

**SHARP**<sup>®</sup>

MODEL  
**EL-531LH**

**SCIENTIFIC CALCULATOR**  
**OPERATION MANUAL**

*EDITION*  
*15*  
*5*  
*1*  
*3*  
*18*  
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## INTRODUCTION

Thank you for purchasing the SHARP Scientific Calculator Model EL-531LH.

This manual will introduce you to EL-531LH.  
Please keep this manual for future reference.

### Operational Notes

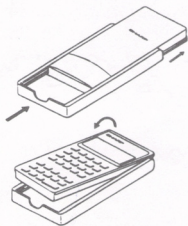
To ensure trouble-free operation, please observe the following points:

1. Do not carry the calculator in the back pocket of slacks or trousers.
2. Do not subject the calculator to extreme temperatures.
3. Do not drop it or apply excessive force.
4. Clean only with a soft, dry cloth.

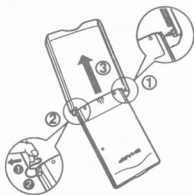
### The protective cover

Your calculator comes with a cover to protect the keyboard and display when the calculator is not in use.

1. Push the rear end of the calculator then slide it to the opposite end.
2. Rotate the calculator to fit into the cover.



Protective cover installation procedure



- Always close the cover when you are not using the calculator. (To close, follow the opening procedure in reverse).

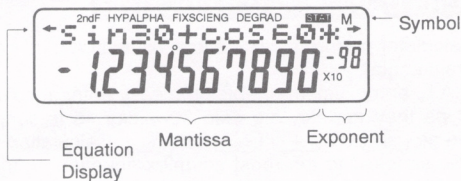
## HOW TO PROCEED IF ABNORMAL CONDITIONS OCCUR

If this calculator is exposed to a powerful external electric field or shock during use, an abnormal condition may occur in which all the keys, including  $\boxed{\text{ON/C}}$ , do not function. In this case, press the **RESET** switch on the back of the calculator. Note that the memory contents will be completely cleared when this operation is performed.

- ◆ Press the RESET switch only in the following cases:
  - After replacing the batteries
  - To clear all memory contents
  - When an abnormal condition occurs and all keys are inoperative.

If service should be required on this calculator, use only a SHARP servicing dealer, SHARP approved service facility, or SHARP repair service where available.

## DISPLAY



(During actual use not all symbols are displayed at the same time.)

This calculator normally displays only the mantissa if the value displayed is within the range  $\pm 0.000000001 - \pm 9999999999$ . Otherwise the display changes to scientific notation. The display mode can be changed according to the purpose of the calculation.

Equation you enter or guidance to the answer is displayed in the equation display.

←→ : Appears in the display when the entire equation or answer cannot be displayed.

**2ndF** : Appears in the display when  $\boxed{2\text{ndF}}$  is pressed, indicating that the functions shown in yellow are enable.

**HYP** : Indicates that  $\boxed{\text{hyp}}$  has been pressed and the hyperbolic functions are enabled. If  $\boxed{2\text{ndF}}$   $\boxed{\text{hyp}}$  are pressed, the symbols "**2ndF HYP**" appear, indicating that inverse hyperbolic functions are enabled.

**ALPHA**: Indicates that entry and recall of memory contents, and recall of statistics can be performed.

**FIX SCI ENG**: Indicates the notation used to display a value.

**DEG RAD GRAD**: Indicates angular units.

**STAT** : Appears when statistics mode is selected.

**M** : Indicates that a numerical value is stored in the independent memory.

## BEFORE USING THE CALCULATOR

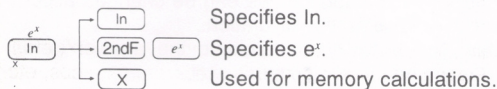
This calculator performs calculations using D.A.L. (Direct Algebraic Logic).

The D.A.L. entry system enables the easy entry of calculations as they appear, e.g.,  $\sin 30 + \cos 45$  is simply entered as  $\boxed{\sin} 30 \boxed{+} \boxed{\cos} 45 \boxed{=}$ . Calculations – from the simplest to the most complex equations – may be performed in an easy to understand manner.

- When first used, press the RESET switch on the back to clear the calculator.

## Key Notation Used in this Manual

In this manual, key operations are described as follows:





As shown above, for the key notation of a second function, only the key's second function is indicated following  $\boxed{2ndF}$  and not the function or number printed on the key itself. Numbers are not shown as keys, but as ordinary numbers.

## Power On and Off

Press  $\boxed{ON/C}$  to turn the calculator on, and  $\boxed{2ndF}$   $\boxed{OFF}$  to turn it off.

## Clearing Methods

There are three clearing methods as follows:

- $\boxed{ON/C}$  : Clears all values including functions and calculation instructions in the calculator (excluding statistical data and memory contents in the normal mode).
- $\boxed{2ndF}$   $\boxed{CA}$  : Clears the values in the calculator, excluding independent memory "M" in the normal mode. Clears all statistical data in the statistics mode.
- $\boxed{DEL}$  : While you enter, it clears the rightmost digit of numerical value.  
In the edit mode, it clears single digit of numerical value, functions, etc. under the cursor.

## Priority Levels in Calculation

This calculator performs operations according to the following priority:

1. Functions preceded by their argument ( $x^{-1}$ ,  $x^2$ ,  $n!$ , etc.)
2.  $Y^x$ ,  ${}^x\sqrt{Y}$
3. Implied multiplication of a memory value ( $2Y$ , etc.)
4. Functions followed by their argument ( $\sin$ ,  $\cos$ , etc.)

