

# Math



## Math Mt 633 plus User's Guide

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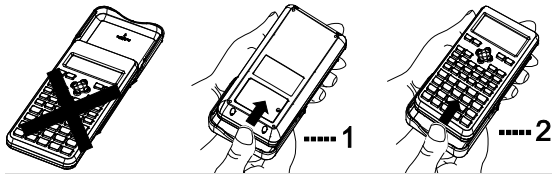
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### Removing and Replacing the Calculator's Cover

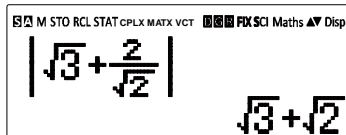
Always slide the keyboard end of the unit into the cover first. Never slide the display end of the unit into the cover. Holding the cover as shown in the illustration, slide the unit out of the cover before use. Picture.....1  
Holding the cover as shown in the illustration, slide the unit out of the cover after use. Picture.....2



### Precautions

- Don't expose the machine to water, direct sunlight, extremely hot or cold temperatures or dusty environments.
- Don't drop the machine or subject it to heavy impact.
- Use a soft cloth to clean the machine. Do not use detergents.

### Display (4-line Dot Matrix Display)



<Status Indicators>

- S : Shift key
- A : Alpha key
- M : Independent memory
- STO : Store memory
- RCL : Recall memory
- STAT : Statistics mode
- CPLX : Complex number Mode
- MATX : Matrix Mode
- VCT : Vector mode
- D : Degree Mode
- R : Radian Mode
- G : Gradient Mode
- FIX : Fixed-decimal setting.
- SCI : Scientific Notation
- Maths : Math Display mode
- ▲ : Scroll Up
- ▼ : Scroll Down
- ◀ : Scroll Left
- ▶ : Scroll Right
- Disp : Multi-statements Display

### Initialize Calculator

When you are not sure of the current calculator setting, you are recommended to initialize the calculator (calculation mode "COMP", angle unit "Degree", and clear reply and variable memories), and LCD contrast by pressing **Shift** **CLR** **3** (All) **=** (Yes) **CA**.

### Before Using the Calculator

#### ■ Check the current Calculation mode

Be sure to check the status indicators that indicate the current calculation mode, display formats setting and angle unit setting ( Deg, Rad, Gra).

#### ■ Return to initial setup

Pressing **Shift** **CLR** **1** (setup) **=** (Yes) **CA** to return the initial calculator setup.

- Calculation mode : COMP
- Input/ Output Format : Maths
- Angle unit : Deg
- Display Digits : Norm 1
- Fraction Display Format : d/c
- COMPLEX Result Display Format : a+bi
- Statistical Data Input : OFF
- Decimal Point format : Dot
- Recurring Decimal Format : ON

This action will not clear the variable memories.

### Getting Started

#### Power On and Off

##### ■ First time operation:

Press **ON** **Shift** **CLR** **3** **=** **CA** to reset the calculator.

**Power ON:** When **ON** is pressed.

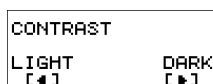
**Power OFF:** **Shift** **OFF** are pressed.

##### Auto Power Off Function:

When the calculator is not used for about 7 minutes, it will automatically power off.

### Display Contrast Adjustment

Press **Shift** **SET-UP** **▼** **6** (6: **◀** CONT **▶**), enter the Display Contrast Adjustment screen.



Press to make the display contrast darken.  
 Press to make the display contrast lighten.  
 Press or to confirm and clear the screen.

- To initialize the LCD contrast, press outside the **Display Contrast Adjustment** screen.

#### Mode Selection

- Press to enter the Calculation Mode Selection screen, 2 pages can be selected as following. ; press / for next/previous page.

|         |          |       |         |          |
|---------|----------|-------|---------|----------|
| 1:COMP  | 2:CPLX   | Press | 1:INEQ  | 2:VERIFY |
| 3:STAT  | 4:BASE   |       | 3:RATIO |          |
| 5:EQN   | 6:MATRIX |       |         |          |
| 7:TABLE | 8:VECTOR |       |         |          |

- Press ~ to select the calculation mode.
- Specifying the Calculation Mode

| Mode  |        | LCD Indicator | Operation |
|---|--------|---------------|-----------|
| Normal calculation                              | COMP   |               |           |
| Complex number Calculation                      | CPLX   | CPLX          |           |
| Statistical calculation                         | STAT   | STAT          |           |
| Binary, Octal, Decimal, Hexadecimal Calculation | BASE   |               |           |
| Equation Calculation                            | EQN    |               |           |
| Matrix Calculation                              | MATRIX | MATX          |           |
| Function Table calculation                      | TABLE  |               |           |
| Vector Calculation                              | VECTOR | VCT           |           |
| Inequality Solution                             | INEQ   |               |           |
| Verify a Calculation                            | VERIFY |               |           |
| Ratio Calculation                               | RATIO  |               |           |

- Initial mode is COMP mode.

#### Calculator Set-up Menu

- Press to enter the Calculator Set-up Menu; press / for next/previous page.

|          |         |                |         |         |
|----------|---------|----------------|---------|---------|
| 1: Maths | 2: Line | Press  or  key | 1: ab/c | 2: d/c  |
| 3: Deg   | 4: Rad  |                | 3: CPLX | 4: STAT |
| 5: Gra   | 6: Fix  |                | 5: Disp | 6: CONT |
| 7: Sci   | 8: Norm |                | 7: Rdec |         |

- To select the calculator input & output format [1] Maths or [2] Line.

- [1] Maths -( Maths mode): The majority of calculation input and output ( e.g. Fraction, pi, square root number) are shown in Mathematics textbook format. And "Maths" icon will be shown.

Maths mode

- [2] Line-( Line mode): The majority of calculation input and output are shown in the lines format.

Line mode

- To select the angle unit [3] Deg, [4] Rad or [5] Gra

- [3] Deg: Angle unit in Degree  
 [4] Rad: Angle unit in Radian  
 [5] Gra: Angle unit in Gradient

$$90^\circ = \frac{\pi}{2} \text{ radians} = 100 \text{ grads}$$

- TO select display digit or notation [6] Fix, [7] Sci or [8] Norm

- [6] Fix: Fixed Decimal, [Fix 0-9?] appears, specify the number of decimal places by pressing [0] - [9].

Example:  $230 \div 7 = 32.8571$  (FIX 4)  
 $= 32.86$  (FIX 2)

- [7] Sci: Scientific Notation, [Sci 0-9?] appears, specify the number of significant digits by pressing [0]-[9].

Example:  $230 \div 7 = 32.8571$  (FIX 4)  
 $= 32.86$  (FIX 2)

- [8] Norm: Exponential Notation, [Norm 1-2?] appears, specify the exponential I notation format by pressing [1] or [2].

Norm 1: Exponential notation is automatically used for

$$|x| < 10^{-2}, |x| \geq 10^{10}$$

Norm2: Exponential notation is automatically used for

$$|x| < 10^{-9}, |x| \geq 10^{10}.$$

Example:  $1 \div 1000 = 1 \times 10^{-3}$  (Norm 1)  
 $= 0.001$  (Norm 2)

■ **To specify the fraction calculation result display format [1] ab/c or [2] d/c**

[1] ab/c : specify Mixed fraction display.  
 [2] d/c : specify Improper fraction display.

■ **To select the COMPLEX result display format [3] CPLX( [1] a+bi or [2] r∠θ)**

[1] a+bi : Show the rectangular coordinates for complex result  
 [2] r∠θ: Show polar coordinates for complex result.

■ **To select the statistical display format [4] STAT( [1] ON or [2] OFF)**

[1] ON: Show FREQ ( Frequency ) Column in Statistical Data Input Screen.  
 [2] OFF: Hide FREQ ( Frequency ) Column in Statistical Data Input Screen.

■ **To select the decimal point display format [5] Disp ( [1] Dot or [2] Comma)**

[1] Dot: specify dot format for Decimal point result display.  
 [2] Comma: specify comma format for Decimal point result display.

■ **To Adjust Display contrast [6] ◀ CONT ▶**

See " Display Contrast Adjustment" section.

■ **To select Recur Decimal Format [7] Rdec( [1] ON or [2] OFF)**

[1] ON: Enable to display calculation results using recurring decimal form.  
 [2] OFF: Disable to display calculation results using recurring decimal form.

**Function menu (Func key)**

- Press [MODE] key to select the correspond mode
- Press [Func] key to enter Function menu.
- Press  or  key for next/previous page.

There are different function menus in different calculation mode as following.

(1) CPLX mode

|        |          |
|--------|----------|
| 1: arg | 2: Conjg |
| 3: r∠θ | 4: a+bi  |

(2) STAT mode—SD mode

|          |          |
|----------|----------|
| 1: Type  | 2: Data  |
| 3: Edit  | 4: S-SUM |
| 5: S-VAR | 6: S-PTS |
| 7: Distr |          |

(3) STAT mode—Reg mode

|          |          |
|----------|----------|
| 1: Type  | 2: Data  |
| 3: Edit  | 4: S-SUM |
| 5: S-VAR | 6: S-PTS |
| 7: Reg   |          |

(4) Base mode

|        |         |
|--------|---------|
| 1: and | 2: or   |
| 3: xor | 4: xnor |
| 5: Not | 6: Neg  |

|      |      |
|------|------|
| 1: d | 2: h |
| 3: b | 4: o |

(5) MATRIX mode

|           |         |
|-----------|---------|
| 1: Dim    | 2: Data |
| 3: MatA   | 4: MatB |
| 5: MatC   | 6: MatD |
| 7: MatAns |         |

|        |        |
|--------|--------|
| 1: Det | 2: Trn |
| 3: Adj |        |

(6) VECTOR mode

|           |         |
|-----------|---------|
| 1: Dim    | 2: Data |
| 3: VctA   | 4: VctB |
| 5: VctC   | 6: VctD |
| 7: VctAns | 8: Dot  |

(7) VERIFY mode

|      |      |
|------|------|
| 1: = | 2: ≠ |
| 3: > | 4: < |
| 5: ≥ | 6: ≤ |

**Inputting Expressions and Values**

**Input Capacity**

- This calculator allows you to input a single calculation up to 99 bytes. Normally , one byte is used as each time you press one of the numeric keys, arithmetic keys, scientific function keys or Ans. Some functions require 4- 13bytes, Shift, Alpha , and the direction keys will not use up any bytes.
- When input capacity is less than 10 bytes, the input cursor will change from " | " to " ■ " that notifying the memory is running now.

**Input Editing**

- New Input begins on the left of display. If input data are more than 15 characters, the line will scroll to the right consecutively. You can scroll back to the left by using  and  to review the input.
- In Line mode, press  to let the cursor jump to the beginning of inputting, while  will jump to the end.
- In Maths mode, press  to let the cursor jump to the beginning of inputting while it is at end of the input calculation. Or press  to let the cursor jump to the end of inputting while it is at the beginning of the input calculation.
- Omit the multiplication sign and final close parenthesis.

Example:  $2 \times \log 100 \times (1+3) = 16$

|                                    |             |           |
|------------------------------------|-------------|-----------|
| Including <input type="checkbox"/> | Operation 1 | Display 1 |
|------------------------------------|-------------|-----------|

|                                       |  |   |
|---------------------------------------|--|---|
| *1<br>2, )<br>*3                      | 2 x log 1 0 0 )<br>x<br>( 1 + 3 ) =<br>*2 *1<br>*3 | $2 \times \log(100) \times (1+3)$<br><br>16     |
| Omitting x<br>*1,<br>Omitting )<br>*3 | <b>Operation 2</b><br>2 log 1 0 0 )<br>( 1 + 3 ) = | <b>Display 2</b><br>$2\log(100)(1+3)$<br><br>16 |

**\*1. Omit multiplication sign (x)**

- Input before an open parentheses ( ):  $1 \times (2+3)$ .
- Input before scientific functions that includes parenthesis:  $2 \times \sin(30)$ .
- Input before Random number function  $\text{Rand}$ .
- Input before Variable (A, B, C, D, E, F, X, Y, M),  $\pi$ , e.

