

# Contents

<b>General guide .....</b>	<b>E - 2</b>
Power supply .....	E - 2
The keyboard .....	E - 2
Display symbols .....	E - 3
Display formats .....	E - 3
Order of operations .....	E - 4
Correction .....	E - 5
Accuracy and Capacity .....	E - 5
Overflow / Error conditions .....	E - 7
<b>Basic calculation .....</b>	<b>E - 8</b>
Mixed arithmetic calculation .....	E - 8
Parentheses calculations .....	E - 8
Constant calculation .....	E - 8
Percentage calculation .....	E - 9
Memory calculation .....	E - 9
<b>Scientific calculation .....</b>	<b>E - 10</b>
Reciprocal, Factorial .....	E - 10
Square, Square / Cubic Root, Power, Root .....	E - 10
Logarithms and Antilogarithms .....	E - 10
Fraction calculation .....	E - 10
Angular units conversion .....	E - 11
Trigonometric / Inverse trigonometric functions .....	E - 11
Hyperbolic / Inverse hyperbolic functions .....	E - 12
Rectangular / Polar coordinates .....	E - 12
Permutations, Combinations .....	E - 12
Sexagesimal ↔ Decimal form conversion .....	E - 13
Base-n mode calculation .....	E - 13
Complex numbers calculation .....	E - 14
Random numbers and Exchange key .....	E - 14
Unit conversion .....	E - 15
<b>Statistics calculation .....</b>	<b>E - 15</b>
Computing single variable statistics .....	E - 15
Viewing statistics data .....	E - 16
Adding a data entry .....	E - 17
Editing statistics data .....	E - 17
Delete error .....	E - 18
Weighted data entry method .....	E - 18

# General guide

## Power supply

### On or Off :

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

### Auto power-off function :

This calculator automatically turns off it when not operated for approximately 9 minutes. Power can be restored by pressing the [ON/C] key again. Memory contents and the previous mode setting (STAT, DEG, CPLX, Base-n,...) are retained even when power is turned off or auto power-off.

### Battery replacement :

The calculator uses two alkaline button batteries GP76A(LR44) for power. If the display becomes dim and difficult to read, the batteries should be replaced as soon as possible.

To replace batteries:

- 1) Remove the screws that hold the back cover.
- 2) Remove the back cover.
- 3) Replace the old batteries and install new ones with polarity in correct directions.
- 4) Secure the screws in place, then press [ON/C] to turn the power on.

## The keyboard

Many of the calculator's keys are used to perform more than one function. The functions marked on the keyboard are printed differently to help you find the one you need quickly and easily.

2nd functions ————  $\sin^{-1}$   
1st functions ———— sin

### 1st functions

Those are the functions that are normally executed when you press the key.

### 2nd functions

The second function is printed above or to the right of the key. To execute 2nd functions key, please press [ 2ndF ] then the corresponding key. When you press [ 2ndF ], the “ 2ndF ” 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 [ 2ndF ] by mistake, simply press [ 2ndF ] again to remove the “ 2ndF ” indicator.

(Note) : [ A ], [ B ], [ C ], [ D ], [ E ], [ F ] are 1<sup>st</sup> functions in HEX mode.

## Display symbols

Indicators shown on the display is to indicate you the current status of the calculator.



DEG or RAD or GRAD : angular unit

- |       |                         |            |                      |
|-------|-------------------------|------------|----------------------|
| M :   | Independent memory      | CPLX :     | Complex number mode  |
| E :   | Overflow / Error        | STAT :     | Statistical mode     |
| - :   | minus                   | 2ndF :     | [2ndF] key pressed   |
| ( ) : | Parenthesis calculation | CP :       | Precision capability |
| BIN : | Binary mode             | CPK :      | Process capability   |
| OCT : | Octal mode              | $\sigma$ : | Deviation            |
| HEX : | Hexadecimal mode        | USL :      | Setting upper limit  |
| ED :  | Edit mode               | LSL :      | Setting lower limit  |
| HYP : | Hyperbolic mode         |            |                      |

## Display formats

The calculator can display numbers in four formats : floating point, fixed point, scientific, and engineering.

### Floating point display format

The floating point format displays numbers in decimal form, using up to 10 digits. Any trailing zeros are truncated.

If the result of a calculation is too large to be represented in 10 digits, the display automatically switches to scientific format. If the result of later calculations is small enough to be displayed in 10 digits, the calculator returns to floating point format.

(Ex.) : Set the display in floating display format.

Step : Press [ 2ndF ] [ TAB ] [ • ]

DEG	0.
-----	----

### Fixed point display format

The fixed point, scientific, and engineering formats use a fixed number of decimal places to display numbers. If more than the selected number of decimal places is keyed, it will be rounded to the correct number of decimal places.