5. Implied multiplication of a function (2sin30, etc.)
  6.  ${}_nC_r, {}_nP_r$
  7.  $\times, \div$
  8.  $+, -$
  9.  $=, M+, M-, \Rightarrow M, \blacktriangleright \text{DEG}, \blacktriangleright \text{RAD}, \blacktriangleright \text{GRAD}, \text{DATA}, \text{CD}, \rightarrow r\theta, \rightarrow xy$  and other calculation ending instruction
- If parentheses are used, parenthesized calculations have precedence over any other calculations.

## Pending Operations

Operations that cannot be performed immediately due to priority levels or to parentheses must be set aside temporarily (pending operations). This calculator can hold up to 16 calculations and up to 8 numeric values. (8 values in normal mode and 4 values in statistics mode.)

## INITIAL SETUP

### Mode Selection

This calculator can operate in any of the four operation modes described below. To select the mode, press **MODE** and then the number key corresponding to the desired mode.

- 0** Normal mode:  
Used to perform arithmetic operations, substitute arithmetic and functions.
- 1** Statistics mode:  
Statistical calculations. "**STAT**" appears on top right of the display.

### Selection of the Display Notation

This calculator has the following four display notation systems for the display values.

**FIX**ed decimal point system:

A value is displayed with the number of decimal places specified. The **FIX** indicator appears.

### SCientific notation system:

A value is displayed using scientific notation. The SCI indicator appears. The mantissa of the value is displayed with the number of decimal places specified.

### ENGineering notation system:

A value is displayed using engineering notation. The ENG indicator appears. The mantissa of the value is displayed with the number of decimal places specified and the exponent is set to a multiple of 3 for display.

### Floating point system:

A value is displayed without regard for the number of decimal places specified. None of the FIX, SCI, or ENG indicators appears. Scientific notation is used if the value is not in the range

$$0.000000001 \leq |x| \leq 9999999999.$$

The display notation is changed by pressing  $\boxed{2\text{ndF}}$   $\boxed{\text{FSE}}$  while the result of a calculation is in the display or after the values in the calculator have been cleared with  $\boxed{\text{ON/C}}$ . Each time  $\boxed{2\text{ndF}}$   $\boxed{\text{FSE}}$  are pressed, the display mode changes in the sequence FIX  $\rightarrow$  SCI  $\rightarrow$  ENG  $\rightarrow$  Floating point system  $\rightarrow$  FIX...

### Determination of the Number of Decimal Places

When the FIX, SCI, or ENG indicator is displayed, the number of decimal places can be set to any value between 0 and 9. After setting the number of decimal places, the display value will be rounded to the corresponding number of digits and displayed. To specify the number of decimal places, first press  $\boxed{2\text{ndF}}$   $\boxed{\text{TAB}}$  when a calculation result is displayed or after clearing the values in the calculator with  $\boxed{\text{ON/C}}$ . Then press the appropriate number key to specify the number of decimal places.

### Determination of the Angular Unit

In this calculator, the following three angular units can be specified.

Degrees ( $^{\circ}$ ): The DEG indicator appears.

Radians (rad): The RAD indicator appears.

Grads (g): The GRAD indicator appears.

To specify the angular unit, press  $\boxed{\text{DRG}}$ . Each time  $\boxed{\text{DRG}}$  is pressed, the angular unit changes in the sequence DEG  $\rightarrow$  RAD  $\rightarrow$  GRAD  $\rightarrow$  DEG...

Note : For the examples given in subsequent explanations, make sure that none of the following symbols or guidance are displayed unless otherwise specified.

FIX, SCI, ENG: See page 6

## Editing the Equation

You can edit the equation not only while you are entering but also after getting your answer.

[While entering]

- Press  $\boxed{\leftarrow}$   $\boxed{\rightarrow}$  to move the cursor.
- If you need to delete a number, move the cursor to the number you wish to delete then press  $\boxed{\text{DEL}}$ . The number under the cursor will be deleted.
- If you need to insert a number, move the cursor to the place immediately after where you wish to insert the number then enter the number.

[After finding an answer]

- Press  $\boxed{2\text{ndF}}$   $\boxed{\curvearrowright}$  to go back to the equation.
- Edit the equation the same way as while entering.

## Substitute Arithmetic Function

If you have a formula and all you have to do is to substitute the numbers, this function might be handy. It remembers the entered equation as a formula. After finding the first answer, press  $\boxed{2\text{ndF}}$   $\boxed{?}$  and this function automatically moves the cursor back to the first number of the equation and lets you change the number. After that, you can skip to the next number by pressing  $\boxed{2\text{ndF}}$   $\boxed{?}$  and so on. At any place, pressing  $\boxed{=}$  lets you know the answer for the new equation.

EX.  $A^2 + B^2 =$     ①  $A = 2.5, B = 3.5$   
                              ②  $A = 2.5, B = 4.5$

	Key Operations	Display	Remarks
1	2.5 $x^2$ + 3.5 $x^2$ =	2.5 <sup>2</sup> + 3.5 <sup>2</sup> = 18.5	①
2	$2^{nd}F$ ?	2.5 <sup>2</sup> + 3.5 <sup>2</sup>	
3	$2^{nd}F$ ?	2.5 <sup>2</sup> + 3.5 <sup>2</sup>	
4	$DEL$ 4 =	2.5 <sup>2</sup> + 4.5 <sup>2</sup> = 26.5	②

## SCIENTIFIC CALCULATIONS

- If the FIX, SCI, or ENG indicator is displayed, clear the indicator by pressing  $2^{nd}F$   $FSE$ . (See page 6)
- Your calculator will show the equation and the answer at the same time although we only show the answers in these examples.