**\*2. Scientific functions come with the open parenthesis.**

Example:  $\sin$ (,  $\cos$ (,  $\text{Pol}$ (,  $\text{LCM}$ (... You need to input the argument and the close parenthesis ).

**\*3. Omit the last close parenthesis before the =, M+, Shift STO.**

■ **Insert and overwrite Input mode**

In Line mode, you can use INSERT  $\text{Insert}$  or overwrite mode for inputting.

In Insert mode (Default input mode), the cursor is a vertical flashing line " | " for inserting a new character.

In overwrite mode, press  $\text{Shift Insert}$  key to switch the cursor to a flashing horizontal ( \_ ) and replace the character at the current cursor position.

In Maths mode, you can only use the insert mode.

Whenever the display format changes from Line mode to Maths mode, it will automatically switch to the insert mode.

■ **Deleting and Correcting an Expression**

In insert mode: Move the cursor to the right of the character or function that needs to be deleted, then press  $\text{DEL}$ .

In overwrite mode: Move the cursor under the character or function being deleted, then press  $\text{DEL}$ .

Example:  $1234567+889912$

**(1) Replace an entry (1234567→1234560)**

| Mode Setting  | Key In operation   | Display(input Line only) |
|---|--|--------------------------|
| <b>Method 1:</b><br>Line/Maths mode-<br>Insert mode | $1234567$ + 889912<br>$\leftarrow$ 7 times                           | $1234567   +889912$      |
|   | $\text{DEL}$ 0   | $1234560   +889912$      |
| <b>Method2:</b> Line mode-<br>Overwrite mode        | $\text{Shift SET-UP}$ 2<br>$1234567+889912$<br>$\text{Shift Insert}$ | $1234567+889912\_$       |
|   | $\leftarrow$ 8 times   | $1234567+889912$         |
|   | 0  | $1234560+889912$         |

**(2) Deletion ( 1234567→ 134567)**

|   |                       |                     |
|---|-----------------------|---------------------|
| <b>Method1:</b> Line/Maths<br>mode- Insert mode   | $\leftarrow$ 12 times | $12   34567+889912$ |
|   | $\text{DEL}$          | $134567+889912$     |
| <b>Method 2:</b> Line<br>mode – Overwrite<br>mode | $\text{Shift Insert}$ | $1234567+889912\_$  |
|   | $\leftarrow$ 13times  | $1234567+889912$    |
|   | $\text{DEL}$          | $134567+889912$     |

**(3) Insertion (889912→2889912)**

|                                  |                     |                     |
|----------------------------------|---------------------|---------------------|
| Line/Maths mode –<br>Insert mode | $\leftarrow$ 6times | $1234567+   889912$ |
|                                  | 2                   | $1234567+2  889912$ |

**Inputting and Display Result in Maths Mode**

- In Maths Mode, the Input and display result of fraction or certain functions ( $\log$ ,  $x^2$ ,  $x^3$ ,  $x^\square$ ,  $\sqrt{\square}$ ,  $\sqrt[\square]{\square}$ ,  $\sqrt[\square]{\square}$ ,  $x^1$ ,  $10^\square$ ,  $e^\square$ ,  $\text{Abs}$ ) are shown in Handwriting/ Mathematics format.

| Example In<br>Maths mode                       | Key In operation  | Display   |
|--|---|---|
| $\left  \sqrt{3} + \frac{2}{\sqrt{2}} \right $ | $\text{Shift Abs}$ $\sqrt{\square}$ 3 $\text{Shift}$<br>+ 2 $\sqrt[\square]{\square}$ 2 = | $\left  \sqrt{3} + \frac{2}{\sqrt{2}} \right $<br><br>$\sqrt{3} + \sqrt{2}$ |

**Remark**

(1) Some input expressions cause the height of a calculation expression to be greater than one display screen. Maximum input capacity: 2 display screen (31 dots x2).

(2) Calculator memory limits how many functions or parentheses can be input in any single expression. In this case divide the expression into multiple parts and calculate separately.

(3) If part of the expression you input is cut off after calculation and in the result display screen you can press  $\leftarrow$  or  $\rightarrow$  to view the full expression.

### Basic Calculations

- Press **MODE** **1** to enter COMP mode.
- During the busy calculation, the calculator shows only the indicators (without any calculation result). You can press **CA** key to interrupt the calculating operation.

#### Arithmetic Calculations

- To calculate with negative values (exclude the negative exponent) enclose them with parentheses.
- This calculator supports 99 levels of parenthetical expression.

| Example in Maths mode                           | Key in operation  | Display                                  |
|---|---|--|
| $(2.5)^2$                                       | <b>(</b> <b>2</b> <b>.</b> <b>5</b> <b>)</b> <b>x<sup>2</sup></b><br><b>=</b>   | $(2.5)^2$<br>$\frac{25}{4}$              |
| $(4 \times 10^{75}) \cdot (-2 \times 10^{-78})$ | <b>4</b> <b>EXP</b> <b>7</b> <b>5</b> <b>x</b> <b>( )</b><br><b>2</b> <b>EXP</b> <b>( )</b> <b>7</b><br><b>8</b> <b>=</b> | $4E75 \times -2E-78$<br>$-\frac{1}{125}$ |

### Memory Calculations

#### Memory Variables

- There are 9 memory variables (A – F, M, X and Y), which store data, results, or dedicated values.
  - Store values into memory by pressing **Shift** **STO** + Memory variable.
  - Recall memory values by pressing **RCL** + Memory variable.
  - Memory content can be cleared by pressing **0** **Shift** **STO** + Memory variable.
- Example:  $24+6 \rightarrow A$  (30 store into A), calculate  $2 \sin A$  and clear memory A.

| Example in Maths mode | Key in operation  | Display                    |
|-----------------------|---|----------------------------|
| $24+6 \rightarrow A$  | <b>2</b> <b>4</b> <b>+</b> <b>6</b> <b>Shift</b><br><b>STO</b> <b>A</b> | $24+6 \rightarrow A$<br>30 |
| $2 \times \sin A = 1$ | <b>2</b> <b>sin</b> <b>Alpha</b> <b>A</b> <b>=</b>                      | $2 \sin(A)$<br>1           |
| Clear memory A        | <b>0</b> <b>Shift</b> <b>STO</b> <b>A</b>                               | $0 \rightarrow A$<br>0     |

#### Independent Memory

- Independent memory **M** uses the same memory area as variable M. It is convenient for calculating cumulative total by just pressing **M+** (add to memory) or **M-** (subtract from memory).
- Memory contents are retained even when the calculator is powered off.
- Clear independent memory (M) by pressing **0** **Shift** **STO** **M**.
- Clear all memory values by pressing **Shift** **CLR** 2(Memory) **=** **CA**.

#### Answer Memory

- The input values or the most recent calculation result will be automatically stored into Answer memory whenever you press **=**, **Shift** **=**, **M+**, **Shift** **M-**, **Shift** **STO** memory, **RCL** memory. Answer memory can hold up to 18 digits.
- Recall and use the latest stored Answer memory by pressing **Ans**.
- Answer memory is not updated as an error operation had been performed.
- Answer memory contents can be maintained even if pressing **CA**, changing the calculation mode, or turning off the calculator.

| Example in Maths mode                           | Key in operation  | Display                      |
|---|---|------------------------------|
| $123+456 \rightarrow M+$ ,<br>$Ans^2 = 335,241$ | <b>1</b> <b>2</b> <b>3</b> <b>+</b> <b>4</b><br><b>5</b> <b>6</b> <b>M+</b> <b>x<sup>2</sup></b> <b>=</b> | $Ans^2$<br>335241            |
| $789012 \cdot Ans = 453,771$                    | <b>7</b> <b>8</b> <b>9</b> <b>0</b> <b>1</b><br><b>2</b> <b>-</b> <b>Ans</b> <b>=</b>                     | $789012 \cdot Ans$<br>453771 |

### Fraction Calculations

The calculator supports Fraction calculation and the conversions between Fraction, Decimal point, Mixed fraction and Improper fraction.

- Specify the fraction calculation result display format by either mixed fraction (**■-**) or improper fraction (**■**) in set-up menu.
- At the default setting, fractions are displayed as improper fractions (**■**).
- Mixed Fraction display result only available after set the (**■-**) in the setup menu.

|            | Improper Fraction<br>( <b>■</b> ) | Mixed Fraction<br>( <b>■-</b> ) |
|------------|-----------------------------------|---------------------------------|
| Maths Mode | $\frac{13}{3}$                    | $4\frac{1}{3}$                  |
| Line Mode  | $13 \downarrow 3$                 | $4 \downarrow 1 \downarrow 3$   |

- Press **F $\leftrightarrow$ D** to switch a calculation result between fraction and decimal format.
- Press **Shift** **a/b/c $\leftrightarrow$ d/c** to switch a calculation result between improper fraction and mixed fraction format.
- Result will be displayed in decimal format automatically whenever the total digit of a fractional value (integer + numerator + denominator + separator marks) exceeds 10.
- As a fraction calculation is mixed with decimal value, the result will be displayed by decimal format.

Fraction  $\leftrightarrow$  Decimal point conversion

| Example in Maths mode | Key in operation | Display |
|-----------------------|------------------|---------|
|                       |                  |         |



|   |   |  |
|---|---|--|
| $1\frac{1}{3} + \frac{5}{6} = \frac{13}{6}$   | $\boxed{1} \boxed{\text{Shift}} \boxed{\frac{1}{x}} \boxed{1} \boxed{\text{Shift}} \boxed{\frac{1}{x}} \boxed{3} \boxed{+} \boxed{5} \boxed{6} \boxed{=}$ | $1\frac{1}{3} + \frac{5}{6}$<br>$\frac{13}{6}$ |
| In Maths mode   |   |  |
| $\frac{13}{6} \rightarrow 2.16666667$<br>(Fraction $\leftrightarrow$ Decimal)       | $\boxed{\text{F}\leftrightarrow\text{D}} \boxed{\text{F}\leftrightarrow\text{D}}$   | $1\frac{1}{3} + \frac{5}{6}$<br>2.16666667     |
| $2.16666667 \rightarrow 2\frac{1}{6}$<br>(Decimal $\leftrightarrow$ Mixed Fraction) | $\boxed{\text{Shift}} \boxed{\text{a b/c}\leftrightarrow\text{d/c}}$  | $1\frac{1}{3} + \frac{5}{6}$<br>$2\frac{1}{6}$ |

### Percentage Calculations

| Example in Maths mode                        | Key in operation   | Display        |
|--|--|----------------|
| To calculate 30% of 820 (Maths mode)         | $\boxed{8} \boxed{2} \boxed{0} \boxed{\times} \boxed{3} \boxed{0} \boxed{\text{Shift}} \boxed{\%} \boxed{=}$ | 820x30%<br>246 |
| The percentage of 75 against 12 (Maths mode) | $\boxed{7} \boxed{5} \boxed{\div} \boxed{1} \boxed{2} \boxed{\text{Shift}} \boxed{\%} \boxed{=}$             | 75÷12%<br>625  |

### Degree-Minutes-Seconds Calculations

Use degrees (hours), minutes and seconds key to perform a sexagesimal (base-60 notational system) calculation or convert the sexagesimal value into decimal value.