(Ex.) : Fix the display at 2 decimal places, then key in 3.256

Step 1 : press [ 2ndF ] [ TAB ] 2

DEG	0.00
-----	------

Step 2 : key in 3.256 [ = ]

DEG	3.26
-----	------

On the contrary, if fewer than the selected number of decimal places is keyed, it will be padded with trailing zero.

(Ex.) : Fix the display at 4 decimal places, then key in 4.23

Step 1 : press [ 2ndF ] [ TAB ] 4

DEG	0.0000
-----	--------

Step 2 : key in 4.23 [=]

DEG	4.2300
-----	--------

## Scientific display format

In Scientific display format, the number 891500 can be shown in scientific format as  $8.915 \times 10^{05}$ , where 8.915 is called the mantissa and 5 is as the exponent of 10.

(Ex.) : 7132 x 125 is displayed in scientific display format.

Step 1 : key in 7132 [ x ] 125 [=]

DEG	891500.
-----	---------

Step 2 : press [ F↔E ]

DEG	8.915 <sup>05</sup>
-----	---------------------

(in floating point format)

Besides, entry can be made in scientific notation by using the [ EXP ] key after entering the mantissa.

(Ex.) : Key the number  $4.82296 \times 10^5$

Step : key in 4.82296 [ EXP ] 5

DEG	4.82296 <sup>05</sup>
-----	-----------------------

(in floating point format)

## Engineering display format

The format is similar to the scientific format, expect the mantissa can have up to three digits left of the decimal, instead of only one, and the exponent is always a multiple of three. It is useful for engineers to convert units based on multiples of  $10^3$ .

(Ex.) : Convert 15V into 15000mV (V : Volt)

Step 1 : key in 15

DEG	15.
-----	-----

Step 2 : press [ ENG ] twice

DEG	15000. <sup>-03</sup>
-----	-----------------------

(Ex.) : Convert 15V into 0.015KV (V : Volt)

Step 1 : key in 15

DEG	15.
-----	-----

Step 2 : press [ 2ndF ] [ ← ] twice

DEG	0.015 <sup>03</sup>
-----	---------------------

## Order of operations

Each calculation is performed in the following order of precedence :

- 1) Operation in parenthesis
- 2) Functions required pressing the function key before entering, for example, [ DATA ] in STAT mode and [ EXP ] key .
- 3) Functions required inputing values before pressing the function key, for example, cos, sin, tan,  $\cos^{-1}$ ,  $\sin^{-1}$ ,  $\tan^{-1}$ , log, ln,  $X^2$ ,  $1/x$ ,  $\sqrt{\quad}$ ,  $\pi$ ,  $\sqrt[3]{\quad}$ , X!, %, RND, ENG,  $\rightarrow \circ \circ$ ,  $\circ \circ \rightarrow$ , and 6 units conversion.
- 4) Fractions

- 5) +/-
- 6)  $X^y, \sqrt[y]{X}$
- 7) nPr, nCr
- 8)  $\times, \div$
- 9) +, -

## Correction

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 using the backspace key [ 00→0 ]

(Ex.) : Correct 12385 as 789

Step : press [ CE ] 789

DEG	789.
-----	------

(Ex.) : Correct 12385 as 123

Step : press [ 00→0 ] twice

DEG	123.
-----	------

In a series of calculations, you can correct errors in immediate results by pressing [ON/C] to clear the calculation completely (expect clearing memory, see page 9).

If you press the wrong arithmetic operation key, just press [ CE ] key before entering anything else.

## Accuracy and Capacity

**Accuracy** :  $\pm 1$  in 10th digit.

**Capacity** :

In general, every reasonable calculation is displayed up to 10 digit mantissa, or 10-digit mantissa plus 2-digit exponent up to  $10^{\pm 99}$  or integers between -9999999999 and 9999999999.

Numbers used as input must be within the range of the given function. The range for each of the calculator's functions is given in the following pages.