### Arithmetic Operations

Example	Key operations	Display	Remarks
45+285+3=	45 + 285 ÷ 3 =	140.	
$\frac{18+6}{15-8}$	$ON/C$ ( 18 + 6 ) ÷ ( 15 - 8 = *	3.428571429	
42×(-5)+ 120=	42 × +/- 5 (42 × 5 +/-) + 120 =	-90.	
$(5 \times 10^3) +$ $(4 \times 10^{-3}) =$	5 Exp 3 ÷ 4 Exp +/- 3 (4 Exp 3 +/-) =	1250000.	

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

## Functions

Before performing function calculations be sure to press  $\text{ON/C}$ .

- Before starting calculations, specify the angular unit. (See page 7)
- Chain calculations (The result of the last calculation is used as the first operand.)

Example	Key operations	Display	Remarks
$\sin 60^\circ =$	$\text{ON/C}$ $\sin$ 60 $=$	DEG <b>0.866025403</b>	DEG
$\cos \frac{\pi}{4} [\text{rad}] =$	$\text{ON/C}$ $\cos$ ( 2ndF $\pi$ $\div$ 4 ) $=$	RAD <b>0.707106781</b>	RAD
$\tan^{-1} 1 = [^\circ]$	$\text{ON/C}$ 2ndF $\tan^{-1}$ 1 $=$	GRAD <b>50.</b>	GRAD [g]
$25+5=30$	$\text{ON/C}$ 25 $+$ 5 $=$	<b>30.</b>	DEG
$\sin 30^\circ =$	$\sin$ 2ndF $\text{ANS}$ $=$	DEG <b>0.5</b>	

- The results of inverse trigonometric functions are displayed within the following range:

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

Example	Key operations	Display	Remarks
$(\cosh 1.5 + \sinh 1.5)^2 =$	$\text{ON/C}$ ( $\text{hyp}$ $\cos$ 1.5 $+$ $\text{hyp}$ $\sin$ 1.5 ) $x^2$ $=$	<b>20.08553692</b>	
$\tanh^{-1} \frac{5}{7} =$	$\text{ON/C}$ 2ndF $\text{archyp}$ $\tan$ ( 5 $\div$ 7 ) $=$	<b>0.895879734</b>	

Example	Key operations	Display	Remarks
$\ln 20 =$	$\text{ON/C}$ $\ln$ 20 $=$	<b>2.995732274</b>	
$\log 50 =$	$\text{ON/C}$ $\log$ 50 $=$	<b>1.698970004</b>	
$e^3 =$	$\text{ON/C}$ $2\text{ndF}$ $e^x$ 3 $=$	<b>20.08553692</b>	
$10^{1.7} =$	$\text{ON/C}$ $2\text{ndF}$ $10^x$ 1.7 $=$	<b>50.11872336</b>	
$\frac{1}{6} + \frac{1}{7} =$	$\text{ON/C}$ 6 $2\text{ndF}$ $x^{-1}$ $+$ 7 $2\text{ndF}$ $x^{-1}$ $=$	<b>0.309523809</b>	
$8^{-2} - 3^4$ $\times 5^2 =$	$\text{ON/C}$ 8 $y^x$ $+/-$ 2 $-$ 3 $y^x$ 4 $\times$ 5 $x^2$ $=$	<b>-2024.984375</b>	
$(12^3)^{\frac{1}{4}} =$	$\text{ON/C}$ 12 $y^x$ 3 $y^x$ 4 $2\text{ndF}$ $x^{-1}$ $=$	<b>6.447419591</b>	
$\sqrt{49} -$ $\sqrt[4]{81} =$	$\text{ON/C}$ $\sqrt{\quad}$ 49 $-$ 4 $2\text{ndF}$ $\sqrt[4]{\quad}$ 81 $=$	<b>4.</b>	
$4! =$ $(4 \times 3 \times 2 \times 1 =)$	$\text{ON/C}$ 4 $2\text{ndF}$ $n!$ $=$  $n! = n \cdot (n-1) \cdot (n-2) \cdots 2 \cdot 1$	<b>24.</b>	
${}_{10}P_3 = \frac{n!}{n-r!}$	$\text{ON/C}$ 10 $2\text{ndF}$ $nPr$ 3 $=$	<b>720.</b>	
${}^5C_2 = \frac{n!}{r!(n-r)!}$	$\text{ON/C}$ 5 $nCr$ 2 $=$	<b>10.</b>	
$500 \times 25\% =$	500 $\times$ 25 $\%$	<b>125.</b>	
$120 \div 400 = ?\%$	120 $\div$ 400 $\%$	<b>30.</b>	
$500 + (500 \times 25\%) =$	500 $+$ 25 $\%$	<b>625.</b>	
$400 - (400 \times 30\%) =$	400 $-$ 30 $\%$	<b>280.</b>	

## Random Numbers

A pseudo-random number with three significant digits can be generated by pressing  $\boxed{2\text{ndF}} \boxed{\text{RANDOM}} \boxed{=}$ . To generate the next random number, press  $\boxed{=}$ . You can perform this function in the normal and statistics modes.

