + 3.75 = 12.55$

8 [$a\ b/c$] 4 [$a\ b/c$] 5 [+] 3.75 [ENTER]	DEG 8 ⌴ 4 ⌟ 5 + 3 . 7 5 = 1 2.5 5

Angle unit conversions

The calculator enables you to convert an angle unit among degrees(DEG), radians(RAD), and grads(GRAD).

The relation among the three angle units is :

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

1) To change the default setting to another setting, first press [2nd] [DRG] key repeatedly until the angle unit you want is indicated in the display.
2) After entering a value, press [2nd] [DRG$\rightarrow$] repeatedly until the unit you want is displayed.

➢ 90 deg. = 1.57079632679 rad. = 100 grad.

[2nd] [DRG]	DEG 0.

90 [2nd] [DRG→]	RAD 90 °= 1.570796326790
[2nd] [DRG→]	GRAD 1.570796326790 100.

Sexagesimal ↔ Decimal transformation

The calculator enables you to convert the sexagesimal figure (degree, minute and second) to decimal notation by pressing [°’’’→] or convert the decimal notation to the sexagesimal notation by [2nd] [→°’’’].

Sexagesimal figure value display is as follow :

125 □ 45 ' 30 '' 55	Represent 125 degrees (D), 45 minutes(M), 30.55 seconds(S)

(Note) : The total digits of D, M and S and separator marks must be within 12 digits, or the sexagesimal couldn't be shown completely.

➢ 12.755 = 12 □ 45 ' 18 ''

12.755 [2nd] [→°’’’]	DEG 12 □ 45 ' 18 ''

➢ 2 □ 45 ' 10.5 '' = 2.75291666667

2 [°’’’→] 45 [°’’’→] 10.5 [°’’’→]	DEG 2.752916666667

Trigonometric / Inverse-Tri. functions

SR-281 / **SR-282** provides standard trigonometric functions and inverse trigonometric functions - sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$.

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

➢ sin 30 deg.= 0.5

[sin] 30 [ENTER]	DEG sin30= 0.5

➢ $3 \cos (\frac{2}{3}\pi \text{ rad}) = -1.5$

3 [cos] [( ] 2 [x] [2nd] [π] [÷] 3 [ENTER]	RAD 3 ∗ c o s (2 ∗ π ÷ 3 = – 1.5

➢ $3 \sin^{-1} 0.5 = 90 \text{ deg}$

3 [2nd] [$\sin^{-1}$] 0.5 [ENTER]	DEG 3 ∗ s i n $^{-1}$ 0 . 5 = 90 .

Hyperbolic / Inverse-Hyp. functions

SR-281 / **SR-282** uses [2nd] [HYP] to calculate the hyperbolic functions and inverse-hyperbolic functions - sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$ and $\tanh^{-1}$.

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

➢ cosh 1.5 + 2 = 4.35240961524

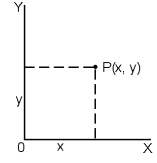
[2nd] [HYP] [cos] 1.5 [+] 2 [ENTER]	DEG c o s h 1 . 5 + 2 = 4.3524096152 4

➢ $\sinh^{-1} 7 = 2.64412076106$

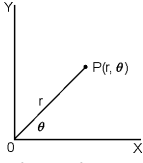
[2nd] [HYP] [2nd] [$\sin^{-1}$] 7 [ENTER]	DEG s i n h 1 $^{-1}$ 7 = 2.6441207610 6

Coordinates transformation

Rectangular Coordinates



Polar Coordinates



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

(Note) : When using those key, 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].

➢ If x = 5, y = 30, what are r, θ ? Ans : r = 30.4138126515, θ = 80.537677792 °

[2nd] [R→P] 5 [2nd] ['] 30	DEG ( ) R→P (5 , 3 0
[ENTER]	DEG r 30.4 1 3 8 1 2 6 5 1 5
[2nd] [x ↔y]	DEG θ 8 0.5 3 7 6 7 7 7 9 2

➢ If r = 25, θ = 56 ° what are x, y ? Ans : x = 13.9798225868, y = 20.7259393139

[2nd] [P→R] 25 [2nd] ['] 56	DEG ( ) P→R (2 5 , 5 6
[ENTER]	DEG X 13. 9 7 9 8 2 2 5 8 6 8
[2nd] [x ↔y]	DEG Y 2 0.7 2 5 9 3 9 3 1 3 9

Probability

This calculator provides the following probability functions :

[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 positive integer n, where n≦69.