Degree-Minutes-Seconds  $\leftrightarrow$  Decimal points

| Example in Maths mode                                      | Key in operation  | Display  |
|--|---|--|
| $99^{\circ}0'4.8'' + 0.8 = 123^{\circ}45'6''$ (Maths mode) | $\boxed{9} \boxed{9} \boxed{^{\circ}} \boxed{0} \boxed{'} \boxed{4} \boxed{.} \boxed{8} \boxed{''} \boxed{+} \boxed{0} \boxed{.} \boxed{8} \boxed{=}$ | $99^{\circ}0'4.8'' + 0.8$<br>$123^{\circ}45'6''$ |
| $123^{\circ}45'6'' \rightarrow 123.7516667$ (Maths mode)   | $\boxed{^{\circ}} \boxed{'} \boxed{''}$   | $99^{\circ}0'4.8'' + 0.8$<br>123.7516667         |
| $2.345 \rightarrow 2^{\circ}20'44.16''$ (Maths mode)       | $\boxed{2} \boxed{.} \boxed{3} \boxed{4} \boxed{5} \boxed{=}$<br>$\boxed{^{\circ}} \boxed{'} \boxed{''}$  | 2.3456<br>$2^{\circ}20'44.16''$                  |

### Replay & Multi-statements

#### Replay Memory Function

- Replay memory is only available in COMP mode.
- After the calculation is executed, the calculation input and result will be stored in the replay memory automatically.
- Pressing  $\boxed{\checkmark}$  (or  $\boxed{\Delta}$ ) can replay the performed calculation input and result history.
- After obtaining the calculation result on the display, press  $\boxed{\leftarrow}$  or  $\boxed{\rightarrow}$  to edit the input expression of that result.
- If the  $\blacktriangleright$  indicator is on the right side of a calculation result display, you need to press  $\boxed{\text{CA}}$  and then  $\boxed{\leftarrow}$  or  $\boxed{\rightarrow}$  to scroll the calculation.
- Replay memory is cleared when you press
  - Initialize calculator setting by  $\boxed{\text{Shift}} \boxed{\text{CLR}} \boxed{3} \boxed{=}$   $\boxed{\text{CA}}$ .
  - Change from one calculation mode or display mode to other
  - Press  $\boxed{\text{ON}}$  key.
  - Press  $\boxed{\text{Shift}} \boxed{\text{OFF}}$  to power off machine.

#### Multi-statements Function

- Use a colon  $\boxed{:}$  to put two or more calculations input together.  
The first executed statement will have "Disp" indicator; and the "Disp" icon will disappear after the last statement is being executed.

| Example in Maths mode  | Key in operation  | Display                                      |
|--|---|--|
| $1 \times 23 = 23$<br>$2 + 25 = 27$<br>Using a multi-statement in Maths mode | $\boxed{1} \boxed{\times} \boxed{2} \boxed{3} \boxed{\text{Alpha}} \boxed{:} \boxed{2} \boxed{+} \boxed{2} \boxed{5} \boxed{=}$ | $1 \times 23:2+25$                           |
|  | $\boxed{=}$   | $\blacktriangle$ Disp<br>$1 \times 23$<br>23 |
|  | $\boxed{=}$   | $\blacktriangle$<br>$2+25$<br>27             |
| Replay the previous Calculation history $1 \times 23 = 23$                   | $\boxed{\blacktriangle}$  | $\blacktriangledown$<br>$1 \times 23$<br>23  |

### Functional Scientific Calculations

- Press  $\boxed{\text{MODE}} \boxed{1}$  to enter COMP mode.
- $\pi = 3.1415926535897932385$
- $e = 2.7182818284590452353$

### Square, Root, Cube, Cube Root, Power, Power Root, Reciprocal and Pi.

| Example in Maths mode                                       | Key in operation   | Display   |
|---|--|---|
| $(\sqrt[3]{3^2 + 5^3})^{-1} \times \pi$<br>$= 0.6139244642$ | $\boxed{(\sqrt[3]{\quad})^{-1}} \boxed{\text{Shift}} \boxed{\sqrt[3]{\quad}} \boxed{3} \boxed{x^2} \boxed{+} \boxed{5} \boxed{\text{Shift}} \boxed{x^2} \boxed{\text{Shift}} \boxed{\frac{1}{x}} \boxed{\text{Shift}} \boxed{\pi} \boxed{=}$ | $(\sqrt[3]{3^2 + 5^3})^{-1} \times \pi$<br>0.6139244642 |

|                                       |  |  |
|---------------------------------------|--|--|
| $\sqrt[3]{2^6} + \sqrt[3]{243}$<br>=7 | $\left[ \frac{\square}{\square} \right]$ $\left[ \text{Shift} \right]$ $\left[ \frac{\square}{\square} \right]$ $\left[ 2 \right]$ $\left[ \times \right]$ $\left[ \frac{\square}{\square} \right]$<br>$\left[ \frac{\square}{\square} \right]$ $\left[ \frac{\square}{\square} \right]$ $\left[ + \right]$ $\left[ \text{Shift} \right]$ $\left[ \frac{\square}{\square} \right]$ $\left[ \frac{\square}{\square} \right]$<br>$\left[ 2 \right]$ $\left[ 4 \right]$ $\left[ 3 \right]$ $\left[ \frac{\square}{\square} \right]$ $\left[ \frac{\square}{\square} \right]$ $\left[ = \right]$ | $(\sqrt[3]{2^6} + \sqrt[3]{243})$<br>7 |
|---------------------------------------|--|--|

**Logarithm, Natural logarithm, Antilogarithm and logab.**

| Example in Maths mode                        | Key in operation   | Display                                     |
|--|--|---|
| $e^{-3} + 10^{1.2} + \ln 3 =$<br>16.99733128 | $\left[ \text{Shift} \right]$ $\left[ e^{\square} \right]$ $\left[ (-) \right]$ $\left[ 3 \right]$ $\left[ \frac{\square}{\square} \right]$<br>$\left[ + \right]$ $\left[ \text{Shift} \right]$ $\left[ 10^{\square} \right]$ $\left[ 1 \right]$ $\left[ \cdot \right]$ $\left[ 2 \right]$<br>$\left[ \frac{\square}{\square} \right]$ $\left[ + \right]$ $\left[ \ln \right]$ $\left[ 3 \right]$ $\left[ = \right]$ | $e^{-3} + 10^{1.2} + \ln(3)$<br>16.99733128 |
| $\log_2 8 - \log 1 = 3$                      | $\left[ \text{Alpha} \right]$ $\left[ \log \right]$ $\left[ 8 \right]$ $\left[ \frac{\square}{\square} \right]$ $\left[ 2 \right]$ $\left[ \frac{\square}{\square} \right]$ $\left[ 8 \right]$<br>$\left[ \frac{\square}{\square} \right]$ $\left[ - \right]$ $\left[ \log \right]$ $\left[ 1 \right]$ $\left[ = \right]$  | $\log_2(8) - \log(1)$<br>3                  |

**Angle unit Conversion**

The calculator angle unit setting is "Degree", pressing  $\left[ \text{Shift} \right]$   $\left[ \text{SET-UP} \right]$  enter the setup menu to change the unit to "Radian" or "Gradient":

|          |         |
|----------|---------|
| 1: Maths | 2: Line |
| 3: Deg   | 4: Rad  |
| 5: Gra   | 6: Fix  |
| 7: Sci   | 8: Norm |

Press the corresponding number key  $\left[ 3 \right]$ ,  $\left[ 4 \right]$  or  $\left[ 5 \right]$  for the angle unit you need then the display will show the  $\text{D}$ ,  $\text{R}$ ,  $\text{G}$  indicator accordingly.

Convert an angle unit between "Degree", "Radian" and "Gradient" by pressing  $\left[ \text{Shift} \right]$   $\left[ \text{DRG} \right]$ .

|      |      |
|------|------|
| 1: ° | 2: ° |
| 3: ° |      |

Then, pressing  $\left[ 1 \right]$ ,  $\left[ 2 \right]$  or  $\left[ 3 \right]$  will convert the displayed value into the selected Angle unit.

| Example in Maths mode   | Key in operation   | Display     |
|---|--|-------------|
| Convert 180 Degree into radian and gradient<br>( $180^\circ = \pi^{\text{Rad}} = 200^{\text{Grad}}$ ) | $\left[ \text{Shift} \right]$ $\left[ \text{SET-UP} \right]$ $\left[ 4 \right]$<br>$\left[ 1 \right]$ $\left[ \frac{\square}{\square} \right]$ $\left[ 0 \right]$ $\left[ \text{Shift} \right]$<br>$\left[ \text{DRG} \right]$ $\left[ 1 \right]$ $\left[ = \right]$ | 180°<br>π   |
|   | $\left[ \text{Shift} \right]$ $\left[ \text{SET-UP} \right]$ $\left[ 5 \right]$ $\left[ = \right]$   | 180°<br>200 |

**Trigonometry Calculations**

- Before using the trigonometric functions(except hyperbolic calculations),select the appropriate angle unit(Deg/Rad/Gra) by pressing  $\left[ \text{Shift} \right]$   $\left[ \text{SET-UP} \right]$ .
- $90^\circ = \frac{\pi}{2}$  Radians=100 Gradients.

| Example in Maths mode  | Key in operation   | Display                       |
|--|--|-------------------------------|
| Degree Mode  | $\left[ \text{Shift} \right]$ $\left[ \text{SET-UP} \right]$ $\left[ 3 \right]$  | D                             |
| $\sin 30 = \frac{1}{2}$  | $\left[ \sin \right]$ $\left[ 3 \right]$ $\left[ 0 \right]$ $\left[ = \right]$   | $\sin(30)$<br>$\frac{1}{2}$   |
| $\frac{1}{\sin 45^\circ} = \text{Cosec } 45^\circ$<br>= $\sqrt{2}$ | $\left[ \sin \right]$ $\left[ 4 \right]$ $\left[ 5 \right]$ $\left[ \frac{\square}{\square} \right]$ $\left[ X^{-1} \right]$<br>$\left[ = \right]$ | $\sin(45)^{-1}$<br>$\sqrt{2}$ |

- Hyperbolic (sinh /cosh/tanh), Inverse Hyperbolic (sinh<sup>-1</sup>/cosh<sup>-1</sup>/tanh<sup>-1</sup>) Functions.
- Pressing  $\left[ \text{hyp} \right]$  enter sub-hyperbolic menu.

|                       |                       |
|-----------------------|-----------------------|
| 1: sinh               | 2: cosh               |
| 3: tanh               | 4: sinh <sup>-1</sup> |
| 5: cosh <sup>-1</sup> | 6: tanh <sup>-1</sup> |

| Example in Maths mode                         | Key in operation   | Display                                     |
|---|--|---|
| $\sinh 2.4 - \cosh 2.4$<br>= $-0.09071795329$ | $\left[ \text{hyp} \right]$ $\left[ 1 \right]$<br>$\left[ 2 \right]$ $\left[ \cdot \right]$ $\left[ 4 \right]$ $\left[ \frac{\square}{\square} \right]$ $\left[ - \right]$<br>$\left[ \text{hyp} \right]$ $\left[ 2 \right]$<br>$\left[ 2 \right]$ $\left[ \cdot \right]$ $\left[ 4 \right]$ $\left[ \frac{\square}{\square} \right]$ $\left[ = \right]$ | $\sinh(2.4 - \cosh(>))$<br>$-0.09071795329$ |
| $\cosh^{-1} 45$<br>= $4.499686191$            | $\left[ \text{hyp} \right]$ $\left[ 5 \right]$ $\left[ 4 \right]$ $\left[ 5 \right]$ $\left[ = \right]$  | $\cosh^{-1}(45)$<br>4.499686191             |

**Permutation, Combination, Factorials and Random Number Generation**

- Permutation:  $nPr = \frac{n!}{(n-r)!}$
- Combination:  $nCr = \frac{n!}{r!(n-r)!}$
- Factorial:  $x! = x(x-1)(x-2)...(2)(1)$

| Example in Maths mode | Key in operation  | Display              |
|-----------------------|---|----------------------|
| ${}_{10}P_4=5040$     | $\boxed{1} \boxed{0} \boxed{Shift} \boxed{nPr} \boxed{4} \boxed{=}$ | ${}_{10}P_4$<br>5040 |
| ${}^4C_2=6$           | $\boxed{4} \boxed{=} \boxed{Shift} \boxed{nCr} \boxed{2}$           | ${}^4C_2$<br>6       |
| $10!=3628800$         | $\boxed{1} \boxed{0} \boxed{Shift} \boxed{x!} \boxed{=}$            | $10!$<br>3628800     |

### Random Number Generation

$\boxed{Shift} \boxed{Rand}$ : Generate a random number between 0.000 and 0.999. And the Display result will be fraction format in Maths mode status.