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

$\sin^{-1} x, \cos^{-1} x$	$  X   \leq 1$
$\tan^{-1} x$	$  X   < 1 \times 10^{100}$
$\sinh x, \cosh x$	$  X   \leq 230.2585092$
$\tanh x$	$  X   < 1 \times 10^{100}$
$\sinh^{-1} x$	$  X   < 5 \times 10^{99}$
$\cosh^{-1} x$	$1 \leq X < 5 \times 10^{99}$
$\tanh^{-1} x$	$  x   < 1$
$\log x, \ln x$	$1 \times 10^{-99} \leq X < 1 \times 10^{100}$
$10^x$	$-1 \times 10^{100} < X < 100$
$e^x$	$-1 \times 10^{100} < X \leq 230.2585092$
$\sqrt{X}$	$0 \leq X < 1 \times 10^{100}$
$x^2$	$  X   < 1 \times 10^{50}$
$1/X$	$  X   < 1 \times 10^{100}, X \neq 0$
$\sqrt[3]{X}$	$  X   < 1 \times 10^{100}$
$X!$	$0 \leq X \leq 69, X \text{ is an integer.}$
$R \rightarrow P$	$\sqrt{X^2 + Y^2} < 1 \times 10^{100}$
$P \rightarrow R$	$0 \leq r < 1 \times 10^{100}$ Deg : $  \theta   < 4.5 \times 10^{10} \text{ deg}$ Rad : $  \theta   < 2.5 \times 10^8 \pi \text{ rad}$ Grad : $  \theta   < 5 \times 10^{10} \text{ grad}$ however, for $\tan x$ Deg : $  \theta   \neq 90 (2n+1)$ Rad : $  \theta   \neq \frac{\pi}{2} (2n+1)$ Grad : $  \theta   \neq 100 (2n+1)$ (n is an integer)
$\rightarrow \circ, \circ, \circ$	$  DD  , MM, SS.SS < 1 \times 10^{100},$ $0 \leq MM, SS.SS$
$\circ, \circ, \circ \rightarrow$	$  x   < 1 \times 10^{100}$
$X^y$	$X > 0 : -1 \times 10^{100} < y \log X < 100$ $X = 0 : y > 0$ $X < 0 : y = n, 1/(2n+1), n \text{ is an integer.}$ but $-1 \times 10^{100} < \frac{1}{y} \log   X   < 100$
$\sqrt[y]{X}$	$X > 0 : y \neq 0, -1 \times 10^{100} < \frac{1}{y} \log X < 100$ $X = 0 : y > 0$ $X < 0 : y = 2n+1, 1/n, n \text{ is an integer.}(n \neq 0)$ but $-1 \times 10^{100} < \frac{1}{y} \log   X   < 100$

a <sup>b</sup> /c	Input : Total of integer, numerator and denominator must be within 10 digits (includes division marks) Result : Result displayed as fraction for integer when integer, numerator and denominator are less than $1 \times 10^{10}$
nPr, nCr	$0 \leq r \leq n$ , $n \leq 9999999999$ , n,r are integers.
STAT	$ x  < 1 \times 10^{50}$ , $ \sum x  < 1 \times 10^{100}$ $0 \leq  \sum x^2  < 1 \times 10^{100}$ , n, r are integer $\bar{x} : n \neq 0$ , S : $n > 1$ , $\sigma : n > 0$ Range = 1 ~ r, $1 \leq n \leq r$ , $80 \leq r \leq 20400$
→ DEC	$0 \leq X \leq 9999999999$ (for zero or positive ) $-9999999999 \leq X \leq -1$ (for negative)
→ BIN	$0 \leq X \leq 0111111111$ (for zero, positive) $1000000000 \leq X \leq 1111111111$ (for negative)
→ OCT	$0 \leq X \leq 3777777777$ (for zero or positive) $4000000000 \leq X \leq 7777777777$ (for negative)
→ HEX	$0 \leq X \leq 2540BE3FF$ ( for zero or positive) $FDABF41C01 \leq X \leq FFFFFFFF$ (for negative)

## Overflow / Error conditions

A symbol “ E ” are indicated on the display when any of the following conditions occur and further calculation becomes impossible. Just press [ ON/C ] to release those overflow or error indicator and the subsequent calculation can then be performed.

- 1) When function calculations are performed with a number exceeding the input range.
- 2) When a number is divided by 0.
- 3) When the [ ( ] key is used more than 15 times in a single expression.
- 4) When a result (whether intermediate or final) or accumulated total in memory exceeds the limit. ( $\pm 9.999999999 \times 10^{99}$ )
- 5) When more than six pending operations.

## Basic calculation

Before performing the following calculation, check to see that your calculator is in decimal base and floating point display.

## Mixed arithmetic calculation

$1 + 2 \times 3 = ?$	1 [ + ] 2 [ x ] 3 [ = ]	DEG	7.
$-3.5 + 8 \div 2 = ?$	3.5 [ +/- ] [ + ] 8 [ ÷ ] 2 [ = ]	DEG	0.5

## Parentheses calculations

Operation inside parentheses are always executed first. You can use up to 15 levels of parentheses in a single calculation. When the first parenthesis is opened, the “ ( ) ” indicator appears and remains in the display until the last parenthesis is closed.