[RND] Generates a random number between 0.000 and 0.999

➢ $\frac{7!}{[(7-4)]!} = 840$

7 [2nd] [nPr] 4 [ENTER]	DEG 7 P 4 = 8 4 0.

➢ $\frac{7!}{4![(7-4)]!} = 35$

7 [2nd] [nCr] 4 [ENTER]	DEG 7 C 4 = 35.

➢ 5 ! = 120

5 [2nd] [X !] [ENTER]	DEG 5 ! 120.

➢ Generates a random between 0.000 ~ 0.999

[2nd] [RND]	DEG Rnd 0.449

Other functions (1/x, $\sqrt{}$, $\sqrt[3]{}$, $\sqrt[x]{}$, x^2, x^3, x^y, INT, FRAC)

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

➢ $\frac{1}{1.25} = 0.8$

1.25 [2nd] [1 / x] [ENTER]	DEG 1.25^{-1} 0.8

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

2 [x^2] [+] [$\sqrt{}$] [( ] 4 [+] 21 [ )] [+] [2nd] [$\sqrt[3]{}$] 125 [+] 5 [2nd] [x^3] [ENTER]	DEG $2^2 + \sqrt{}(4+21) +$ 139.

➢ $7^5 + \sqrt[4]{625} = 16812$

7 [x^y] 5 [+] 4 [$\sqrt[x]{}$] 625 [ENTER]	DEG $7\ x^y\ 5 + 4\ \sqrt[x]{}\ 625 =$ 16812.

INT Indicate the integer part of a given number

FRAC Indicate the fractional part of a given number

➢ INT (10 ÷ 8) = INT (1.25) = 1

[2nd] [INT] 10 [÷] 8 [ENTER]	DEG INT (10 ÷ 8 = 1.

➢ FRAC (10 ÷ 8) = FRAC (1.25) = 0.25

[2nd] [FRAC] 10 [÷] 8 [ENTER]	DEG FRAC (10÷8 = 0.25

Unit Conversion

The calculator has a built-in unit conversion feature that enables you to convert numbers among different units.

1. Enter the number you want to convert.
2. Press [CONV] to display the menu. There are 7 menus, covering distance, area, temperature, capacity, weight, energy, and pressure.
3. Use the [CONV] to scroll through the list of units until a appropriate units menu is shown, then [ENTER].
4. Pressing [→] or [2nd] [↶] can convert the number to another unit.

➢ 1 yd^2 = 9 ft^2 = 0.00000083612 km^2

1 [CONV] [CONV] [→] [ENTER]	DEG ft^2 $\underline{yd^2}$ m^2 1.
[2nd] [↶]	DEG $\underline{ft^2}$ yd^2 m^2 9.
[→] [→] [→]	DEG $\underline{km^2}$ hectares 0.000000083612

Physics constants

You can use 136 physics constants in your calculations. With the following constants :

Data is referred to Peter J.Mohr and Barry N.Taylor, CODATA Recommended Values of the Fundamental Physical Constants:1998, Journal of Physical and Chemical Reference Data,Vol.28, No.6,1999 and Reviews of Modern Physics,Vol.72, No.2, 2000.

No.	Quantity	Symbol	Value, Unit
1.	Speed of light in vacuum	c	299792458 $m\ s^{-1}$
2.	Magnetic constant	μ_0	$1.2566370614 \times 10^{-6}\ N\ A^{-2}$
3.	Electric constant	ε_0	$8.854187817 \times 10^{-12}\ F\ m^{-1}$
4.	Characteristic impedance of vacuum	Z_0	376.730313461 Ω