$\boxed{Alpha} \boxed{I-Rand}$ : Generate a random number between two specified positive integers. The entry is divided by " , ".

| Example in Maths mode                          | Key in operation   | Display                    |
|--|--|----------------------------|
| Generate a random number between 0.000 & 0.999 | $\boxed{Shift} \boxed{Rand} \boxed{=}$   | Rand<br>$\frac{739}{1000}$ |
| Generate an integer from range of 1 to 100     | $\boxed{Alpha} \boxed{I-Rand} \boxed{1} \boxed{1} \boxed{Shift} \boxed{,} \boxed{1} \boxed{0} \boxed{=}$ | I-Rand(1,100)<br>43        |

\*The value is only a sample, results will differ each time.

### Least Common Multiple and Greatest Common Divisor

- LCM: Calculate the least common multiple among three positive integers.
- GCD: Calculate the greatest common divisor among three positive integers.

| Example in LINE mode    | Key in operation  | Display               |
|-------------------------|---|-----------------------|
| LCM(15,27,39.)<br>=1755 | $\boxed{Alpha} \boxed{LCM} \boxed{1} \boxed{5} \boxed{Shift} \boxed{,} \boxed{2} \boxed{7} \boxed{Shift} \boxed{,} \boxed{3} \boxed{9} \boxed{=}$ | LCM(15,27,39)<br>1755 |
| GCD(12,24,60)<br>=12    | $\boxed{Alpha} \boxed{GCD} \boxed{1} \boxed{2} \boxed{Shift} \boxed{,} \boxed{2} \boxed{4} \boxed{Shift} \boxed{,} \boxed{6} \boxed{0} \boxed{=}$ | GCD(12,24,60)<br>12   |

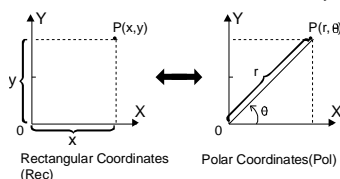
### Integer Division Calculations (I-Div)

- "Q" is quotient of an integer division. "R" is remainder of an integer division.
- The calculated quotient value(Q) and remainder(R) will be stored into memory variables "C" and "D" automatically assigned.
- In Maths mode, press  $\boxed{Left}$  or  $\boxed{Right}$  to scroll a long calculation result.
- In Line mode, the quotient value (Q) and remainder (R) will be shown over 2 line.
- Only Quotient Value (Q) can continue to be used for the next calculation or be stored into memory variables.

| Example in Line mode  | Key in operation  | Display                      |
|---|---|------------------------------|
| $35 \div 10 = 3 \times 10 + 5$<br>Q=3<br>R=5<br>(Line mode) | $\boxed{Alpha} \boxed{I-Div} \boxed{3} \boxed{5} \boxed{Shift} \boxed{,} \boxed{1} \boxed{0} \boxed{=}$ | I-Div(35,10)<br>Q= 3<br>R= 5 |
| Quotient value(Q)+3<br>=6                                   | $\boxed{+} \boxed{3} \boxed{=}$   | Ans+3<br>6                   |
| Recall Quotient Value(Q)                                    | $\boxed{RCL} \boxed{C}$   | C<br>3                       |
| Recall Remainder Value(R)                                   | $\boxed{RCL} \boxed{D}$   | D<br>5                       |

### Coordinate Conversion

- With polar coordinates, you can calculate and Display  $\theta$  within  $-180^\circ < \theta \leq 180^\circ$  range, (Same as Radian and Gradient).
- In Maths mode, press  $\boxed{Left}$  or  $\boxed{Right}$  to scroll the calculation result.
- In Line mode, (x, y) or (r,  $\theta$ ) will be shown over 2 line.
- After conversion, the results will automatically be assigned to memory variables X and Y Press  $\boxed{RCL} \boxed{X}$  or  $\boxed{Y}$  to show the results.



$\boxed{Shift} \boxed{Pol}$ : Convert rectangular coordinates (x, y) to polar coordinates (r,  $\theta$ ); Press  $\boxed{RCL} \boxed{X}$  for r, or  $\boxed{RCL} \boxed{Y}$  for  $\theta$ .

| Example in Maths mode                             | Key in operation  | Display                                 |
|---|---|---|
| With rectangular coordinate (x=1,y= $\sqrt{3}$ ). | $\boxed{Shift} \boxed{Pol} \boxed{1} \boxed{Shift} \boxed{,} \boxed{\sqrt{}} \boxed{3} \boxed{=}$ | Pol(1, $\sqrt{3}$ )<br>r=2, $\theta=60$ |

|   |                     |   |    |
|---|---------------------|---|----|
| Find Polar coordinate (r,θ) at degree mode. | <b>RCL</b> <b>X</b> | X | 2  |
|   | <b>RCL</b> <b>Y</b> | Y | 60 |

**Shift** **Rec**: Convert polar coordinates (r, θ) to rectangular coordinates (x, y); Press **RCL** **X** for x, or **RCL** **Y** for y.

| Example in Line mode   | Key in operation   | Display                            |
|--|--|------------------------------------|
| With Polar coordinate (r=2,θ = 60°)<br>Find Rectangular Coordinate (x, y) at Degree mode | <b>Shift</b> <b>Rec</b> <b>2</b> <b>Shift</b><br><b>,</b> <b>6</b> <b>0</b> <b>=</b> | Rec(2,60<br>X= 1<br>Y= 1.732050808 |
|  | <b>RCL</b> <b>X</b>  | X<br>1                             |
|  | <b>RCL</b> <b>Y</b>  | Y<br>1.732050808                   |

#### Absolute Value Calculation

| Example in Maths mode                 | Key in operation   | Display                              |
|---------------------------------------|--|--------------------------------------|
| $ \sin(30-5)x(-\pi) $<br>=1.327694426 | <b>Shift</b> <b>Abs</b> <b>sin</b> <b>3</b> <b>0</b><br><b>,</b> <b>5</b> <b>)</b> <b>x</b> <b>(</b> <b>(-)</b><br><b>Shift</b> <b>π</b> <b>)</b> <b>=</b> | $ \sin(30-5)x(-\pi) $<br>1.327694426 |

#### Engineering Notation

| Example in Line mode                              | Key in operation   | Display                               |
|---|--|---------------------------------------|
| $1 \div 200 = 5 \times 10^{-3}$<br>(In Line Mode) | <b>1</b> <b>÷</b> <b>2</b> <b>0</b> <b>0</b><br><b>=</b> | $1 \div 200$<br>$5 \times 10^{-3}$    |
|   | <b>ENG</b> <b>ENG</b>                                    | $1 \div 200$<br>$5000 \times 10^{-6}$ |
|   | <b>Shift</b> <b>ENG</b>                                  | $1 \div 200$<br>$5 \times 10^{-3}$    |

#### Display Values Exchange(F↔D)

- In Maths mode pressing **F↔D** to change the calculation result value between fraction form ↔ Decimal form, π form ↔ Decimal form,  $\sqrt{\quad}$  form ↔ Decimal form.
- In Line mode, pressing **F↔D** to **ONLY** change the calculation result value between fraction form ↔ Decimal form, the other π and  $\sqrt{\quad}$  calculation will display the decimal value only.

| Example in Line mode   | Key in operation   | Display                       |
|--|--|-------------------------------|
| $\frac{2}{3} + 2 = \frac{8}{3}$<br>= 2.666666667<br>(In Line Mode) | <b>2</b> <b>÷</b> <b>3</b> <b>+</b> <b>2</b><br><b>=</b> | $2 \div 3 + 2$<br>$8 \div 3$  |
|  | <b>F↔D</b> <b>F↔D</b>                                    | $2 \div 3 + 2$<br>2.666666667 |

| Example in Maths mode                                    | Key in operation   | Display                            |
|--|--|------------------------------------|
| $\frac{1}{2} + 2 = \frac{5}{2} = 2.5$<br>(In Maths Mode) | <b>1</b> <b>÷</b> <b>2</b> <b>+</b> <b>2</b><br><b>=</b> | $\frac{1}{2} + 2$<br>$\frac{5}{2}$ |
|  | <b>F↔D</b>   | $\frac{1}{2} + 2$<br>2.5           |

| Example in Maths mode                          | Key in operation                                    | Display                          |
|--|---|----------------------------------|
| $\tan 60 = \sqrt{3}$<br>=1.732050808           | <b>tan</b> <b>6</b> <b>0</b> <b>=</b>               | $\tan(60)$<br>$\sqrt{3}$         |
|  | <b>F↔D</b>  | $\tan(60)$<br>1.732050808        |
|  | <b>F↔D</b>  | $\tan(60)$<br>$\sqrt{3}$         |
| $\pi \div 6 = \frac{1}{6}\pi$<br>=0.5235987756 | <b>Shift</b> <b>π</b> <b>÷</b> <b>6</b><br><b>=</b> | $\pi \div 6$<br>$\frac{1}{6}\pi$ |
|  | <b>F↔D</b>  | $\pi \div 6$<br>0.5235987756     |

#### Remark

- Some Calculation results pressing **F↔D** key will not convert the display value.
- Some Calculation results pressing **F↔D** key will display Recurring Decimal when the Rdec setting "ON" is selected on the setup menu.
- Some display result conversion may take a long time.
- In MATHS mode, pressing **Shift** **=** instead of **=** after inputting a calculation will display the calculation result in decimal form. Pressing

$\left[ \frac{\leftrightarrow}{D} \right]$  after that will switch the calculation result to recurring decimal form, fraction form or  $\pi$  form. The  $\sqrt{\blacksquare}$  form of the result will not appear in the case.

**Summation function( $\Sigma$ )**

Maths mode:  $\sum_{x=a}^b (f(x))$       Line mode:  $\sum (f(x), a, b)$   
 (a=start, b=end, f(x)=formula)

**Example:** Summation of (X + 1) from 1 to 5

| Example in Maths mode       | Key in operation   | Display                      |
|-----------------------------|--|------------------------------|
| $\sum_{x=1}^5 (x + 1) = 20$ | Shift $\Sigma$ Alpha $\left[ \frac{\leftrightarrow}{D} \right]$<br>1 $\downarrow$ 1 $\uparrow$ 5<br>$\left[ \frac{\leftrightarrow}{D} \right]$ | $\sum_{x=1}^5 (x + 1)$<br>20 |

**Product function( $\Pi$ )**

Maths mode:  $\prod_{x=a}^b (f(x))$       Line mode:  $\prod (f(x), a, b)$   
 (a=start, b=end, f(x)=formula).

**Example:** Product (2x+1) from 0 to 5 in line mode

| Example in Line mode            | Key in operation   | Display                         |
|---------------------------------|--|---------------------------------|
| $\prod_{=10395} (2x + 1, 0, 5)$ | Shift Mode 2 Alpha<br>1 2 Alpha $\left[ \frac{\leftrightarrow}{D} \right]$<br>1 Shift . 0 Shift<br>. 5 ) = | $\prod (2x + 1, 0, 5)$<br>10395 |

**Mod: Modulus after division**

- Mod: Calculate the remainder of the value1 divided by the value2.

| Example in Maths mode | Key in operation               | Display        |
|-----------------------|--------------------------------|----------------|
| Mod(27,8)<br>=3       | Alpha Mod 2 7 Shift<br>. 8 ) = | Mod(27,8)<br>3 |

**Recurring Decimal Calculations**

- The calculator can input a recurring decimal value, and the calculation results also can be displayed using recurring decimal form whenever applicable.