- Random numbers use memory Y. Each random number is generated on the basis of the value stored in memory Y (pseudo-random number series).

## Angular Unit Conversions

The angular unit can be changed in the following sequence: degrees  $\rightarrow$  radians  $\rightarrow$  grads  $\rightarrow$  degrees  $\rightarrow$  ...

Example	Key operations	Display	Remarks
$90^\circ \rightarrow ?[\text{rad}]$ $\rightarrow ?g$		DEG <b>90.</b>	DEG
	$\boxed{2\text{ndF}} \boxed{\text{DRG}\blacktriangleright}$	RAD <b>1.570796327</b>	$\frac{\pi}{2}$ [rad]
	$\boxed{2\text{ndF}} \boxed{\text{DRG}\blacktriangleright}$	GRAD <b>100.</b>	100g
	$\boxed{2\text{ndF}} \boxed{\text{DRG}\blacktriangleright}$	DEG <b>90.</b>	$90^\circ$
$\sin^{-1} 0.8 = ?^\circ$ $\rightarrow ?[\text{rad}]$ $\rightarrow ?g$	$\boxed{2\text{ndF}} \boxed{\sin^{-1}}$	DEG <b>53.13010235</b>	$^\circ(\text{DEG})$
	0.8 $\boxed{=}$	RAD <b>0.927295218</b>	[rad]
	$\boxed{2\text{ndF}} \boxed{\text{DRG}\blacktriangleright}$	GRAD <b>59.03344706</b>	g
	$\boxed{2\text{ndF}} \boxed{\text{DRG}\blacktriangleright}$		

$$180^\circ = \pi [\text{rad}] = 200^g (\pi = 3.141592654)$$

## Memory Calculations

This calculator has one independent memory (M), one last answer memory, and two temporary memories (X,Y).

Independent memory (M)

M memory is available in the normal mode.

$\boxed{\text{STO}}$   $\boxed{\text{M}}$ :

Clears the independent memory and then stores

the displayed value in it.

**RCL** **M** or **2ndF** **ALPHA** **M** **=** :

Recalls the value in the independent memory.

**M+** :

Adds the displayed value to the value stored in the independent memory.

**2ndF** **M-** :

Subtracts the displayed value from the value stored in the independent memory.

- Press 0 **STO** **M** to clear (i.e. store 0) in the independent memory.

### Temporary memories (X, Y)

X and Y memories are available in the normal mode.

**STO** **X**, **Y** :

Stores the displayed value in the specified temporary memory (X, Y)

**RCL** **X**, **Y** or **2ndF** **ALPHA** **X**, **Y** **=** :

Recalls the value stored in the memory corresponding to the alphabetic key pressed.

- Temporary memory contents are cleared when the mode is changed or the value 0 is stored.

### Last answer memory

The last answer memory is available in the normal and statistics modes.

The calculation result obtained by pressing **=** or any other calculation ending instruction is automatically stored in the last answer memory.

**2ndF** **ANS** :

Recalls the contents of the last answer memory.

- Last answer memory is cleared when the mode is changed.

### Note:

Calculation results from the functions indicated below are automatically stored in memories X or Y. For this reason, when using these functions, be careful with the use of memories X and Y.

- Random numbers ..... Y memory
- $\rightarrow r\theta \rightarrow xy$  ..... X memory, Y memory

Example	Key operations	Display	Remarks
$24 + (8 \times 2) =$ $(8 \times 2) \times 5 =$	$8 \times 2 \text{ (STO) M}$ $24 \div \text{RCL M} =$ $\text{RCL M} \times 5 =$	$16.^M$ $1.5.^M$ $80.^M$	①
$23 + 45 + 78 =$ $+ ) 52 - 31 + 43 =$ $- ) 64 + 73 - 12 =$ (A)	$\text{ON/C (STO) M}$ $23 + 45 + 78 \text{ M+}$ $52 - 31 + 43 \text{ M+}$ $64 + 73 - 12$ $\text{2ndF M-}$ $\text{RCL M}$	$0.$ $146.^M$ $64.^M$ $125.^M$ $85.^M$	(A)
$\$1 = \text{¥}104$ $\text{¥}25,090 = \$?$	$104 \text{ (STO) Y}$ $25090 \div \text{RCL Y}$ $=$	$104.$ $241.25$	②
$\$2,750 = \text{¥}?$	$2750 \times$ $\text{RCL Y} =$	$286000.$	
$r = 3\text{cm}$ $\pi r^2 = ?$ $(r \rightarrow Y)$	$3 \text{ (STO) Y}$ $\text{2ndF } \pi \text{ 2ndF ALPHA}^*$ $\text{Y } x^2$ $=$	$3.$ $28.27433388$	
$\frac{24}{4 + 6} = 2.4 \dots \text{(A)}$ $3x(\text{A}) + 60 + (\text{A}) =$	$24 \div ( 4 +$ $6 ) =$ $3 \times \text{2ndF ANS}$ $+ 60 \div$ $\text{2ndF ANS}$ $=$	$2.4$ $32.2$	③ (A)

① Independent memory

② Temporary memory

③ Last answer memory

\* Entry of the multiplication procedure is omitted between " $\pi$ " and a variable.

## Fraction Calculations

$\text{a}^b/c$  : Used to enter a fraction or to convert numbers.

$\text{2ndF } d/c$  : Used to convert numbers.