5.	Newtonian constant of gravitation	G	$6.67310 \times 10^{-11}\ m^3\ kg^{-1}\ s^{-2}$
6.	Planck constant	h	$6.6260687652 \times 10^{-34}$ J s
7.	Planck constant over 2 pi	$\hbar$	$1.05457159682 \times 10^{-34}$ J s
8.	Avogadro constant	N_A	$6.0221419947 \times 10^{23}\ mol^{-1}$
9.	Planck length	l_P	1.616012×10^{-35} m
10.	Planck time	t_P	5.390640×10^{-44} s
11.	Planck mass	m_P	2.176716×10^{-8} kg
12.	Atomic mass constant	m_μ	$1.6605387313 \times 10^{-27}$ kg
13.	Atomic mass constant energy equivalent	$m_\mu c^2$	$1.4924177812 \times 10^{-10}$ J
14.	Faraday constant	lF	$96485.341539\ C\ mol^{-1}$
15.	Elementary charge	e	$1.60217646263 \times 10^{-19}$ C
16.	Electron volt–joule relationship	eV	$1.60217646263 \times 10^{-19}$ J
17.	Elementary charge over h	e/h	$2.41798949195 \times 10^{14}\ A J^{-1}$
18.	Molar gas constant	R	$8.31447215\ J\ mol^{-1}\ K^{-1}$
19.	Boltzmann constant	k	$1.380650324 \times 10^{-23}\ J\ K^{-1}$
20.	Molar planck constant	$N_A h$	$3.99031268930 \times 10^{-10}$ Js mol^{-1}
21.	Sackur–Tetrode constant	S_0/R	− 1.164867844
22.	Wien displacement law constant	b	$2.897768651 \times 10^{-3}$ m K
23.	Lattice parameter of silicon	a	$543.10208816 \times 10^{-12}$ m
24.	Stefan–Boltzmann constant	σ	$5.67040040 \times 10^{-8}\ W\ m^{-2}\ K^{-4}$
25.	Standard acceleration of gravity	g	$9.80665\ m\ s^{-2}$
26.	Atomic mass unit–kilogram relationship	μ	$1.6605387313 \times 10^{-27}$ kg
27.	First radiation constant	c_1	$3.7417710729 \times 10^{-16}\ W m^2$
28.	First radiation constant for spectral radiance	$c_1 L$	$1.19104272293 \times 10^{-16} W m^2 sr^{-1}$
29.	Second radiation constant	c_2	$1.438775225 \times 10^{-2}$ m K
30.	Molar volume of ideal gas	V_m	$22.41399639 \times 10^{-3}\ m^3\ mol^{-1}$
31.	Rydberg constant	R_∞	$10973731.5685\ m^{-1}$
32.	Rydberg constant in Hz	$R_\infty c$	3.28984196037 x10 ^{15} Hz
33.	Rydberg constant in joules	$R_\infty hc$	$2.1798719017 \times 10^{-18}$ J
34.	Hartree energy	E_h	$4.3597438134 \times 10^{-18}$ J
35.	Quantum of circulation	h/m_e	$7.27389503253 \times 10^{-4}\ m^2\ s^{-1}$
36.	Fine structure constant	α	$7.29735253327 \times 10^{-3}$
37.	Loschmidt constant	n_0	$2.686777547 \times 10^{25}\ m^{-3}$
38.	Bohr radius	a_0	$0.52917720832 \times 10^{-10}$ m
39.	Magnetic flux quantum	Φ_0	$2.06783363681 \times 10^{-15}$ Wb
40.	Conductance quantum	G_0	$7.74809169628 \times 10^{-5}$ S
41.	Inverse of conductance quantum	G_0^{-1}	12906.4037865 Ω