$(5 - 2 \times 1.5) \times 3$ $+ 0.8 \times (-4) = ?$	[ ( ] 5 [ - ] 2 [ x ] 1.5 [ ) ] [ x ] 3 [ + ] 0.8 [ x ] 4 [ +/- ] [ = ]	DEG	2.8
$2 \times \{ 7 + 6 \times (5 + 4) \}$ $= ?$	2 [ x ] [ ( ] 7 [ + ] 6 [ x ] [ ( ] 5 [ + ] 4 [ = ]	DEG	122.

(Note) : It is unnecessary to press the [ ) ] key before the [ = ] key.

## Constant calculation

The calculator enables you to repeat the last number entered or the last operation executed by pressing [ = ] key.

### Repeating the last number

$3 \times 3 = ?$	3 [ x ] [ = ]	DEG	9.
$3 \times 3 \times 3 = ?$	[ = ]	DEG	27.
$3 \times 3 \times 3 \times 3 = ?$	[ = ]	DEG	81.

### Repeating the arithmetic operation

$321 + 357 = ?$	321 [ + ] 357 [ = ]	DEG	678.
$654 + 357 = ?$	654 [ = ]	DEG	1011.

$579 - 159 = ?$	579 [ - ] 159 [ = ]	DEG	420.
$456 - 159 = ?$	456 [ = ]	DEG	297.

$18 \times 45 = ?$	3 [ x ] 6 [ x ] 45 [ = ]	DEG	810.
$18 \times 23 = ?$	23 [ = ]	DEG	414.
$18 \times (0.5 \times 10^2) = ?$	0.5 [ EXP ] 2 [ = ]	DEG	900.

$96 \div 8 = ?$	$96 [ \div ] 8 [ = ]$	DEG	12.
$75 \div 8 = ?$	$75 [ = ]$	DEG	9.375
$(1.2 \times 10^2) \div 8 = ?$	$1.2 [ \text{EXP} ] 2 [ = ]$	DEG	15.

## Percentage calculation

30% of 120 = ?	$120 [ \times ] 30 [ 2\text{ndF} ] [ \% ] [ = ]$	DEG	36.
70% of 120 = ?	$70 [ 2\text{ndF} ] [ \% ] [ = ]$	DEG	84.
88 is 55% of what number = ?	$88 [ \div ] 55 [ 2\text{ndF} ] [ \% ] [ = ]$	DEG	160.
30% add-on of 120 = ?	$120 [ + ] 30 [ 2\text{ndF} ] [ \% ] [ = ]$	DEG	156.
30% discount of 120 = ?	$120 [ - ] 30 [ 2\text{ndF} ] [ \% ] [ = ]$	DEG	84.

## Memory calculation

You should keep the following rules in mind when performing memory calculations.

- 1) The “M” indicator appears when a number is stored in the memory.
- 2) Recalling from a memory by pressing [ MR ] key does not affect its contents .
- 3) All memories are unavailable under STAT mode.
- 4) In order to exchange the content of the memory for the displayed number, please press [ X→M ] key.
- 5) The contents of the memories can be cleared by pressing [ 0 ] [ X→M ] or [ CE ] [ X→M ] in sequence.

	[ CE ] [ X→M ]	DEG	0.
$3 \times 5$	$3 [ \times ] 5 [ \text{M}+ ]$	M DEG	15.
$+ ) 56 \div 7$	$56 [ \div ] 7 [ \text{M}+ ]$	M DEG	8.
$+ ) 74 - 8 \times 7$	$74 [ - ] 8 [ \times ] 7 [ \text{M}+ ]$	M DEG	18.
Total = ?	[ MR ]	M DEG	41.
	0 [ X→M ]	DEG	0.

## Scientific calculation

Before performing the following calculation, check to see that your calculator is fixed at 2 decimal places display format.

## Reciprocal, Factorial

$\frac{1}{1.25} = ?$	1.25 [2ndF] [1/X] [=]	DEG	0.80
$5! = ?$	5 [2ndF] [X!] [=]	DEG	120.00

## Square, Square / Cubic Root, Power, Root

$2^2 + 3^4 = ?$	2 [X <sup>2</sup> ] [+] 3 [X <sup>y</sup> ] 4 [=]	DEG	85.00
$5 \times \sqrt[3]{27} + \sqrt{34} = ?$	5 [x] 27 [2ndF] [ $\sqrt[3]{\phantom{x}}$ ] [+] 34 [ $\sqrt{\phantom{x}}$ ] [=]	DEG	20.83
$\sqrt[9]{72} = ?$	72 [2ndF] [ $\sqrt[x]{\phantom{x}}$ ] 9 [=]	DEG	1.61