- A decimal number or exponent cannot be entered as a fraction.
- In all cases, a total of up to 10 digits including integer, numerator, denominator and the symbol ( $\Gamma$ ) can be entered.
- If the number of digits to be displayed is greater than 10, the number is converted to and displayed as a decimal number.

Example	Key operations	Display
$3\frac{1}{2} + \frac{4}{3}$ $= 4\frac{5}{6} \left(\frac{29}{6}\right)$	3 $\boxed{a^b/c}$ 1 $\boxed{a^b/c}$ 2 $\boxed{+}$ 4 $\boxed{a^b/c}$ 3 $\boxed{=}$ $\boxed{a^b/c}$ 2ndF $\boxed{d/c}$	4 $\Gamma$ 5 $\Gamma$ 6 <b>4.833333333</b> 29 $\Gamma$ 6
$\sqrt[3]{2\frac{8}{9}} =$	$\boxed{ON/c}$ 2ndF $\boxed{\sqrt[3]{\quad}}$ 2 $\boxed{a^b/c}$ 8 $\boxed{a^b/c}$ 9 $\boxed{=}$	<b>1.424219561</b>

## Time, Decimal and Sexagesimal Calculations

Conversion between decimal and sexagesimal numbers can be performed. In addition, the four basic arithmetic operations and memory calculations can be carried out using the sexagesimal system. (These operations, except the memory calculations, are also available in the statistical mode.)

Example	Key operations	Display	Remarks
$12^{\circ}39'18''05$ $\rightarrow ?(10)$ ①	12 $\boxed{D^{\circ}M'S}$ 39 $\boxed{D^{\circ}M'S}$ 18 $\boxed{D^{\circ}M'S}$ 5 2ndF $\boxed{D^{\circ}M'S}$	<b>12.65501389</b>	$12.65501389^{\circ}$
$123.678$ $\rightarrow ?(60)$ ②	123.678 $\boxed{2ndF}$ $\boxed{D^{\circ}M'S}$	<b>123^{\circ}40'40.80</b>	$123^{\circ}40'40''80$

- ① Decimal  
 ② Sexagesimal

Example	Key operations	Display	Remarks
3h30m45s + 6h45m36s = ?(60) ②	3 $\boxed{D^{\circ}M'S}$ 30 $\boxed{D^{\circ}M'S}$ 45 $\boxed{+}$ 6 $\boxed{D^{\circ}M'S}$ 45 $\boxed{D^{\circ}M'S}$ 36 $\boxed{=}$	<b>10°16'21.00</b>	10h16m21s
3h45m - 1.69h = ?(60) ②	3 $\boxed{D^{\circ}M'S}$ 45 $\boxed{-}$ 1.69 $\boxed{=}$ $\boxed{2ndF}$ $\boxed{+DEG}$	<b>2°03'36.00</b>	2h3m36s
sin62°12' 24" = ?(10) ①	$\boxed{ON/C}$ $\boxed{\sin}$ 62 $\boxed{D^{\circ}M'S}$ 12 $\boxed{D^{\circ}M'S}$ 24 $\boxed{=}$	DEG <b>0.884635235</b>	DEG

- ① Decimal  
② Sexagesimal

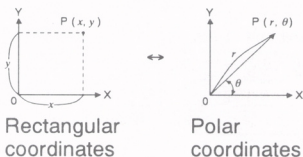
## Coordinate Conversions

Coordinate conversion can be performed in the normal and statistics modes.

- Before performing a calculation select the angular unit.  
(See page 7)

$\boxed{2ndF}$   $\boxed{\rightarrow r\theta}$  : Converts rectangular coordinates  $(x, y)$  to polar coordinates  $(r, \theta)$ .

$\boxed{2ndF}$   $\boxed{\rightarrow xy}$  : Converts polar coordinates  $(r, \theta)$  to rectangular coordinates  $(x, y)$ .



$\boxed{2ndF}$   $\boxed{,}$  : Used to enter the  $y$  value for rectangular coordinates or the  $\theta$  value for polar coordinates.

$\boxed{\leftarrow}$   $\boxed{\rightarrow}$  : Switches between the  $x$  and  $y$  or  $r$  and  $\theta$  coordinates.

- The calculation result is automatically stored in memories X and Y.

Value of  $r$  or  $x$ : X memory

Value of  $\theta$  or  $y$ : Y memory

Example	Key operations	Display	Remarks
$\begin{cases} x = 6 \\ y = 4 \\ \downarrow \\ r = ? \\ \theta = ? \end{cases}$	$6$ <b>2ndF</b> $\cdot$ $4$ <b>2ndF</b> $\rightarrow r\theta$ $\rightarrow$ $\leftarrow$	<b>4.</b> <b>7.211102551</b> $\rightarrow$ <b>33.69006753</b> $\leftarrow$ <b>7.211102551</b> $\rightarrow$	DEG $r$ $\theta$ $r$
$\begin{cases} r = 14 \\ \theta = \frac{\pi}{5} \\ \downarrow \\ x = ? \\ y = ? \end{cases}$	$14$ <b>2ndF</b> $\cdot$ <b>2ndF</b> $\pi$ $\div$ $5$ <b>2ndF</b> $\rightarrow xy$ $\rightarrow$ $\leftarrow$	<b>11.32623792</b> $\rightarrow$ <b>8.228993532</b> $\leftarrow$ <b>11.32623792</b> $\rightarrow$	RAD $x$ $y$ $x$

## Modify Function

In this calculator, all calculation results are internally obtained in scientific notation with up to 12 digits for the mantissa. However, since calculation results are displayed in the form designated by the display notation and the number of decimal places indicated, the internal calculation result may differ from that shown in the display. By using the modify function, the internal value is converted to match that of the display, so that the displayed value can be used without change in subsequent operations. This function is useful, for example, when performing calculations in which the significant digits of a number need to be taken into account.