**Inputting a Recurring Decimal**

- Recurring Decimal input is possible only in Math input/output of COMP mode and VERIFY mode, other mode can't input.
- When input a recurrent decimal, press  $\left[ \frac{\leftrightarrow}{D} \right]$  and then input the period up to the ending value. e.g: input the recurring decimal 0.909090...(0.9 $\dot{0}$ ), perform the following operation: "0 . Shift  $\left[ \frac{\leftrightarrow}{D} \right]$  90".
- If the recurrent value starts with an integer part (like:12.3123123...), do not include the integer part when input the period(12.31 $\dot{2}$ )

| Example in Maths mode                               | Key in operation                                     | Display           |
|---|--|-------------------|
| input<br>1.923076923076...<br>(1.92307 $\dot{6}$ ). | 1 . Shift $\left[ \frac{\leftrightarrow}{D} \right]$ | 1. $\dot{0}$      |
|   | 9 2 3 0 7<br>6                                       | 1.92307 $\dot{6}$ |

**NOTE:**

- You can specify up to 14 decimal places for the recurring decimal period. If you input more than 14 decimal places, the value will be treated as a terminating decimal and not a recurring decimal.
- Recurring decimal value input can be perform regardless of the Rdec setting on the set up menu.

**Displaying a calculation result as a Recurring Decimal value**

- Press the  $\left[ \frac{\leftrightarrow}{D} \right]$  key will switch a calculation result among Fraction and Recurring Decimal and Decimal format.
- Pressing the  $\left[ \frac{\leftrightarrow}{D} \right]$  key will cycle switch the calculation result display formats as "Fraction -> Recurring Decimal -> Decimal Value According to display ->Fraction" or "Decimal Value According to display ->Fraction-> Recurring Decimal -> Decimal Value According to display".

| Example in Maths mode | Key in operation | Display |
|-----------------------|------------------|---------|
|                       |                  |         |

|   |                                   |  |
|---|-----------------------------------|--|
| $\frac{5}{7} = 0.\dot{7}1428\dot{5}$<br><br>=0.7142857143<br><br>(Norm1). | $5 \div 7 =$                      |  |
|   | $\text{F}\leftrightarrow\text{D}$ |  |
|   | $\text{F}\leftrightarrow\text{D}$ |  |
|   | $\text{F}\leftrightarrow\text{D}$ |  |

| Example in LINE mode   | Key in operation                  | Display |
|--|-----------------------------------|---------|
| $5 \div 7 = \frac{5}{7} = 0.\dot{7}1428\dot{5}$<br><br>=0.7142857143<br><br>(Norm1). | $5 \div 7 =$                      |         |
|  | $\text{F}\leftrightarrow\text{D}$ |         |
|  | $\text{F}\leftrightarrow\text{D}$ |         |
|  | $\text{F}\leftrightarrow\text{D}$ |         |

**Condition for Displaying a calculation result as a Recurring Decimal**

If a calculation result satisfies the following conditions, Press the  $\text{F}\leftrightarrow\text{D}$  key will display it as a recurring decimal value. (the Rdec setting "ON" is selected on the setup menu by pressing  $\text{Shift}$   $\text{MODE}$   $\text{7}$   $\text{1}$ ).

- The total number of digits used in the mixed fraction (including integer, numerator, denominator, and separator symbol) must be no more than 10 digits.
- The data size of the value to be displayed as the recurring decimal must be no larger than 99 bytes. Each value and the decimal point require one byte, and each digit of the period requires one byte. The following, for example, would require of the total of 8 bytes(4 bytes for the values, 1 byte for the decimal point, 3 bytes for the period):  $0.\dot{1}2\dot{3}$ .

| Example in Maths mode             | Key in operation                                  | Display |
|-----------------------------------|---|---------|
| calculate<br>$2.3 + 9.45 = 11.78$ | $2 \div \text{Shift} 3 + 9 \div \text{Shift} 4 =$ |         |
| calculate<br>$1.4 - 2.9 = -1.5$   | $1 \div \text{Shift} 4 - 2 \div \text{Shift} 9 =$ |         |

| Example in Maths mode                 | Key in operation                  | Display |
|---------------------------------------|-----------------------------------|---------|
| $0.\dot{1}2\dot{3} = \frac{123}{999}$ | $1 \div 2 \div 3 \div 9 \div 9 =$ |         |
|                                       | $\text{F}\leftrightarrow\text{D}$ |         |

| Example in Maths mode | Key in operation | Display |
|-----------------------|------------------|---------|
|-----------------------|------------------|---------|

|                              |   |  |
|------------------------------|---|--|
| $0.1234 = \frac{1234}{9999}$ | $\boxed{1} \boxed{2} \boxed{3} \boxed{4}$<br>$\boxed{=} \boxed{9} \boxed{9} \boxed{9}$<br>$\boxed{9} \boxed{=} \boxed{9}$ | $\frac{1234}{9999}$<br>$\frac{1234}{9999}$ |
|                              | $\boxed{F \leftrightarrow D}$   | $\frac{1234}{9999}$<br>$0.1234$            |

#### Prime Factorization

- Factor a positive integer of up to 10 digits into prime factors of up to 3 digits in the COMP mode only. PFact Number:  $0 < X \leq 9999999999$  (X is integer)
- The remainder that cannot be factored will be enclosed in parentheses on the display.

| Example in Maths mode  | Key in operation  | Display  |
|--|---|--|
| $9999999999 =$<br>$3^2 \times 11 \times 41 \times 271 \times (9091)$ | $\boxed{9} \boxed{9} \boxed{9} \boxed{9} \boxed{9}$<br>$\boxed{9} \boxed{9} \boxed{9} \boxed{9} \boxed{9}$<br>$\boxed{=} \boxed{\text{Shift}} \boxed{\text{PFact}}$ | $9999999999$<br>$3^2 \times 11 \times 41 \times 271 \times (9091)$ |
| $1777 =$<br>$(1777)$   | $\boxed{1} \boxed{7} \boxed{7} \boxed{7}$<br>$\boxed{=} \boxed{\text{Shift}} \boxed{\text{PFact}}$  | $1777$<br>$(1777)$   |

#### NOTE:

- Pressing  $\boxed{\text{Shift}} \boxed{\text{PFact}}$  or  $\boxed{=}$  or  $\boxed{\text{ENG}}$  or  $\boxed{\text{F} \leftrightarrow \text{D}}$  key or to use the setup menu to change the angle unit setting (Deg, Rad, Gra) or display digit setting (Fix, Sci, Norm) will exit the prime factorization result display.
- "Math ERROR" will be shown if decimal value, fraction, negative value calculation result, or Pol, Rec, I-Div is displayed.

#### Scientific Constants

- Your calculator comes with 53 built-in scientific constants that can be used in any mode besides BASE mode. Each scientific constant is displayed as a unique symbol (such as  $\pi$ ) which can be used inside of calculations.
- To input a scientific constant into a calculation, press  $\boxed{\text{Shift}} \boxed{\text{CONST}}$  and then input the two-digit number that corresponds to the constant you want. You can press  $\boxed{\downarrow}$  or  $\boxed{\uparrow}$  key to look up all of constants table.

| Example in Maths mode                          | Key in operation  | Display  |
|--|---|--|
| $C_0 = 299792458$ (speed of light in a vacuum) | $\boxed{\text{Shift}} \boxed{\text{CONST}}$   | $\text{Constant}_1$<br>$01: m_p \quad 02: m_n$<br>$03: m_e \quad 04: m_\mu$<br>$05: a_0 \quad 06: h$ |
|  | $\boxed{2} \boxed{8} \boxed{=}$   | $C_0$<br>$299792458$   |
| $C_0 = \frac{1}{\sqrt{\epsilon_0 \mu_0}}$      | $\boxed{1} \boxed{-} \boxed{\sqrt{\quad}} \boxed{\text{Shift}}$<br>$\boxed{\text{CONST}} \boxed{3} \boxed{2} (\epsilon_0) \boxed{\text{Shift}}$<br>$\boxed{\text{CONST}} \boxed{3} \boxed{3} (\mu_0) \boxed{=}$ | $\frac{1}{\sqrt{\epsilon_0 \mu_0}}$<br>$299792458$   |

The following shows the two-digit numbers for each of the scientific constants.

| No. | Constant  | Symbol          | Value                           | Unit                            |
|-----|---|-----------------|---------------------------------|---------------------------------|
| 1   | Proton mass   | $m_p$           | $1.672621777 \times 10^{-27}$   | Kg                              |
| 2   | Neutron mass  | $m_n$           | $1.674927351 \times 10^{-27}$   | Kg                              |
| 3   | Electron mass                                       | $m_e$           | $9.10938291 \times 10^{-31}$    | Kg                              |
| 4   | Muon mass   | $m_\mu$         | $1.883531475 \times 10^{-28}$   | Kg                              |
| 5   | Bohr radius $a_0/4\pi R^\infty$                     | $a_0$           | $0.52917721092 \times 10^{-10}$ | m                               |
| 6   | Planck constant                                     | $h$             | $6.62606957 \times 10^{-34}$    | J s                             |
| 7   | Nuclear magneton $e h / 2m_p$                       | $\mu_N$         | $5.05078353 \times 10^{-27}$    | J T <sup>-1</sup>               |
| 8   | Bohr magneton $eh / 2m_e$                           | $\mu_B$         | $927.400968 \times 10^{-26}$    | J T <sup>-1</sup>               |
| 9   | $h/2\pi$  | $\hbar$         | $1.054571726 \times 10^{-34}$   | J s                             |
| 10  | Fine-structure constant $e^2/4\pi\epsilon_0\hbar c$ | $\alpha$        | $7.2973525698 \times 10^{-3}$   |                                 |
| 11  | Classical electron radius $\alpha^2 a_0$            | $r_e$           | $2.8179403267 \times 10^{-15}$  | m                               |
| 12  | Compton wavelength $h/m_e c$                        | $\lambda_c$     | $2.4263102389 \times 10^{-12}$  | m                               |
| 13  | Proton gyromagnetic ratio $2\mu_p / \hbar$          | $\gamma_p$      | $2.675222005 \times 10^8$       | s <sup>-1</sup> T <sup>-1</sup> |
| 14  | Proton Compton wavelength $h / m_p c$               | $\lambda_{c,p}$ | $1.32140985623 \times 10^{-15}$ | m                               |
| 15  | Neutron Compton wavelength $h / m_n c$              | $\lambda_{c,n}$ | $1.3195909068 \times 10^{-15}$  | m                               |
| 16  | Rydberg constant $\alpha^2 m_e c / 2h$              | $R_\infty$      | 10973731.568539                 | m <sup>-1</sup>                 |
| 17  | (Unified) atomic mass constant                      | $u$             | $1.660538921 \times 10^{-27}$   | kg                              |
| 18  | Proton magnetic moment                              | $\mu_p$         | $1.410606743 \times 10^{-26}$   | J T <sup>-1</sup>               |
| 19  | Electron magnetic moment                            | $\mu_e$         | $-928.476430 \times 10^{-26}$   | J T <sup>-1</sup>               |
| 20  | Neutron magnetic moment                             | $\mu_n$         | $-0.96623647 \times 10^{-26}$   | J T <sup>-1</sup>               |
| 21  | Muon magnetic moment                                | $\mu_\mu$       | $-4.49044807 \times 10^{-26}$   | J T <sup>-1</sup>               |
| 22  | Faraday constant $N_A e$                            | $F$             | 96485.3365                      | C mol <sup>-1</sup>             |
| 23  | Elementary charge                                   | $e$             | $1.602176565 \times 10^{-19}$   | C                               |
| 24  | Avogadro constant                                   | $N_A$           | $6.02214129 \times 10^{23}$     | mol <sup>-1</sup>               |