## Logarithms and Antilogarithms

$\ln 7 + \log 100 = ?$	7 [ln] [+] 100 [log] [=]	DEG	3.95
$10^2 = ?$	2 [2ndF] [10 <sup>x</sup> ] [=]	DEG	100.00
$e^5 - e^{-2} = ?$	5 [2ndF] [e <sup>x</sup> ] [-] 2 [+/-] [2ndF] [e <sup>x</sup> ] [=]	DEG	148.28

## Fraction calculation

Fraction value display is as follow :

5 $\frac{\text{┘}}{\text{┘}}$ 12	Display of $\frac{5}{12}$
----------------------------------	---------------------------

56 $\frac{\text{┘}}{\text{┘}}$ 5 $\frac{\text{┘}}{\text{┘}}$ 12	Display of $56 \frac{5}{12}$
---	------------------------------

(Note) : Total of integer, numerator and denominator must be within 10 digits, or the fractional value couldn't be shown completely.

By pressing [2ndF] [ $\rightarrow$ d/e], the displayed value will be converted to the improper fraction.

$\frac{2}{3} + 7 \frac{3}{5}$ $= 8 \frac{4}{15}$ $= \frac{124}{15}$	2 [a <sup>b/c</sup> ] 3 [+] 7 [a <sup>b/c</sup> ] 3 [a <sup>b/c</sup> ] 5 [=]	DEG	8 $\frac{\text{┘}}{\text{┘}}$ 4 $\frac{\text{┘}}{\text{┘}}$ 15
	[2ndF] [ $\rightarrow$ d/e]	DEG	124 $\frac{\text{┘}}{\text{┘}}$ 15

When a press of [a<sup>b/c</sup>] key after the [=] key or a fraction performed with a decimal, the answer is displayed as a decimal.

$5 \frac{4}{9} + 3 \frac{3}{4}$ $= 9 \frac{7}{36}$	5 [a <sup>b/c</sup> ] 4 [a <sup>b/c</sup> ] 9 [+] 3 [a <sup>b/c</sup> ] 3 [a <sup>b/c</sup> ] 4 [=]	DEG	9 $\frac{\text{┘}}{\text{┘}}$ 7 $\frac{\text{┘}}{\text{┘}}$ 36
= 9.19	[a <sup>b/c</sup> ]	DEG	9.19

$8\frac{4}{9} + 3.75$ = 12.19	8 [a b/c] 4 [a b/c] 9 [ + ] 3.75 [=]	DEG 12.19
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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 [=] key.

$3\frac{119}{21} = 8\frac{2}{3}$	3 [a b/c] 119 [a b/c] 21 [ = ]	DEG 8 $\frac{2}{3}$
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If total of integer, numerator and denominator exceeds 10 digits (including division marks), the result answer will be displayed as a decimal.

$12345\frac{5}{16} + 5\frac{6}{13}$ = 12350.77	12345 [a b/c] 5 [a b/c] 16 [ + ] 5 [a b/c] 6 [a b/c] 13 [=]	DEG 12350.77
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## Angular units conversion

The calculator enables you to convert a angular unit among degrees (DEG), radians (RAD), and grad (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, press [ DRG ] key repeatedly until the angular unit you want is indicated in the display.
- 2) After entering an angle, press [ 2ndF ] [ DRG→ ] repeatedly until the converted value is displayed.

90 °(deg)	90	DEG 90
= ? (rad)	[ 2ndF ] [ DRG→ ]	RAD 1.57
= ? (grad)	[ 2ndF ] [ DRG→ ]	GRAD 100.00

## Trigonometric / Inverse trigonometric functions

When using those key, make sure the calculator is set for the angular unit you want.

$3 \sin 85^\circ = ?$	3 [ x ] 85 [ sin ] [=]	DEG 2.99
$\cos\left(\frac{\pi}{4} \text{ rad}\right) = ?$	[ 2ndF ] [ $\pi$ ] [ ÷ ] 4 [=] [ cos ]	RAD 0.71
$\tan 150\text{grad} = ?$	150 [ tan ]	GRAD -1.00
$\sin^{-1} 0.5 = ? \text{ deg}$	0.5 [ 2ndF ] [ $\sin^{-1}$ ]	DEG 30.00

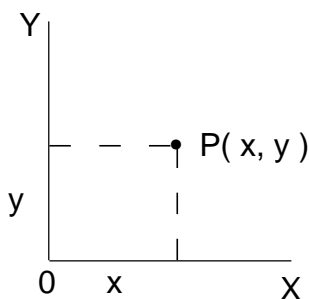
$\cos^{-1}\left(\frac{1}{\sqrt{2}}\right) = ? \text{ rad}$	2 [√] [2ndF] [1/X] [2ndF] [cos <sup>-1</sup> ]	RAD	0.79
$\tan^{-1} 1 = ? \text{ grad}$	1 [2ndF] [tan <sup>-1</sup> ]	GRAD	50.00