Example	Key operations	Display	Remarks
$5 \div 9 = (A)$	$5$ $\div$ $9$ $=$	<b>0.6</b>	FIX, TAB = 1
$(A) \times 9 =$	$\times$ $9$ $=$	<b>5.0</b>	$5.555555555555 \times 10^{-1} \times 9$
	$5$ $\div$ $9$ $=$ <b>2ndF</b> <b>MDF</b> $\times$ $9$ $=$	<b>0.6</b> <b>5.4</b>	FIX, TAB = 1 $0.6 \times 9$

## STATISTICAL CALCULATIONS

The following statistics can be obtained (refer to the table below):

Press **MODE** **1** to select statistics mode.

$\bar{x}$	Mean of samples ( $x$ data)
$sx$	Sample standard deviation ( $x$ data)
$\sigma x$	Population standard deviation ( $x$ data)
$n$	Number of samples
$\Sigma x$	Sum of samples ( $x$ data)
$\Sigma x^2$	Sum of squares of samples ( $x$ data)

### [Data Entry]

Entered data are kept in memory until **2ndF** **CA** are pressed. Before entering new data, clear the memory contents. Alternatively, press **MODE** **1** to clear the calculator.

Data **DATA**

Data **,** frequency **DATA** (To enter multiples of the same data)

### [Data Correction]

Correction prior to pressing **DATA**:

Delete incorrect data with **ON/C**. If you have not pressed **,** after entering an incorrect value, this value can be corrected with **DEL**.

Correction after pressing **DATA**:

If you have pressed **DATA** but no other key, delete the incorrect data with **2ndF** **CD**.

If you have performed any other operation, reenter the data to be corrected and press **2ndF** **CD**.

### [Recalling Statistics]

- The values of  $\bar{x}$ ,  $sx$ ,  $\sigma x$ ,  $n$ ,  $\Sigma x$  and  $\Sigma x^2$  can be viewed by pressing **RCL** followed by the corresponding key.

## Statistical Calculation Formulas

In the statistical calculation formulas, an error will occur when:

- the absolute value of the intermediate result or calculation result is equal to or greater than  $1 \times 10^{100}$ .
- the denominator is zero.
- an attempt is made to take the square root of a negative number.

$$\bar{x} = \frac{\sum x}{n}$$

$$s_x = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n-1}}$$

$$\sigma_x = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n}}$$

$$\sum x = x_1 + x_2 + \dots + x_n$$

$$\sum x^2 = x_1^2 + x_2^2 + \dots + x_n^2$$

(n: Number of samples)

[Single-variable Statistical Calculations]

As an example, obtain the statistics for the following data.

Ex.

Score	30 40 50 60 70 80 90 100
Number of people	2 5 4 6 11 13 7 2

Key operations	Display	Remarks
	<b>STAT</b>	
	<b>0.</b>	
(MODE) 1		
30 (.) 2 (DATA)	<b>2.</b>	n
40 (.) 5 (DATA)	<b>7.</b>	n
50 (.) 4 (DATA)	<b>11.</b>	n
60 (.) 6 (DATA)	<b>17.</b>	n
70 (.) 11 (DATA)	<b>28.</b>	n
80 (.) 13 (DATA)	<b>41.</b>	n
90 (.) 7 (DATA)	<b>48.</b>	n
100 (.) 2 (DATA)	<b>50.</b>	n

Key operations	Display	Remarks
RCL $\bar{x}$	69.2	$\bar{x}$
RCL $\sigma x$	17.7583783	$\sigma x$
RCL $\Sigma x$	3460.	$\Sigma x$
RCL $sx$	17.93867103	$sx$
$x^2$ =	321.7959184	$sx^2$

## ERROR AND CALCULATION RANGES

### 1. Errors

An error will occur if an operation exceeds the calculation ranges on page 21, or if a mathematically illegal operation is attempted. When an error occurs, pressing  $\leftarrow$  (or  $\rightarrow$ ) automatically moves the cursor back to the place in the equation where the error occurred. Edit the equation (see page 8) or press  $\text{ON/C}$  to clear the equation.

- The number following the indicator "Error" is an error code. Since this code indicates the type of error, carefully check the code number and its meaning.

### 2. Error Codes and Error Types

1	<p>Syntax error</p> <ul style="list-style-type: none"> <li>An attempt was made to perform an invalid operation.</li> </ul> <p>Ex. Attempting to perform coordinate conversion after entering only one item of data. 2 <math>\text{2ndF}</math> <math>\rightarrow r\theta</math></p>
2	<p>Calculation error</p> <ul style="list-style-type: none"> <li>The absolute value of an intermediate or final calculation result equals or exceeds <math>10^{100}</math>.</li> <li>An attempt was made to divide by 0.</li> <li>The calculation ranges on page 21 were exceeded while performing function calculations or statistical calculations.</li> </ul>
3	<p>Depth error</p> <ul style="list-style-type: none"> <li>The available number of buffers was exceeded. (There are 8 buffers for numeric values and 16 buffers for calculation instructions). (See page 6)</li> </ul>

4	<p>Equation too long</p> <ul style="list-style-type: none"> <li>The equation exceeded its maximum input buffer (159 characters). An equation must be shorter than 159 characters.</li> </ul>
---	--

### 3. Calculation Ranges

- Within the ranges specified below, this calculator is accurate to  $\pm 1$  in the least significant digit of the mantissa. When performing continuous calculations (including chain calculations), errors accumulate leading to reduced accuracy.
- Calculation ranges  
 $\pm 10^{-99} \sim \pm 9.999999999 \times 10^{99}$  and 0.