42.	Josephson constant	K_J	483597.89819 x10 ^{9} Hz V $^{-1}$
43.	Von Klitzing constant	R_K	25812.8075730 Ω
44.	Bohr magneton	μ_B	927.40089937 x10 $^{-26}$ J T $^{-1}$
45.	Bohr magneton in Hz/T	μ_B/h	13.9962462456 x10 ^{9} Hz T $^{-1}$
46.	Bohr magneton in K/T	μ_B/k	0.671713112 K T $^{-1}$
47.	Nuclear magneton	μ_N	5.0507831720 x10 $^{-27}$ J T $^{-1}$
48.	Nuclear magneton in MHz/T	μ_N/h	7.6225939631 MHz T $^{-1}$
49.	Nuclear magneton in K/T	μ_N/k	3.658263864 x10 $^{-4}$ K T $^{-1}$
50.	Classical electron radius	r_e	2.81794028531 x10 $^{-15}$ m
51.	Electron mass	m_e	9.1093818872 x10 $^{-31}$ kg
52.	Electron mass energy equivalent	$m_e c^2$	8.1871041464 x10 $^{-14}$ J
53.	Electron–muon mass ratio	m_e/m_μ	4.8363321015 x10 $^{-3}$
54.	Electron–tau mass ratio	m_e/m_τ	2.8755547 x10 $^{-4}$
55.	Electron–proton mass ratio	m_e/m_p	5.44617023212 x10 $^{-4}$
56.	Electron–neutron mass ratio	m_e/m_n	5.43867346212 x10 $^{-4}$
57.	Electron–deuteron mass ratio	m_e/m_d	2.72443711706x10 $^{-4}$
58.	Electron charge to mass quotient	$-e/m_e$	– 1.75882017471 x10^{11} Ckg $^{-1}$
59.	Compton wavelength	λ_C	2.42631021518 x10 $^{-12}$ m
60.	Compton wavelength over 2 pi	$\bar{\lambda}_C$	386.159264228 x10 $^{-15}$ m
61.	Thomson cross section	σ_e	0.66524585415 x10 $^{-28}$ m^2
62.	Electron magnetic moment	μ_e	– 928.47636237x10 $^{-26}$ J T $^{-1}$
63.	Electron magnetic moment to Bohr magneton ratio	μ_e/μ_B	– 1.00115965219
64.	Electron magnetic moment to nuclear magneton ratio	μ_e/μ_N	– 1838.28196604
65.	Electron–muon magnetic moment ratio	μ_e/μ_μ	206.766972063
66.	Electron–proton magnetic moment ratio	μ_e/μ_p	– 658.210687566
67.	Electron–neutron magnetic moment ratio	μ_e/μ_n	960.9205023
68.	Electron–deuteron magnetic moment ratio	μ_e/μ_d	– 2143.92349823
69.	Electron to shielded helion magnetic moment ratio	μ_e/μ'_h	864.05825510
70.	Electron magnetic moment anomaly	a_e	1.15965218694 x10 $^{-3}$
71.	Electron g–factor	g_e	– 2.00231930437
72.	Electron gyromagnetic ratio	γ_e	1.76085979471 x10 ^{11} s $^{-1}$ T $^{-1}$

73.	Muon mass	m_μ	1.8835310916 x10 $^{-28}$ kg
74.	Muon mass energy equivalent	$m_\mu c^2$	1.6928333214 x10 $^{-11}$ J
75.	Muon–tau mass ratio	m_μ/m_τ	5.9457297 x10 $^{-2}$
76.	Muon–proton mass ratio	m_μ/m_p	0.11260951733
77.	Muon–neutron mass ratio	m_μ/m_n	0.11245450793
78.	Muon magnetic moment anomaly	a_μ	1.1659160264 x10 $^{-3}$
79.	Muon g–factor	g_μ	– 2.00233183201
80.	Muon Compton wavelength	$\lambda_{c,\mu}$	11.7344419735 x10 $^{-15}$ m
81.	Muon Compton wavelength over 2 pi	$\bar{\lambda}_{c,\mu}$	1.86759444455 x10 $^{-15}$ m
82.	Muon magnetic moment	μ_μ	– 4.4904481322x10 $^{-26}$ J T $^{-1}$
83.	Muon magnetic moment to Bohr magneton ratio	μ_μ/μ_B	– 4.8419708515 x10 $^{-3}$
84.	Muon magnetic moment to nuclear magneton ratio	μ_μ/μ_N	– 8.8905977027
85.	Muon–proton magnetic moment ratio	μ_μ/μ_p	– 3.1833453910
86.	Tau Compton wavelength	$\lambda_{c,\tau}$	0.6977011 x10 $^{-15}$ m
87.	Tau Compton wavelength over 2 pi	$\bar{\lambda}_{c,\tau}$	0.11104218 x10 $^{-15}$ m
88.	Tau mass	m_τ	3.1678852 x10 $^{-27}$ kg
89.	Tau mass energy equivalent	$m_\tau c^2$	2.8471546 x10 $^{-10}$ J
90.	Tau–proton mass ratio	m_τ/m_p	1.8939631
91.	Proton Compton wavelength	$\lambda_{c,p}$	1.32140984710 x10 $^{-15}$ m
92.	Proton Compton wavelength over 2 pi	$\bar{\lambda}_{c,p}$	0.21030890892 x10 $^{-15}$ m
93.	Proton mass	m_p	1.6726215813 x10 $^{-27}$ kg
94.	Proton mass energy equivalent	$m_p c^2$	1.5032773112 x10 $^{-10}$ J
95.	Proton–neutron mass ratio	m_p/m_n	0.99862347856
96.	Proton charge to mass quotient	e/m_p	9.5788340838 x10 ^{7} C kg $^{-1}$
97.	Proton magnetic moment	μ_p	1.41060663358 x10 $^{-26}$ J T $^{-1}$
98.	Shielded proton magnetic moment	μ'_p	1.41057039959 x10 $^{-26}$ J T $^{-1}$
99.	Proton magnetic moment to nuclear magneton ratio	μ_p/μ_N	2.79284733729
100.	Proton–neutron magnetic moment ratio	μ_p/μ_n	– 1.4598980534
101.	Shielded proton magnetic moment to Bohr magneton ratio	μ'_p/μ_B	1.52099313216 x10 $^{-3}$