## Hyperbolic / Inverse hyperbolic functions

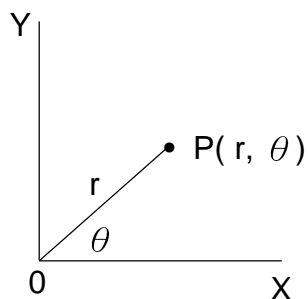
$\cosh 1.5 + \sinh 1.5 =$	1.5 [HYP] [cos] [+] 1.5 [HYP] [sin] [=]	DEG	4.48
$\sinh^{-1} 7 =$	7 [HYP] [2ndF] [sin <sup>-1</sup> ]	DEG	2.64
$\tanh 1 =$	1 [HYP] [tan]	DEG	0.76

## Rectangular / Polar coordinates

Rectangular Coordinates



Polar Coordinates



$$a + bi = r(\cos \theta + i \sin \theta)$$

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

### Converting from Rectangular to Polar

If $a = 5$ and $b = 6$ , what are $r$ and $\theta$ ?	5 [a] 6 [b] [2ndF] [R→P]	DEG	7.81
	[b]	DEG	50.19

### Converting from Polar to Rectangular

If $r = 25$ and $\theta = 56^\circ$ , what are $a$ and $b$ ?	25 [a] 56 [b] [2ndF] [P→R]	DEG	13.98
	[b]	DEG	20.73

## Permutations, Combinations

$$nPr = \frac{n!}{(n-r)!}$$

$$nC_r = \frac{n!}{r!(n-r)!}$$

Howmany permutations of 4 items can you select out of a set of numbers of 7 items?	7 [2ndF] [nPr] 4 [=]	DEG	840.00
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How many combinations of 4 items can you select out of a set of numbers of 7 items?	7 [ 2ndF ] [ nCr ] 4 [=]	DEG	35.00
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## Sexagesimal ↔ Decimal form conversion

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

Sexagesimal figure value display is as follow :

12 □ 45   30    5	Represent 12 degrees, 45 minutes, 30.27 seconds
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(Note) : The total of DD, MM and SS.SS must be within 8 digits, or the sexagesimal couldn't be shown completely.

### Converting from Sexagesimal to Decimal

12 deg., 45 min., 30.5 sec.=?	12 [ ° ’ ” → ] 45 [ ° ’ ” → ] 30.5 [ ° ’ ” → ]	DEG	12.76
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### Converting from Decimal to Sexagesimal

2.12345 = ?	2.12345 [ 2ndF ] [ → ° ’ ” ]	2 □ 7   24    42
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## Base-n mode calculation

### Converting between bases

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. Select the number base you want by the [ →BIN ], [ →OCT ], [ →HEX ], [ →DEC ] keys. The BIN, OCT, and HEX indicators show you which base you are using. (if none of the indicators appears in the display, you are in decimal base.)

The keys active in each base is described as follows :

Binary base : [ 0 ] [ 1 ]

Octal base : [ 0 ] ~ [ 7 ]

Decimal base : [ 0 ] ~ [ 9 ]

Hexadecimal base : [ 0 ] ~ [ 9 ], [ A ] ~ [ F ]

31 (base 10)	[ 2ndF ] [ →DEC ] 31	DEG	31.
= ? (base 2)	[ 2ndF ] [ →BIN ]	DEG BIN	1111.
= ? (base 8)	[ 2ndF ] [ →OCT ]	DEG OCT	37.
= ? (base 16)	[ 2ndF ] [ →HEX ]	DEG HEX	1F.

4 X 1B (base 16)	[ 2ndF ] [→HEX ] 4 [ x ] 1B [ = ]	DEG HEX    6C.
= ? (base 2)	[ 2ndF ] [→BIN ]	DEG BIN 1101100.
= ? (base 10)	[ 2ndF ] [→DEC ]	DEG        108.00
= ? (base 8)	[ 2ndF ] [→OCT ]	DEG OCT    154.

## Negative and Complements

In binary, octal, and hexadecimal bases, the calculator represents negative numbers using complement notation. The complement is the result of subtracting that number from 1000000000 in that number's base by pressing [ +/- ] key in non-decimal bases.

Calculate the complement of binary number 11011	[ 2ndF ] [→BIN ] 11011 [ +/- ]	DEG BIN 1111100101.
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## Complex numbers calculation

Select the complex numbers mode by pressing [ CPLX ] key and make sure " CPLX " indicator appears on the display. The calculator enables you to add, subtract, multiply, and divide complex numbers.