If the absolute value of an entry or a final or intermediate result of a calculation is less than  $10^{-99}$ , the value is considered to be 0 in calculations and in the display.

Function	Dynamic range
$\sin x$ $\cos x$ $\tan x$	DEG: $ x  < 10^{10}$ $(\tan x :  x  \neq 90 (2n-1))^*$ RAD: $ x  < \frac{\pi}{180} \times 10^{10}$ $(\tan x :  x  \neq \frac{\pi}{2} (2n-1))^*$ GRAD: $ x  < \frac{10}{9} \times 10^{10}$ $(\tan x :  x  \neq 100 (2n-1))^*$
$\sin^{-1}x$ $\cos^{-1}x$	$ x  \leq 1$
$\tan^{-1}x, \sqrt[3]{x}$	$ x  < 10^{100}$
$\ln x$ $\log x$	$10^{-99} \leq x < 10^{100}$
$y^x$	<ul style="list-style-type: none"> <li><math>y &gt; 0</math>: <math>-10^{100} &lt; x \log y &lt; 100</math></li> <li><math>y = 0</math>: <math>0 &lt; x &lt; 10^{100}</math></li> <li><math>y &lt; 0</math>:  <math>x = n (0 &lt;  x  &lt; 1; \frac{1}{x} = 2n-1, x \neq 0)^*</math>,  <math>-10^{100} &lt; x \log  y  &lt; 100</math></li> </ul>

Function	Dynamic range
$\sqrt[n]{y}$	<ul style="list-style-type: none"> <li>• <math>y &gt; 0</math>: <math>-10^{100} &lt; \frac{1}{x} \log y &lt; 100</math> (<math>x \neq 0</math>)</li> <li>• <math>y = 0</math>: <math>0 &lt; x &lt; 10^{100}</math></li> <li>• <math>y &lt; 0</math>: <math>x = 2n-1</math>  <math>(0 &lt;  x  &lt; 1 : \frac{1}{x} = n, x \neq 0)^*</math>,  <math>-10^{100} &lt; \frac{1}{x} \log  y  &lt; 100</math></li> </ul>
$e^x$	$-10^{100} < x \leq 230.2585092$
$10^x$	$-10^{100} < x < 100$
$\sinh x$ $\cosh x$ $\tanh x$	$ x  \leq 230.2585092$
$\sinh^{-1} x$	$ x  < 10^{50}$
$\cosh^{-1} x$	$1 \leq x < 10^{50}$
$\tanh^{-1} x$	$ x  < 1$
$x^2$	$ x  < 10^{50}$
$\sqrt{x}$	$0 \leq x < 10^{100}$
$x^{-1}$	$ x  < 10^{100}$ ( $x \neq 0$ )
$n!$	$0 \leq n \leq 69^*$
$nPr$	$0 \leq r \leq n \leq 9999999999^*$ $\frac{n!}{(n-r)!} < 10^{100}$
$nCr$	$0 \leq r \leq n \leq 9999999999^*$ $0 \leq r \leq 69$ $\frac{n!}{(n-r)!} < 10^{100}$
$\rightarrow$ DEG D°M'S	$0^\circ 00' 00.01 \leq  x  < 10000^\circ$

Function	Dynamic range
$x, y \rightarrow r, \theta$	$\sqrt{x^2 + y^2} < 10^{100}$
$r, \theta \rightarrow x, y$	$0 \leq r < 10^{100}$ DEG: $ \theta  < 10^{10}$ RAD: $ \theta  < \frac{\pi}{180} \times 10^{10}$ GRAD: $ \theta  < \frac{10}{9} \times 10^{10}$
DRG▶	DEG→RAD, GRAD→DEG: $ x  < 10^{100}$ RAD→GRAD: $ x  < \frac{\pi}{2} \times 10^{98}$

\* (n, r: integer)

## SCIENTIFIC AND CALCULATOR FUNCTIONS

### Scientific Functions

	Function	No.
Statistical	$n, \Sigma x, \Sigma x^2, \bar{x}, \sigma x, s x, x \text{ DATA}, x, w \text{ DATA}, \text{CD}$	9
Conversion	$\leftrightarrow \text{D}^\circ\text{M}'\text{S}, \leftrightarrow \text{DEG}, \rightarrow r\theta, \rightarrow xy, \leftarrow (r \text{ or } y), \rightarrow (\theta \text{ or } y), \text{DEG} \leftrightarrow \text{RAD}, \text{RAD} \leftrightarrow \text{GRAD}, \text{GRAD} \leftrightarrow \text{DEG}$	12
Time	Arithmetic, (+, -, x, /), STO, RCL, M+, M-	8
Pending operations	16 calculation instructions 8 numbers	24
Power, power root	$y^x, \sqrt[x]{y}$	2
Fractional	Arithmetic, ANSWER (fractions ↔ decimal, mixed fraction ↔ improper fraction), decimal → fraction, STO, RCL, M+, M-	13