|    |   |              |                                |                      |
|----|---|--------------|--------------------------------|----------------------|
| 25 | Boltzmann constant $R/N_A$  | k            | $1.3806488 \times 10^{-23}$    | $J K^{-1}$           |
| 26 | Molar volume of ideal gas $RT/p$<br>$T=273.15 K, p=101.325 kPa$             | $V_m$        | $22.413968 \times 10^{-3}$     | $m^3 mol^{-1}$       |
| 27 | Molar gas constant  | R            | 8.3144621                      | $J mol^{-1} K^{-1}$  |
| 28 | Speed of light in vacuum  | $c_0$        | 299792458                      | $m s^{-1}$           |
| 29 | First radiation constant $2\pi hc^2$  | $c_1$        | $3.74177153 \times 10^{-16}$   | $W m^2$              |
| 30 | Second radiation constant $hc/k$  | $c_2$        | $1.4387770 \times 10^{-2}$     | $m K$                |
| 31 | Stefan-Boltzmann constant   | $\sigma$     | $5.670373 \times 10^{-8}$      | $W m^{-2} K^{-4}$    |
| 32 | Electric constant $1/\mu_0 c^2$   | $\epsilon_0$ | $8.854187817 \times 10^{-12}$  | $F m^{-1}$           |
| 33 | Magnetic constant   | $\mu_0$      | $12.566370614 \times 10^{-7}$  | $N A^{-2}$           |
| 34 | Magnetic flux quantum $h/2e$  | $\Phi_0$     | $2.067833758 \times 10^{-15}$  | $Wb$                 |
| 35 | Standard acceleration of gravity  | g            | 9.80665                        | $ms^{-2}$            |
| 36 | Conductance quantum $2e^2/h$  | $G_0$        | $7.7480917346 \times 10^{-5}$  | S                    |
| 37 | Characteristic impedance of vacuum<br>$\sqrt{(\mu_0/\epsilon_0)} = \mu_0 c$ | $Z_0$        | 376.730313461                  | $\Omega$             |
| 38 | Celsius temperature   | t            | 273.15                         |                      |
| 39 | Newtonian constant of gravitation   | G            | $6.67384 \times 10^{-11}$      | $m^3 kg^{-1} s^{-2}$ |
| 40 | Standard atmosphere   | atm          | 101325                         | Pa                   |
| 41 | Atomic mass constant  | $m_u$        | $1.660538921 \times 10^{-27}$  | kg                   |
| 42 | Electron volt: $(e/c)J$   | eV           | $1.602176565 \times 10^{-19}$  | J                    |
| 43 | Hartree energy $e^2/4\pi\epsilon_0 a_0$                                     | Eh           | $4.35974434 \times 10^{-18}$   | J                    |
| 44 | Josephson constant $2e/h$   | $K_J$        | $483597.870 \times 10^9$       | $Hz V^{-1}$          |
| 45 | Von Klitzing constant $h/e^2$   | $R_K$        | 25812.8074434                  | $\Omega$             |
| 46 | Astronomical Unit   | AU           | 1.495979e11                    | m                    |
| 47 | Parsec  | pc           | 3.085678e16                    | m                    |
| 48 | Planck length<br>$h/m_p c = (\hbar G/c^3)^{1/2}$                            | $l_p$        | $1.616199 \times 10^{-35}$     | m                    |
| 49 | Planck time $l_p/c = (\hbar G/c^5)^{1/2}$                                   | $t_p$        | $5.39106 \times 10^{-44}$      | s                    |
| 50 | Planck mass $(\hbar c/G)^{1/2}$   | $m_p$        | $2.17651 \times 10^{-8}$       | kg                   |
| 51 | Molar Planck constant   | $N_A h$      | $3.9903127176 \times 10^{-10}$ | $J s mol^{-1}$       |
| 52 | Wien displacement law constant  | b            | $2.8977721 \times 10^{-3}$     | $m K$                |
| 53 | Loschmidt constant $N_A/V_m$  | $n_0$        | $2.6867805 \times 10^{25}$     | $m^{-3}$             |

The values are based on CODATA(2012) recommended values.

#### Metric Conversion

- The calculator's built-in metric conversion commands make it simple to convert values from one unit to another. You can use the metric conversion commands in any calculation mode except for BASE and TABLE mode.
- There are 9 Category pages (Length, area, capacity, weight, speed, pressure, temperature, energy, power) containing 37 metric symbols, you can press  or  to change the category selection page.
- To input a metric conversion command into a calculation, press **Shift** **CONV** and then input the two-digit number that corresponds to the command you want.

| Example in LINE mode        | Key in operation  | Display  |
|-----------------------------|---|--|
| 5cm=<br>1.968503937 inch    | <b>5</b> <b>Shift</b> <b>CONV</b>   | Length_1<br>1:in 2:cm<br>3:feet 4:m<br>5:yd 6:n mile |
|                             | <b>2</b> <b>1</b> <b>=</b>  | 5cm>in<br>1.968503937                                |
| 100g=<br>3.527396584 ounces | <b>1</b> <b>0</b> <b>0</b> <b>Shift</b> <b>CONV</b><br><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <b>2</b> <b>1</b><br><b>=</b> | 100g>oz<br>3.527396584                               |
| -31°C=<br>-23.8°F           | <b>(-)</b> <b>3</b> <b>1</b> <b>Shift</b> <b>CONV</b><br><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <b>2</b><br><b>1</b> <b>=</b>          | -31°C>°F<br>-23.8                                    |

| NO. | Name of Unit  | Symbol for unit |
|-----|---------------|-----------------|
| 1   | inch          | in              |
| 2   | centimeter    | cm              |
| 3   | feet          | feet            |
| 4   | meter         | m               |
| 5   | yard          | yd              |
| 6   | nautical mile | n mile          |
| 7   | mile          | mile            |
| 8   | kilometer     | km              |
| 9   | parsec        | pc              |
| 10  | acre          | acre            |
| 11  | square meter  | m <sup>2</sup>  |
| 12  | hectare       | ha              |

| NO. | Name of Unit                         | Symbol for unit     |
|-----|--------------------------------------|---------------------|
| 20  | gram                                 | g                   |
| 21  | libra                                | lb                  |
| 22  | kilogram                             | kg                  |
| 23  | meter per second                     | m/s                 |
| 24  | kilometer per hour                   | km/h                |
| 25  | standard atmosphere                  | atm                 |
| 26  | pascal                               | pa                  |
| 27  | millimeter of mercury                | mmHg                |
| 28  | kilogram-force per square centimeter | kgf/cm <sup>2</sup> |
| 29  | kilopascal                           | kpa                 |
| 30  | Libra-force per square inch          | lbf/in <sup>2</sup> |
| 31  | degree Fahrenheit                    | °F                  |



|    |                  |                   |
|----|------------------|-------------------|
| 13 | square kilometer | km <sup>2</sup>   |
| 14 | square mile      | mile <sup>2</sup> |
| 15 | square yard      | yd <sup>2</sup>   |
| 16 | gallon(U.S.)     | gal US            |
| 17 | liter            | liter             |
| 18 | gallon(U.K.)     | gal_UK            |
| 19 | ounces           | oz                |

|    |                      |       |
|----|----------------------|-------|
| 32 | degree Celsius       | °C    |
| 33 | joule                | J     |
| 34 | calorie              | cal.f |
| 35 | kilogram-force meter | kgf.m |
| 36 | horse power          | hp    |
| 37 | kilowatt             | kW    |

**Solve Function**

- You can solve custom calculation expressions in COMP Mode only.
- SOLVE solves for X, for example:  $X^2 + 2X - 2$ ,  $Y = X + 5$ ,  $X = \sin(M)$ ,  $X + 3 = B + C$ .
- SOLVE solves for Y, for example, when an equation is input as:  $Y = X + 5$ , Y.

| Example in Maths mode  | Key in operation  | Display   |
|--|---|---|
| Solve $y = x^3 + x^2 - 5x + 60$ for $x$ when $y = 7$ (Solutions: $x = 1$ ) | Alpha Y Alpha =<br>Alpha x Shift x <sup>2</sup><br>+ Alpha x x <sup>2</sup><br>- 5 Alpha x<br>+ 6 0 | $Y = X^3 + X^2 - 5X + 60$                               |
|  | Shift Solve   | Y?  |
|  | 1 =   | Solve for X   |
|  | =   | $Y = X^3 + X^2 - 5X + 60$<br>$X = -4.714732093$<br>L-R= |

**NOTE:**

- If the expression does not include the equal sign (=) when Solve calculation is performed, the calculator will transform the solution as zero (0).
- The following functions are not allowed inside of an equation:  $\int dx$ ,  $d/dx$ ,  $\Sigma$ ,  $\Pi$ , Pol, Rec, Round, I-Rand, I-Div.
- When the expression cannot be solved, "Can't Solve" will be displayed.
- During the time from when you press **Shift Solve** until you exit SOLVE by pressing **CA**, you should use linear Display input procedures for input.
- Depending on what you input for the initial value for X(solution value), SOLVE may not be able to obtain solution. If this happens, try changing the initial value so they are closer to the solution.
- SOLVE may not be able to determine the correct solution, even when one exists.
- SOLVE uses Newton's Law, so even if there are multiple solutions, only one of them will be returned.
- Due to limitations in Newton's Law, solutions tend to be difficult to obtain for equations like the following:  $y = \sin(x)$ ,  $y = e^x$ ,  $y = \sqrt{x}$ .

**Calc Function**

- CALC function can only be used in COMP and CPLX Mode.
- The following describes the type of expressions you can save with CALC:
  - Expressions:  $2X + 3Y$ ,  $2AX + 3BY + C$ ,  $A + Bi$ .
  - Multi-statements:  $X + Y : X(X + Y)$ .
  - Equalities with a single variable on the left and an expression including variables on the right:  $A = B + C$ ,  $Y = X^2 + X + 3$  (Use **Alpha CALC (=)** to input the equals sign of the equality.)
- After inputting the calculation expression and pressing **CALC**, the calculator will request for the current value of your input variables.

| Example in Maths mode   | Key in operation   | Display                   |
|---|--|---------------------------|
| Calculate the result for $Y = X^2 + 3X - 12$ . when $X = 7$ (Result: 58), and when $X = 8$ (Result: 76) | Alpha Y Alpha = Alpha<br>x x <sup>2</sup> + 3 Alpha x<br>- 1 2 | $Y = X^2 + 3X - 12$       |
|   | CALC   | X?                        |
|   | 7 =  | $Y = X^2 + 3X - 12$<br>58 |
|   | CALC 8 =   | $Y = X^2 + 3X - 12$<br>76 |

**NOTE:**

- The **CALC** stored expression will be cleared when you start a new calculation, change into another mode, or turn off the calculator.

**Differential Calculations**

- Press **MODE** **1** to enter COMP mode.
- To perform a differential calculation, you have to input expression in the form of:
  - Shift**  $\frac{d}{dx}$  differential expression **▢** a **▢**  $\Delta x$  **▢**
  - The differential expression must contain the variable x.
  - "a" is the differential coefficient.
  - " $\Delta x$ " is the change interval of x (calculation precision).

Example: To determine the derivative at point  $x = 10$ ,  $\Delta x = 10^{-8}$ , for the function  $f(x) = \ln(3x + 30)$ .

| Example in LINE mode                                  | Key in operation  | Display |
|---|---|---------|
| $\frac{d}{dx} \ln(3x + 30), 10, 10^{-8}$<br><br>=0.05 | <b>MODE</b> <b>1</b><br>(COMP MODE)                                       |         |
|   | <b>Shift</b> $\frac{d}{dx}$ <b>ln</b> <b>3</b>                            |         |
|   | <b>Alpha</b> <b>x</b> <b>+</b> <b>3</b>                                   |         |
|   | <b>0</b> <b>)</b> <b>Shift</b> <b>.</b> <b>1</b> <b>0</b>                 |         |
|   | <b>Shift</b> <b>.</b> <b>1</b> <b>EXP</b> <b>(-)</b><br><b>8</b> <b>=</b> |         |

Note:

- You can leave out the  $\Delta x$  in the differential expression and the calculator will automatically substitute a value for  $\Delta x$ .
- The smaller the enter value  $\Delta x$  is, the longer calculation time will be with more accurate results, the larger enter value  $\Delta x$  is, the shorter the calculation time will be with comparatively less accurate results.
- Discontinuous points and extreme changes in the value of x can cause inaccurate results or errors.
- When performing differential calculations with trigonometric functions, select radian (Rad) as the angle unit setting.
- Log<sub>b</sub>, i-Rand, Rec( and Pol( functions can not join to differential calculations.