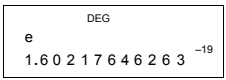
102.	Proton gyromagnetic ratio	γ_p	2.6752221211 x10 ^{8} s $^{-1}$ T $^{-1}$
103.	Shielded proton gyromagnetic ratio	γ'_p	2.6751534111 x10 ^{8} s $^{-1}$ T $^{-1}$
104.	Proton magnetic shielding correction	σ'_p	25.68715 x10 $^{-6}$
105.	Proton g–factor	g p	5.58569467557
106.	Neutron Compton wavelength	$\lambda_{c,n}$	1.31959089810 x10 $^{-15}$ m
107.	Neutron Compton wavelength over 2 pi	$\bar{\lambda}_{c,n}$	0.21001941422 x10 $^{-15}$ m
108.	Neutron mass	m_n	1.6749271613 x10 $^{-27}$ kg
109.	Neutron mass energy equivalent	$m_n c^2$	1.5053494612 x10 $^{-10}$ J
110.	Neutron magnetic moment	μ_n	– 0.9662364023x10 $^{-26}$ J T $^{-1}$
111.	Neutron magnetic moment to Bohr magneton ratio	μ_n/μ_B	–1.0418756325 x10 $^{-3}$
112.	Neutron g–factor	g_n	– 3.8260854590
113.	Neutron gyromagnetic ratio	γ_n	1.8324718844 x10 ^{8} s $^{-1}$ T $^{-1}$
114.	Deuteron mass	m_d	3.3435830926 x10 $^{-27}$ kg
115.	Deuteron mass energy equivalent	$m_d c^2$	3.0050626224 x10 $^{-10}$ J
116.	Deuteron molar mass	M(d)	2.01355321271x10^{-3} kg mol $^{-1}$
117.	Deuteron–electron mass ratio	m_d/m_e	3670.48295508
118.	Deuteron–proton mass ratio	m_d/m_p	1.99900750083
119.	Deuteron magnetic moment	μ_d	0.43307345718 x10 $^{-26}$ J T $^{-1}$
120.	Deuteron magnetic moment to Bohr magneton ratio	μ_d/μ_B	0.46697545565 x10 $^{-3}$
121.	Deuteron magnetic moment to nuclear magneton ratio	μ_d/μ_N	0.85743822849
122.	Deuteron–proton magnetic moment ratio	μ_d/μ_p	0.30701220835
123.	Helion mass	m_h	5.0064117439 x10 $^{-27}$ kg
124.	Helion mass energy equivalent	$m_h c^2$	4.4995384835 x10 $^{-10}$ J
125.	Helion molar mass	M(h)	3.01493223470x10 $^{-3}$kg mol^{-1}
126.	Helion–electron mass ratio	m_h/m_e	5495.88523812
127.	Helion–proton mass ratio	m_h/m_p	2.99315265851
128.	Shielded helion magnetic moment	μ'_h	– 1.07455296745 x10 $^{-26}$ J T^{-1}

129.	Shielded helion magnetic moment to Bohr magneton ratio	μ'_h/μ_B	$-1.15867147414 \times 10^{-3}$
130.	Shielded helion magnetic moment to nuclear magneton ratio	μ'_h/μ_N	-2.12749771825
131.	Shielded helion gyromagnetic ratio	γ'_h	$2.03789476485 \times 10^{8}\ s^{-1}\ T^{-1}$
132.	Alpha particle mass	m_α	$6.6446559852 \times 10^{-27}$ kg
133.	Alpha particle mass energy equivalent	$m_\alpha c^2$	$5.9719189747 \times 10^{-10}$ J
134.	Alpha particle molar mass	$M(\alpha)$	$4.00150617471 \times 10^{-3}$ kg mol^{-1}
135.	Alpha particle to electron mass ratio	m_α/m_e	7294.29950816
136.	Alpha particle to proton mass ratio	m_α/m_p	3.97259968461

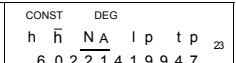
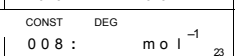
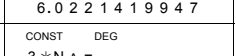
To insert a constant at the cursor position :

1. Press [CONST] to display the physics constants menu.
2. Press [→] or [2nd] [↶] until the constant you want is underlined.
3. Press [ENTER].