Complex numbers are generally represented as  $a + bi$ , where  $a$  is a real and  $b$  is imaginary.

( 7 - 9 i ) + ( 15 + 10 i ) = ?	[ 2ndF ] [ CPLX ] 7 [ a ] 9 [ +/- ] [ b ] [ + ] 15 [ a ] 10 [ b ] [ = ]	DEG CPLX 22.00
	[ b ]	DEG CPLX    1.00

(Note) : Memory calculation is available in complex number mode.

## Random numbers and Exchange key

### Random key

Pressing [ RND ] key enables the display to generate random numbers between 0.000 and 0.999.

Step : press [ 2ndF ] [ RND ]

DEG    0.231
--------------

### Exchange key

Pressing [ 2ndF ] [ X↔Y ] enables the displayed value to exchange as the previous value.

123 + 456 = ?	123 [ + ] 456 [ = ]	DEG        579.00
	[ 2ndF ] [ X↔Y ]	DEG        456.00
	[ 2ndF ] [ X↔Y ]	DEG        579.00

# Unit conversion

in↔cm

12 in = ? cm	12 [ A→B ] [ 2ndF ] [ in↔cm ]	DEG	30.48
98 cm = ? in	98 [ 2ndF ] [ A←B ] [ 2ndF ] [ in↔cm ]	DEG	38.58

(Note) : The operating procedure for unit conversion key, [ °F↔°C ], [ mmHg↔Kpa ], [ gal↔l ], [ lb↔kg ], [ OZ↔g ], is similar to the above example.

## Statistics calculation

### Computing single variable statistics

Select the mode by pressing [ STAT ] key and make sure “ STAT ” indicator appears on the display.

The STAT mode enables you to calculate the following single variable statistics :

n number of all data

$\sum x$  sum of all data

$\sum x^2$  sum of the squares

$\bar{x}$  meanvalue

s Sample Standard deviation  $\sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n - 1}}$

$\sigma$  Population standard deviation  $\sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n}}$

CP Precision capability  $\frac{USL - LSL}{6 \sigma}$

CPK Process capability Min(CPU, CPL)

$$\text{where CPU} = \frac{USL - \bar{x}}{3 \sigma} \quad \text{CPL} = \frac{\bar{x} - LSL}{3 \sigma}$$

(Note) : In STAT mode, all function key are available, except base-n calculation.

(Ex. 1) : Enter the following data to calculate  $\sum x$ ,  $\sum x^2$ , n,  $\bar{x}$ , S, CP, and CPK , where data 1 = 2, data 2~5 = 5, data 6-8 = 9, USL value : 12, LSL value : 2

In STAT mode	[ 2ndF ] [ STAT ]	DEG	STAT	0.00
Enter all data	[ DATA ] 2	DEG	STAT	2.
	[ DATA ] 5	DEG	STAT	5.

	[ DATA ] 5	DEG	STAT	5.
	[ DATA ] 5	DEG	STAT	5.
	[ DATA ] 5	DEG	STAT	5.
	[ DATA ] 9	DEG	STAT	9.
	[ DATA ] 9	DEG	STAT	9.
	[ DATA ] 9	DEG	STAT	9.
	[ = ]	DEG	STAT	0.00
$\bar{x} = ?$	[ $\bar{x}$ ]	DEG	STAT	6.13
$n = ?$	[ n ]	DEG	STAT	8.00
$S = ?$	[ S ]	DEG	STAT	2.59
$\sum x = ?$	[ 2ndF ] [ $\sum x$ ]	DEG	STAT	49.00
$\sum x^2 = ?$	[ 2ndF ] [ $\sum x^2$ ]	DEG	STAT	347.00
$\sigma = ?$	[ 2ndF ] [ $\sigma$ ]	DEG	STAT	2.42 $\sigma$
$CP = ?$	[ 2ndF ] [ CP ] 12	DEG	STAT	12. CP USL
	[ = ] 2	DEG	STAT	2. CP LSL
	[ = ]	DEG	STAT	0.69 CP
$CPK = ?$	[ 2ndF ] [ CPK ]	DEG	STAT	12.00 CPK USL
	[ = ]	DEG	STAT	2.00 CPK LSL
	[ = ]	DEG	STAT	0.57 CPK

(Note) : The calculator keeps a record of all the entries you make and these entries are retained even if auto power-off or turning off, unless exiting STAT mode.

## Viewing statistics data

Pressing [ DATA ] or [ = ] key under ED mode can view the statistics data you have entered. The difference between [ DATA ] and [ = ] is the item of the data entry appears 1.5 sec. before the value by [ DATA ], the value appears immediately without the item by [ = ].