Function		No.
Trigonometric, inverse trigonometric	sin, cos, tan, $\sin^{-1}$ , $\cos^{-1}$ , $\tan^{-1}$ for each angular unit	18
Others	sinh, cosh, tanh, $\sinh^{-1}$ , $\cosh^{-1}$ , $\tanh^{-1}$ , $e^x$ , $10^x$ , ln, log, $x^2$ , $\sqrt{\quad}$ , $\sqrt[3]{\quad}$ , $x^{-1}$ , DEG, RAD, GRAD, n!, ${}_n P_r$ , ${}_n C_r$ , %, +%, -%, x%, +%, FIX, SCI, ENG, TAB (0-9), MDF, $\pi$ , EXP, RANDOM	42
Arithmetic substitution	?	1

## Calculator Functions

Function		No.
Memory	STO, RCL, M+, M-, X, Y, ANS	7
Arithmetic	+, -, $\times$ , $\div$	4
Error recover	Syntax, calculate, depth, equation too long	4
Others	C, CE ( $\blacktriangleleft$ ), $\rightarrow$ (DEL), CA, DEL, +/-, $\curvearrowright$ , $\blacktriangleleft$ , $\blacktriangleright$	9

Scientific function	Calculator function	Total
129	24	153

## BATTERY REPLACEMENT

### Notes on Battery Replacement

Improper handling of batteries can cause electrolyte leakage or explosion. Be sure to observe the following handling rules:

- Replace both batteries at the same time.

- Do not mix new and old batteries.
- Make sure the new batteries are the correct type.
- When installing, orient each battery properly as indicated in the calculator.
- Batteries are factory-installed before shipment, and may be exhausted before they reach the service life stated in the specifications.

## When to Replace the Batteries

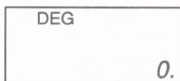
If the display has poor contrast, the batteries require replacement.

### Caution

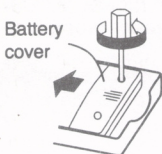
- Keep batteries out of the reach of children.
- Exhausted batteries left in the calculator may leak and damage the calculator.
- Explosion risk may be caused by incorrect handling.
- These batteries must be replaced only with others of the same type.
- Some batteries are rechargeable and some are not. Be sure to use the non-rechargeable type.
- Do not throw batteries into a fire as they may explode.

## Replacement Procedure

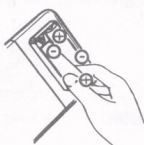
1. Turn the power off by pressing **2ndF** **OFF**.
2. Close the protective cover and remove two screws. Then, slide the body slightly toward the direction of the arrow. (Fig. 1)
3. Slide the battery cover slightly and lift it to remove.
4. Remove used batteries.
5. Install two new batteries.
  - First insert the "⊖" side to the spring. (Fig. 2)
6. Put back the back cover and screws.
7. Press the RESET switch (on the back).
  - Make sure that the display appears as shown below. If the display does not appear as shown, remove the batteries re-install them and check the display once again.



(Fig. 1)



(Fig. 2)



## Automatic Power Off Function

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

## SPECIFICATIONS

Calculations:	Scientific calculations, statistical calculations, etc.
Internal calculations:	Mantissas of up to 12 digits
Power source:	3V $\ddot{\cdot}$ (DC): Heavy duty manganese batteries (size AA or R6) $\times$ 2
Power consumption:	0.0006 W
Operating time:	Approx. 15,000 hours when continuously displaying 55555. at 20°C. Varies according to use and other factors.
Operating temperature:	0°C – 40°C
External dimensions:	84 mm (W) $\times$ 157 mm (D) $\times$ 22.2 mm (H)
Weight:	Approx. 151 g (Including batteries)
Accessories:	Batteries (size AA or R6) $\times$ 2 (installed), quick reference card and operation manual

This equipment complies with the requirements of Directive 89/336/EEC as amended by 93/68/EEC.

Dieses Gerät entspricht den Anforderungen der EG-Richtlinie 89/336/EWG mit Änderung 93/68/EWG.

Ce matériel répond aux exigences contenues dans la directive 89/336/CEE modifiée par la directive 93/68/CEE.

Dit apparaat voldoet aan de eisen van de richtlijn 89/336/EEG, gewijzigd door 93/68/EEG.

Dette udstyr overholder kravene i direktiv nr. 89/336/EEC med tillæg nr. 93/68/EEC.

Quest' apparecchio è conforme ai requisiti della direttiva 89/336/EEC come emendata dalla direttiva 93/68/EEC.

Η εγκατάσταση αυτή ανταποκρίνεται στις απαιτήσεις των οδηγιών της Ευρωπαϊκής Ένωσης 89/336/ΕΟΚ, όπως ο κανονισμός αυτός συμπληρώθηκε από την οδηγία 93/68/ΕΟΚ.

Este equipamento obedece às exigências da directiva 89/336/CEE na sua versão corrigida pela directiva 93/68/CEE.

Este aparato satisface las exigencias de la Directiva 89/336/CEE modificada por medio de la 93/68/CEE.

Denna utrustning uppfyller kraven enligt riktlinjen 89/336/EEC så som kompletteras av 93/68/EEC.

Dette produktet oppfyller betingelsene i direktivet 89/336/EEC i endringen 93/68/EEC.

Tämä laite täyttää direktiivin 89/336/EEC vaatimukset, jota on muutettu direktiivillä 93/68/EEC.



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