You also can use the [CONST] key in combination with a number, 1 through 136, to recall a physical constants. For example, press 15 [CONST].



➢ $3 \times N_A = 1.80664259841 \times 10^{24}$

3 [x] [CONST] [CONST] [→] [→]	
[ENTER]	
[ENTER] [ENTER]	

Base–n calculations

Use MAIN ([MODE] 1 (MAIN)) mode for Base–n calculations.

The unit enables you to calculate in number base other than decimal. The calculator can add, subtract, multiply, and divide binary, octal, and hexadecimal numbers.

The following shows the numerals that can be used in each number base.

Binary base (b) : 0, 1

Octal base (o) : 0, 1, 2, 3, 4, 5, 6, 7

Decimal base : 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

Hexadecimal base (h) : 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

To distinguish the A, B, C, D, E and F used in the hexadecimal base from standard letters, they appear as shown in the below.

Key	Display (Upper)	Display (Lower)	Key	Display (Upper)	Display (Lower)
A	/A	*A*	D	ID	*d*
B	IB	*b*	E	IE	*E*
C	IC	*C*	F	IF	*F*

Select the number base you want to use with [→BIN], [→OCT], [→DEC], [→HEX]. The " BIN ", " b ", " OCT ", " o ", " HEX ", " h " indicators show you which number base you are using. If none of the indictors appears in the display, you are in decimal base.

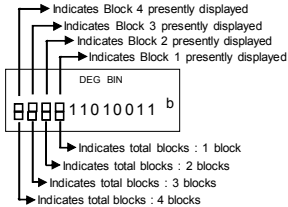
Bases conversions

➢ 37 (base 8) = 31 (base 10) = 1F (base 16)

[2nd] [→OCT] 37	DEG OCT 0 0 0 0 0 0 0 0 0 3 7 o
[2nd] [→DEC]	DEG 3 1.
[2nd] [→HEX]	DEG HEX 0 0 0 0 0 0 1 F h

Block Function

For a result in binary base, it will be displayed using block function. The maximum of 32 digits are displayed in 4 blocks of 8 digits.



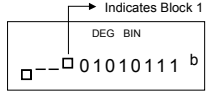
The block function comprises upper and lower block indicators. The upper indicator means current block position, and the lower indicator means total blocks for a result.

In the binary base, the block 1 is displayed immediately after calculation. Other blocks (block 2 ~ block 4) are displayed by pressing [↻].

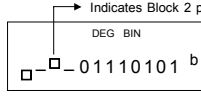
For example, input 47577557_{16}

Press [2nd] [→HEX] 47577557

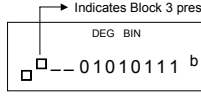
[2nd] [→BIN]



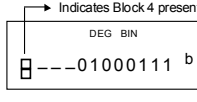
[↻]



[↻]



[↻]



47577557_{16} = Block 4 + Block 3 + Block 2 + Block 1

= $01000111010101110111010101010111_{2}$

Basic arithmetic operations for bases

➢ 1IEIF $_{16}$ + 1234 $_{10}$ ÷ 1001 $_{2}$ = 1170 $_{8}$

[2nd] [→HEX] 1E F [+] [2nd] [→DEC] 1234 [÷] [2nd] [→BIN] 1001 [ENTER] [2nd] [→OCT]	DEG OCT h 1 IE IF + 1 2 3 4 ÷ b 1 0 0 0 0 0 0 0 0 1 1 7 0 o

Negative expressions

In binary, octal, and hexadecimal bases, the calculator represents negative numbers using complement notation. The complement is the result of subtracting that number from 10000000000 in that number's base by pressing [NEG] key in non-decimal bases.

➢ 3/A $_{16}$ = NEG IFIFIFIFIFIFIC6 $_{16}$

[2nd] [→HEX] 3 A [NEG]	DEG HEX NEG h 3 /A F F F F F F C 6 h

Logical operation

Logical operations are performed through logical products (AND), negative logical (NAND), logical sums (OR), exclusive logical sums (XOR), negation (NOT), and negation of exclusive logical sums (XNOR).