(Ex.2) : View the statistics data based on Ex. 1.

Step 0 : Press [ 2ndF ] [ EDIT ] to enter ED mode.

(Method 1) :

Step 1 : Press [ DATA ] once to view the first data.

DEG ED STAT dAtA 1	1.5 sec. →	DEG ED STAT 2.00
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Step 2 : Continue pressing [ DATA ] once for each data, it will display data 2, 5.00, data 3, 5.00, data 4, 5.00, data 5, 5.00, data 6, 9.00, data 7, 9.00, data 8, 9.00 in sequence.

(Method 2) :

Step 1 : Press [=] once to view the first data

DEG ED STAT 2.00
------------------

Step 2 : Continue pressing [=] once for each data, it will display 5.00, 5.00, 5.00, 5.00, 9.00, 9.00, 9.00 in sequence.

## Adding a data entry

(Ex.3) : Add data 9 = 10 to Ex.1

Step 1 : Press [DATA] 10

DEG ED STAT 10.
-----------------

Step 2 : The calculator updates the statistics as you enter data. You can then recall all variable statistics to get the following result :  $\bar{x} = 6.56$ ,  $n = 9.00$ ,  $S = 2.74$ ,  $\sum x = 59.00$ ,  $\sum x^2 = 447.00$ ,  $\sigma = 2.59$ , where data 1 = 2.00, data 2~5 = 5.00, data 6~8 = 9.00, data 9 = 10.00

## Editing statistics data

(Ex.4) : Based on Ex.1, correct data 1 = 2 as data 1 = 3

Method 1 :

Press 2 [2ndF] [DEL] 3 to overwrite.

Method 2 :

Step 1 : Press [2ndF] [EDIT]

DEG ED STAT 0.00
------------------

Step 2 : Find out 2 by [DATA] or [=]

DEG ED STAT 2.00
------------------

Step 3 : Enter 3 to overwrite 2

DEG ED STAT 3.
----------------

Step 4 : Press [=] and [2ndF] [EDIT] to exit ED mode, where those data are changed as data 1 = 3.00, data 2~5 = 5.00, data 6~8 = 9.00.

(Ex.5) : Based on Ex.1, delete data 1 = 2 .

Method 1 :

Press 2 [2ndF] [DEL] to delete 2.

Method 2 :

Step 1 : Press [2ndF] [EDIT]

DEG ED STAT 0.00
------------------

Step 2 : Find out 2 by [DATA] or [=]

DEG ED STAT 2.00
------------------

Step 3 : Press [2ndF] [DEL]

DEG ED STAT 5.00
------------------

Step 4 : Press [2ndF] [EDIT] to exit ED mode, where those data are changed as data 1~4 = 5.00, data 5~7 = 9.00.

## Delete error

(Ex.6) : 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, for example, delete 7 based on Ex.1.

Step 1 : Press 7 [ 2ndF ] [ DEL ]

DEG	STAT
dEL Error	

Step 2 : Press any key to clear it

DEG	STAT	0.00
-----	------	------

Step 3 : Enter ED mode, then view data by [ DATA ] or [ = ], where those data are still data 1 = 2.00, data 2~5 = 5.00, data 6~8 = 9.00.

(Ex.7) : Based on Ex.1, enter 5 x 5 and delete it.

Step 1 : Press 5 [ x ] 5 [ 2ndF ] [ DEL ]

DEG	STAT
dEL Error	

Step 2 : Press any key to clear it

DEG	STAT	0.00
-----	------	------

Step 3 : Enter ED mode, then view data by [ DATA ] or [ = ], where those data are changed as data 1 = 2.00, data 2~4 = 9.00.

## Weighted data entry method

Instead of entering directly each data, when often several item of data have the same value, you can enter the value and the number of occurrences up to 255. The data based on Ex.1 can be rewritten and entered as follow :

Value	Number of occurrences	Alternative method
2	1	[ DATA ] 2
5	4	[ DATA ] 5 [ x ] 4
9	3	[ DATA ] 9 [ x ] 3

, where data 1 = 2, data 2~5 = 5, data 6~8 = 9.

Under ED mode, when you continue choosing a value from data 2~5 and correcting it as 33, the permutation among those data will be changed as data 1 = 2, data 2~4 = 5, data 5 = 33, data 6~8 = 9, where the new value 33 is inserted after data 4 = 5.

(Note) : 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 exiting STAT mode.

- 1) If the times of data entry by [ DATA ] is more than 80
- 2) The number of occurrences is more than 255
- 3)  $n > 20400$  ( $n = 20400$  appears when the times of data entry by [ DATA ] are up to 80 and the number of occurrences for each value are all 255, i.e.  $20400 = 80 \times 255$ .)