### Integration Calculations

- Press **MODE** **1** to enter COMP mode.
- To perform an integration calculation you are required to input the following elements:
  - $\int_a^b$  integration expression **▢** a **▢** b **▢** n **▢**
  - The integration expression has a variable x.
  - "a" and "b" defines the integration range of the definite integral.
  - "n" is the number of partitions (equivalent to  $N = 2^n$ ).
- The integration calculation is based on Simpson's rule.

$$\int_a^b f(x) dx, n=2^n, 1 \leq n \leq 9, n \neq 0$$

As the number of significant digits is increased, internal integration calculations may take considerable time to complete. For some cases, even after considerable time is spent performing a calculation, the calculation results may be erroneous. Particularly when significant digits are less than 1, an ERROR might occur.

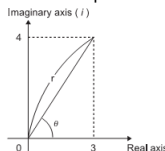
| Example in LINE mode   | Key in operation                                    | Display |
|--|---|---------|
| $\int_2^3 (7x^4 + 4x^2 - 8x + 1) dx$<br>=301.7333333 (n<br>= 4.) | <b>MODE</b> <b>1</b><br>(COMP MODE)                 |         |
|  | <b>▢</b> <b>7</b> <b>Alpha</b> <b>x</b>             |         |
|  | <b>x^2</b> <b>4</b> <b>)</b> <b>+</b>               |         |
|  | <b>4</b> <b>Alpha</b> <b>x</b> <b>x^2</b>           |         |
|  | <b>-</b> <b>8</b> <b>Alpha</b> <b>x</b>             |         |
|  | <b>+</b> <b>1</b> <b>Shift</b> <b>,</b>             |         |
|  | <b>2</b> <b>Shift</b> <b>,</b> <b>3</b>             |         |
|  | <b>Shift</b> <b>.</b> <b>4</b> <b>)</b><br><b>=</b> |         |

Note:

- When performing integration calculations with trigonometric functions, select radian (Rad) as the angle unit setting.
- Log<sub>b</sub>, i-Rand, Rec( and Pol( functions can not join to integration calculations.

### Complex number Calculations (CPLX)

- Complex numbers can be expressed in rectangular form ( $z = a + bi$ ) or polar form ( $r(\angle \theta)$ ).



- Press **MODE** **2** to enter complex mode.

| Example in Maths mode   | Key in operation   | Display |
|---|--|---------|
| $(4+6i) \div 2i = 3-2i$<br>(complex number<br>format: a + bi) | <b>(</b> <b>4</b> <b>+</b> <b>6</b> <b>i</b><br><b>)</b> <b>÷</b> <b>2</b> <b>i</b> <b>=</b> |         |

|  |   |  |
|--|---|--|
| $4\angle 30 = 2\sqrt{3} + 2i$<br>(complex number<br>format: a + bi)    | $\boxed{4} \boxed{\angle} \boxed{3} \boxed{0} \boxed{=}$  |  |
| $\sqrt{2} + \sqrt{2}i = 2\angle 45$<br>(complex number<br>format: r∠θ) | $\boxed{\sqrt{\phantom{x}}} \boxed{2} \boxed{\triangleright} \boxed{+} \boxed{\sqrt{\phantom{x}}} \boxed{2} \boxed{\triangleright} \boxed{1} \boxed{=}$ |  |

Note:

- Imaginary numbers will use up replay memory capacity.
- If you are planning to perform input and display of the calculation result in polar coordinate format, specify the angle unit before starting the calculation.
- The  $\theta$  value of the calculation result is displayed in the range of  $-180^\circ < \theta \leq 180^\circ$ .
- Display of the calculation result while Linear Display is selected will show a and bi (or r and  $\theta$ ) on separate lines.

### Complex Number Type Selection

Press **Func** to select the calculation type. There are 4 types of complex number calculations in the Complex Number Type screen. Press the number to select the type of complex number calculation:

|        |         |
|--------|---------|
| 1: arg | 2: Conj |
| 3: r∠θ | 4: a+bi |

| CPLX ITEM                 | DESCRIPTION   |
|---------------------------|---|
| [1] Arg                   | Determine the argument ( $\theta$ ) of complex number.                |
| [2] Conjg                 | Determine the conjugate a+bi, which is a-bi.                          |
| [3] $\triangleright$ r∠θ  | Change to "Polar coordinate form" from "Rectangular coordinate form"  |
| [4] $\triangleright$ a+bi | Change to "Rectangular coordinate form" from "Polar coordinate form". |

### Rectangular Form and Polar Form Conversion

Pressing **Func** **3** can convert rectangular form complex numbers into polar form; whereas pressing **Func** **4** will convert polar form complex numbers into rectangular form.

| Example in Maths mode               | Key in operation  | Display |
|-------------------------------------|---|---------|
| $3 + 4i =$<br>$5\angle 53.13010235$ | $\boxed{3} \boxed{+} \boxed{4} \boxed{i} \boxed{\text{Func}} \boxed{3} \boxed{=}$   |         |
| $\sqrt{2}\angle 45 =$<br>$1 + i$    | $\boxed{\sqrt{\phantom{x}}} \boxed{2} \boxed{\triangleright} \boxed{\angle} \boxed{45} \boxed{\text{Func}} \boxed{4} \boxed{=}$ |         |

### Absolute Value and Argument calculation

With the rectangular form complex number, you can calculate the corresponding absolute value(r) or argument ( $\theta$ ) by pressing **Abs** or **Func** **1** respectively.

| Example in LINE mode   | Key in operation  | Display |
|--|---|---------|
| Absolute value(r) and argument( $\theta$ ) if complex number is 3-4i | $\boxed{\text{Shift}} \boxed{\text{Abs}} \boxed{3} \boxed{-} \boxed{4} \boxed{=} \boxed{)} \boxed{=}$   |         |
|  | $\boxed{\triangleright} \boxed{\text{DEL}} \boxed{\text{Func}} \boxed{1} \boxed{=} \boxed{)} \boxed{=}$ |         |

### Conjugate of a Complex Number

If the complex number is  $z = a + bi$ , the conjugate value of this complex number should be  $z = a - bi$ .

| Example in LINE mode                 | Key in operation  | Display |
|--------------------------------------|---|---------|
| Conjugate of $3 + 4i$ is<br>$3 - 4i$ | $\boxed{\text{Func}} \boxed{2} \boxed{3} \boxed{+} \boxed{4} \boxed{)} \boxed{)} \boxed{=}$ |         |

### Statistical Calculations (STAT)

- Press **MODE** **3** to enter Statistical Type Selection screen and select 1~8. Then enter Statistical calculation mode and "STAT" indicator lights up.
- In Statistical calculation mode, press **Func** **1** (Type) to select the calculation type.

### Statistical Type Selection

There are 8 types of Statistical Calculation after entered the Statistical Type Selection screen then press the number to select the type of Statistic Calculation.

```

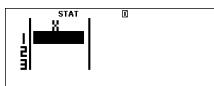
1:SD      2:Lin
3:Quad    4:Log
5:e EXP   6:ab EXP
7:Pwr     8:Inv

```

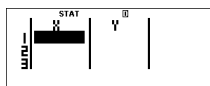
| Pressing Key | Statistical Calculation                                       |
|--------------|---|
| 1(SD)        | One-variable statistics (X)                                   |
| 2(Lin)       | Two-variable, Linear regression ( $y=A+Bx$ )                  |
| 3(Quad)      | Two-variable, Quadratic regression ( $y=A+Bx+Cx^2$ )          |
| 4(Log)       | Two-variable, Logarithmic regression ( $y=A \times B \ln x$ ) |
| 5(e EXP)     | Two-variable, E exponential regression ( $y=Ae^{Bx}$ )        |
| 6(ab EXP)    | Two-variable, ab Exponential regression ( $y=AB^x$ )          |
| 7(Pwr)       | Two-variable, Power regression ( $y=Ax^B$ )                   |
| 8(Inv)       | Two-variable, Inverse regression ( $y=A+B/x$ )                |

### Statistical Data Input

After confirmed the calculation type of the above Statistical Type Selection screen or by pressing **Func** **2** <Data> in the STAT mode, the following Statistical Data input screen will be shown.



1-variable STAT



2-variable STAT

- After turned on Data Frequency "FREQ" in calculator's setup menu, the FREQ column will be added into the above screen.
- The followings are the maximum number of line for data input.

| Statistic type                 | FREQ On | FREQ Off |
|--------------------------------|---------|----------|
| Single Variable (only x input) | 40      | 80       |
| 2 Variable (x & y input)       | 26      | 40       |

- Input expression and display result value in Statistical Data Input screen are in line mode (same as Comp mode with Line mode status).
- After inputted the data, then press = to store the value into statistical registers and display the value (max, 6 digits) in the cell, and you can press cursor key to move the cursor between each cell.

### Editing Statistical Sample Data

- Replacing the Data in a cell.
  - (1) In Statistical Data Input screen, move the cursor to cell you want to edit.
  - (2) Input the new data value or expression, and then press **=**.
- Deleting a line
  - (1) In Statistical Data input screen move the cursor to line you want to delete.
  - (2) Press **DEL**.
- Inserting a line
  - (1) In Statistical Data input screen, move the cursor to the line that will be under the line being inserted.
  - (2) Press **Func** **3** (Edit).
  - (3) Press **1** (Ins).
- Deleting All STAT Data input.
  - (1) Press **Func** **3** (Edit).
  - (2) Press **2** (Del-A).

### Statistical Calculation Screen

- After inputting the STAT Data, press CA to enter Statistical Calculation screen.
- Statistical Calculation screen are in Line mode for input & output Display.
- Use Statistical Menu to calculate the Statistical result, (S-SUM, S-VAR, S-PTS, Reg).