➢ 1010 $_{2}$ AND (/A $_{16}$ OR 7 $_{16}$) = 12 $_{8}$

[2nd] [→BIN] 1010 [AND] [( ] [2nd] [→HEX] A [OR] 7 [ )] [ENTER] [2nd] [→OCT]	DEG BIN b 1 0 1 0 AND (h 0 0 0 0 0 0 0 0 0 1 2 o

Statistical Calculations

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

The calculators can perform both single–variable statistical calculations and paired–variable in this mode.

Press [MODE] 2 (STAT) to enter STAT mode. There are six items in STAT mode, asking you to select one of them,

DEG STAT 1–VAR LIN LOG	[→] [→] [→]	DEG STAT EXP PWR D–CL

Single–variable statistics

1–VAR Single–variable statistics

Paired-variable / Regression statistics

LIN	Linear Regression	$y = a + b\,x$
LOG	Logarithmic Regression	$y = a + b \ln x$
EXP	Exponential Regression	$y = a \cdot e^{bx}$
POW	Power Regression	$y = a \cdot x^{b}$

D–CL Clear all statistical data

Entering data

Always make sure you clear statistical data by D–CL before performing statistical calculations.

(A) To input single–variable data using the following syntaxes :

- # Individual data : [DATA] < x value >
- # Multiple data of the same value :
  [DATA] < x value > [x] < Number of repeats >

(B) To input paired–variable / regression data using the following syntaxes :

- # Individual data-set : [DATA] < x value > [,] < y value >
- # Multiple data of the same value :
  [DATA] < x value > [,] < y value > [x] < Number of repeats >

(Note) : Even you exit STAT mode, all data are still retained unless you clear all data by selecting D-CL mode.

Displaying results

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	Meaning
n ([n])	Number of the x values entered
$\bar{x}$ ([2nd]+[$\bar{x}$])	Mean of the x values
Sx ([2nd]+[Sx])	Sample standard deviation of x values
σx ([2nd]+[σx])	Population standard deviation of x values
$\sum x$ ([2nd]+[$\sum x$])	Sum of all x values
$\sum x^2$ ([2nd]+[$\sum x^2$])	Sum of all x^2 values
CP ([2nd]+[CP])	Potential capability precision of the x values

CPK ([CPK])	Minimum (CPU, CPL) of the x values, where CPU is upper spec. limit of capability precision and CPL is lower spec. limit of capability precision CPK = Min (CPU , CPL) = CP (1 – Ca)

Paired-variable statistics / Regression calculations

Variables	Meaning
n ([n])	Number of x-y pairs entered
$\bar{x}$ ([2nd]+[$\bar{x}$]) $\bar{y}$ ([2nd]+[$\bar{y}$])	Mean of the x values or y values
Sx ([2nd]+[Sx]) Sy ([2nd]+[Sy])	Sample standard deviation of x values or y values
σx ([2nd]+[σx]) σy ([2nd]+[σy])	Population standard deviation of x values or y values
$\sum x$ ([2nd]+[$\sum x$]) $\sum y$ ([2nd]+[$\sum y$])	Sum of all x values or y values
$\sum x^2$ ([2nd]+[$\sum x^2$]) $\sum y^2$ ([2nd]+[$\sum y^2$])	Sum of all x^2 values or y^2 values
$\sum x y$	Sum of (x • y) for all x-y pairs
CP ([2nd]+[CP])	Potential capability precision of the x values
CPK ([CPK])	Minimum (CPU, CPL) of the x values, where CPU is upper spec. limit of capability precision and CPL is lower spec. limit of capability precision CPK = Min (CPU , CPL) = CP (1 – Ca)
a ([2nd]+[a])	Regression formula constant term a
b ([2nd]+[b])	Regression formula regression coefficient b
r ([2nd]+[r])	Correlation coefficient r
x ' ([x '])	Estimated value of x
y ' ([y '])	Estimated value of y

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

➢ Enter data : USL = 95, LSL = 70, DATA 1 = 75, DATA 2 = 85, DATA 3 = 90, DATA 4 = 82, DATA 5 = 77, then find out n = 5, $\overline{x}$ = 81.8, Sx = 6.05805249234, σx = 5.41848687366, CP = 0.76897236513, and CPK = 0.72590991268

[MODE] 2	DEG STAT 1–VAR LIN LOG
[ENTER] [DATA] 75 [DATA] 85 [DATA] 90 [DATA] 82 [DATA] 77	DEG STAT DATA 5 77
[n]	DEG STAT n 5.
[2nd] [$\overline{x}$]	DEG STAT $\overline{x}$ 81.8
[2nd] [Sx]	DEG STAT SX 6.058052492 34
[2nd] [σx]	DEG STAT σx 5.418486873 66
[2nd] [CP] 95	DEG STAT USL = CP USL 95
[ENTER] 70	DEG STAT LSL = CP LSL 70
[ENTER]	DEG STAT CP 0.768972365 13
[CPK]	DEG STAT USL = CPK USL 95.
[ENTER]	DEG STAT LSL = CPK LSL 70.

[ENTER]	DEG STAT C P K 0.7 2 5 9 0 9 9 1 2 6 8

➢ Find a, b and r for the following data using linear regression and estimate x = ? for y =573 and y = ? for x = 19.

Data item	15	17	21	28
FREQ.	451	475	525	678

[MODE] 2 [→]	DEG STAT 1–VAR L I N LOG
[ENTER] [DATA] 15 [,] 451 [DATA] 17 [,] 475 [DATA] 21 [,] 525 [DATA] 28 [,] 678	DEG STAT REG D A T A 4 = 2 8 , 6 7 8
[2nd] [a]	DEG STAT REG a 1 7 6.1 0 6 3 2 9 1 1 4
[2nd] [b]	DEG STAT REG b 1 7.5 8 7 3 4 1 7 7 2 2
[2nd] [r]	DEG STAT REG r 0.9 8 9 8 4 5 1 6 4 1 3
573 [x']	DEG STAT REG x ' 5 7 3 2 2.5 6 7 0 0 7 3 4 1 3
19 [y']	DEG STAT REG y ' 1 9 5 1 0.2 6 5 8 2 2 7 8 5

Deleting data

The method to delete data depends on whether you have already stored the data by next pressing [DATA] key or not.

To delete data you just input but have not yet stored it by next pressing [DATA] , simple press [CE].

To delete data that you have already stored by next pressing [DATA] ,

(A) To delete single–variable data using the following syntaxes :

< x value > [2nd] [DEL]

< x value > [x] < Number of repeats > [2nd] [DEL]

(B) To delete paired–variable / regression data using the following syntaxes:

Individual data-set : < x value > [,] < y value > [2nd] [DEL]

Multiple data-set with the same value :
< x value > [,] < y value > [x] < Number of repeats > [2nd] [DEL]

If you enter and delete a value that isn't included in the stored data by mistake, " dEL Error " appears, but the previous data are still retained.

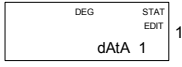
Editing data

Press [2nd] [EDIT] to enter EDIT mode. The EDIT mode is convenient and friendly for you to view, correct, delete data.

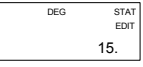
(A) In 1–VAR mode, the method to view data depends on whether you want to view data item or not.

Each time you press [DATA], first data item appears 1 second and then the corresponding value.

[DATA]

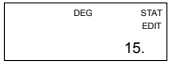


1 second



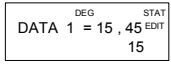
Each time you press [ENTER], value appears directly on the display without data item.

[ENTER]

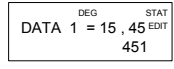


(B) In REG mode, each time you press [DATA], data item and x value appear on the screen at the same time. You can press [,] to switch between x and y value.

[DATA]



[,]



If you want to correct data, find out and enter a new entry to replace it.

FULL message

A " FULL" is indicated when any of the following conditions occur and further data entry becomes impossible. Just pressing any key can clear the indicator. The previous data entries are still retained unless you exit STAT mode.

1) If the times of data entry by [DATA] is more than 50

2) The number of repeats is more than 255

3) n>12750 (n = 12750 appears when the times of data entry by [DATA] are up to 50 and the number of repeats for each value are all 255, i.e. 12750 = 50 x 255)

Complex Calculations

Use CPLX ([MODE] 3 (CPLX)) mode for complex calculations.

Complex mode enables you to add, subtract, multiply, and divide complex numbers.

The results of a complex operation are displayed as follow :

Re	Real value	Im	Imaginary value
ab	Absolute value	ar	Argument value

➢ (7 – 9 i) + (15 + 12 i) = 22 + 3 i , ab = 22.2036033112, ar = 7.76516601843

[MODE] 3	CPLX DEG 0.
7 [–] 9 [i] [+] 15 [+] 12 [i] [ENTER]	CPLX DEG Re Im ab ar 22.
[→]	CPLX DEG Re Im ab ar 3.*i*
[→]	CPLX DEG Re Im ab ar 22.2036033112
[→]	CPLX DEG Re Im ab ar 7.765166018 43