### Statistical Menu

In **Statistical Data Input** screen or **Statistical Calculation** screen, you can press **Func** to display the **Statistical Menu** screen.

```

1:Type  2:Data
3:Edit  4:S-SUM
5:S-VAR 6:S-PTS
7:Distr

```

1-variable STAT

```

1:Type  2:Data
3:Edit  4:S-SUM
5:S-VAR 6:S-PTS
7:Reg

```

2-variable STAT

| STAT items | Description  |
|------------|--|
| (1) Type   | To enter the statistical calculation type screen               |
| (2) Data   | To enter the statistical Data input screen                     |
| (3) Edit   | To enter Edit sub-menu for editing STAT editor screen contents |
| (4) S-SUM  | To enter S-Sum sub-menu (calculating sum)                      |
| (5) S-VAR  | To enter S-Var sub-menu (calculating variable)                 |
| (6) S-PTS  | To enter S-PTS sub-menu (calculating points)                   |

(7) Distr/Reg

To enter Distr sub-menu (calculating distribution)/  
To enter Reg sub-menu (Regression calculation)

Statistical calculation result in [4] S-SUM, [5] S-VAR, [6] S-PTS, [7] Reg

| STAT Sub-menu      | STAT Type            | Value                              | Symbol          | Operation    |
|--------------------|----------------------|------------------------------------|-----------------|--------------|
| S-SUM              | 1&2 variable STAT    | Summation of all $x^2$ value       | $\Sigma x^2$    | Func [4] [1] |
|                    |                      | Summation of all x value           | $\Sigma x$      | Func [4] [2] |
|                    | 2-variable STAT only | Summation of all $y^2$ value       | $\Sigma y^2$    | Func [4] [3] |
|                    |                      | Summation of all y value           | $\Sigma y$      | Func [4] [4] |
|                    |                      | Summation of xy pairs              | $\Sigma xy$     | Func [4] [5] |
|                    |                      | Summation of all $x^3$ value       | $\Sigma x^3$    | Func [4] [6] |
|                    |                      | Summation of all $x^2y$ pairs      | $\Sigma x^2y$   | Func [4] [7] |
|                    |                      | Summation of all $x^4$ pairs       | $\Sigma x^4$    | Func [4] [8] |
| S-VAR              | 1 & 2 Variable STAT  | Number of data sample              | n               | Func [5] [1] |
|                    |                      | Mean of the x values               | $\bar{x}$       | Func [5] [2] |
|                    |                      | Population standard deviation of x | $x\sigma_n$     | Func [5] [3] |
|                    |                      | Sample Standard Deviation of x     | $x\sigma_{n-1}$ | Func [5] [4] |
|                    | 2-variable STAT only | Mean of the y values               | $\bar{y}$       | Func [5] [5] |
|                    |                      | Population standard deviation of y | $y\sigma_n$     | Func [5] [6] |
|                    |                      | Sample standard Deviation of y     | $y\sigma_{n-1}$ | Func [5] [7] |
| S-PTS              | 1&2 variable STAT    | Minimum value of x                 | min X           | Func [6] [1] |
|                    |                      | Maximum value of x                 | max X           | Func [6] [2] |
|                    | 1-variable STAT only | 1st Quartile Value                 | Q1              | Func [6] [3] |
|                    |                      | Median                             | med             | Func [6] [4] |
|                    |                      | 3rd Quartile Value                 | Q3              | Func [6] [5] |
|                    | 2-variable STAT only | Minimum value of y                 | min Y           | Func [6] [3] |
| Maximum value of y |                      | max Y                              | Func [6] [4]    |              |
| Reg                | For non-Quad Reg     | Regression coefficient A           | A               | Func [7] [1] |
|                    |                      | Regression coefficient B           | B               | Func [7] [2] |
|                    |                      | Correlation coefficient r          | r               | Func [7] [3] |
|                    |                      | Estimated value of x               | $\hat{x}$       | Func [7] [4] |
|                    |                      | Estimated value of y               | $\hat{y}$       | Func [7] [5] |
| Reg                | For Quad Reg only    | Regression coefficient A           | A               | Func [7] [1] |
|                    |                      | Regression coefficient B           | B               | Func [7] [2] |

|                          |             |          |
|--------------------------|-------------|----------|
| Regression coefficient C | C           | Func 7 3 |
| Estimated value of x1    | $\hat{x}_1$ | Func 7 4 |
| Estimated value of x2    | $\hat{x}_2$ | Func 7 5 |
| Estimated value of y     | $\hat{y}$   | Func 7 6 |

**Statistical Calculation Example.**

■ **SD type Statistical calculation Example:**

To calculate  $\sum x^2, \sum x_1, n, \bar{x}, x \sigma_n, x \sigma_{n-1}, \min X, \max X$ , of data: 75,85,90 77,79 in SD mode (Freq: OFF).

| Key in operation                 | Display   |
|----------------------------------|---|
| MODE 3                           | 1:SD 2:Lin<br>3:Quad 4:Log<br>5:e EXP 6:ab EXP<br>7:Pwr 8:Inv |
| 1 (SD)                           | 1 X<br>2<br>3   |
| 7 5 = 8 5 = 9 0<br>= 7 7 = 7 9 = | 4 X 77<br>5 79<br>6   |
| CA Func 4 1 =                    | $\sum x^2$<br>33120   |
| CA Func 4 2 =                    | $\sum x$<br>406   |
| CA Func 5 1 =                    | n<br>5  |
| CA Func 5 2 =                    | $\bar{x}$<br>81.2   |
| CA Func 5 3 =                    | $x\sigma_n$<br>5.528109984                                    |
| CA Func 5 4 =                    | $x\sigma_{n-1}$<br>6.180614856                                |

**Quadratic Regression type Statistical Calculation Example:**

ABC Company investigate the effectiveness of the advertisement expense in coded units, the following data were obtained:

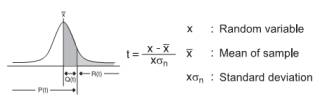
|                           |    |    |    |    |    |
|---------------------------|----|----|----|----|----|
| Advertisement expenses: X | 18 | 35 | 40 | 21 | 19 |
| Effectiveness: y (%)      | 38 | 54 | 59 | 40 | 38 |

Please use the regression to estimate the effectiveness (estimate the value of y) if the advertisement expenses X=30, and estimate the advertisement expenses level (estimate the value of  $X_1, X_2$ ) for effectiveness y = 50.

| Key in operation  | Display   |
|---|---|
| MODE 3  | 1:SD 2:Lin<br>3:Quad 4:Log<br>5:e EXP 6:ab EXP<br>7:Pwr 8:Inv |
| 3 (Quad)  | STAT  |
| 1 8 = 3 5 = 4 0<br>= 2 1 = 1 9 =<br>v ><br>3 8 = 5 4 = 5 9<br>= 4 0 = 3 8 = | 4 X 21 Y 40<br>5 19<br>6                                      |
| CA 3 0 Func 7 6 =   | 30y<br>48.69615715  |
| CA 5 0 Func 7 4 =   | 50x <sub>1</sub><br>31.30538226                               |
| CA 5 0 Func 7 5 =   | 50x <sub>2</sub><br>-167.1096731                              |

**Distribution Calculations**


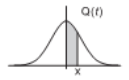

- After sample data is entered in Statistic (SD) mode, you can perform the normal distribution or probability distribution calculation such as P(t), Q(t) and R(t) in which t is the variate of the probabilistic experiment.



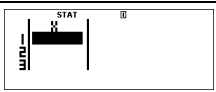
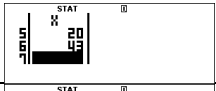
- Press **Func** **7** to display the distribution calculations screen.

|        |        |
|--------|--------|
| 1: P ( | 2: Q ( |
| 3: R ( | 4: ▶t  |

- Press **1**, **2**, **3** or **4** for the corresponding calculations.

|  |  |   |
|--|--|---|
| P(t): Probability below a given point x                    | $P(t) = \int_{-\infty}^x \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{t-\mu}{\sigma}^2} dt$ |  |
| Q(t): Probability below a given point x and above the mean | Q(t) = 0.5 - R(t)  |  |
| R(t): Probability above a given point x                    | R(t) = 1 - P(t)  |  |

- Example:** Calculate the probability distribution P(t) for the sample data: 20,43,26, 46,20,43, when x=26.

| Key in operation  | Display   |
|---|---|
| <b>MODE</b> <b>3</b> <b>1</b>   |   |
| <b>2</b> <b>0</b> <b>=</b> <b>4</b> <b>3</b> <b>=</b><br><b>2</b> <b>6</b> <b>=</b> <b>4</b> <b>6</b> <b>=</b><br><b>2</b> <b>0</b> <b>=</b> <b>4</b> <b>3</b> <b>=</b> |  |
| <b>CA</b> <b>2</b> <b>6</b> <b>Func</b> <b>7</b> <b>4</b> <b>=</b>  | 26▶t<br>-0.6236095645   |
| <b>Func</b> <b>7</b> <b>1</b> <b>=</b>  | P(Ans)<br>0.26644   |

**Base Calculations (BASE)**

- Press **MODE** **4** to enter Base mode.
- To select a specific number system in base mode, simply press **DEC** Decimal [DEC], **HEX** Hexadecimal [HEX], **BIN** Binary [BIN] or **OCT** Octal [OCT]
- Press **Func** key to perform logical calculations, specifying the number mode of a particular input value.
- If the binary or octal calculation result is more than 8 digits, "◀Byte" will be displayed to indicate the result has a next Block, press **Byte** to loop between result blocks.
- In Base mode all the scientific function cannot be used, and you cannot input the value with decimal places or exponents.

| Example   | Key in operation  | Display                               |
|---|---|---------------------------------------|
| 10101011+1100-1001×101÷10=<br>10100001 (In Binary Mode) | <b>BIN</b> <b>1</b> <b>0</b> <b>1</b> <b>0</b><br><b>1</b> <b>0</b> <b>1</b> <b>1</b> <b>+</b><br><b>1</b> <b>1</b> <b>0</b> <b>0</b> <b>-</b><br><b>1</b> <b>0</b> <b>0</b> <b>1</b> <b>x</b><br><b>1</b> <b>0</b> <b>1</b> <b>÷</b> <b>1</b><br><b>0</b> <b>=</b> | 10101011+1100-1▶<br>BIN<br>10100001   |
| 621+345-27×3÷2=1124<br>(In Octal Mode)                  | <b>OCT</b> <b>6</b> <b>2</b> <b>1</b> <b>+</b><br><b>3</b> <b>4</b> <b>5</b> <b>-</b> <b>2</b><br><b>7</b> <b>x</b> <b>3</b> <b>÷</b> <b>2</b><br><b>=</b>  | 621+345-27×3÷2▶<br>OCT<br>00000001124 |
| (77ABC+D9)×E÷A=A79D0<br>(In Hexadecimal Mode)           | <b>HEX</b> <b>(</b> <b>7</b> <b>7</b> <b>A</b><br><b>B</b> <b>C</b> <b>+</b> <b>D</b> <b>9</b><br><b>)</b> <b>x</b> <b>E</b> <b>÷</b> <b>A</b><br><b>=</b>  | (77ABC+D9)×E÷A▶<br>HEX<br>000A79D0    |

- Base-n Transformation **DEC** → **OCT** → **HEX** → **BIN**.

| Example | Key in operation | Display |
|---------|------------------|---------|
|---------|------------------|---------|

|   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
|---|---|--|-----------|-----|----------------|---|---|---|---|---|---|---|-----------|-----|-------|
| 12345+101=12446                                   | <table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>+</td><td>1</td><td>0</td><td>1</td><td>=</td></tr> </table> | 1  | 2         | 3   | 4              | 5 | + | 1 | 0 | 1 | = | <table border="1"> <tr><td>12345+101</td></tr> <tr><td>DEC</td></tr> <tr><td>12446</td></tr> </table> | 12345+101 | DEC | 12446 |
|   | 1   | 2  | 3         | 4   | 5              |   |   |   |   |   |   |   |           |     |       |
|   | +   | 1  | 0         | 1   | =              |   |   |   |   |   |   |   |           |     |       |
|   | 12345+101   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| DEC   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| 12446   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| <table border="1"> <tr><td>HEX</td></tr> </table> | HEX   | <table border="1"> <tr><td>12345+101</td></tr> <tr><td>HEX</td></tr> <tr><td>0000309E</td></tr> </table>       | 12345+101 | HEX | 0000309E       |   |   |   |   |   |   |   |           |     |       |
| HEX   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| 12345+101   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| HEX   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| 0000309E  |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| <table border="1"> <tr><td>BIN</td></tr> </table> | BIN   | <table border="1"> <tr><td>12345+101</td></tr> <tr><td>BIN</td></tr> <tr><td>Byte1 10011110</td></tr> </table> | 12345+101 | BIN | Byte1 10011110 |   |   |   |   |   |   |   |           |     |       |
| BIN   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| 12345+101   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| BIN   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| Byte1 10011110                                    |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| <table border="1"> <tr><td>OCT</td></tr> </table> | OCT   | <table border="1"> <tr><td>12345+101</td></tr> <tr><td>OCT</td></tr> <tr><td>0000030236</td></tr> </table>     | 12345+101 | OCT | 0000030236     |   |   |   |   |   |   |   |           |     |       |
| OCT   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| 12345+101   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| OCT   |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |
| 0000030236  |   |  |           |     |                |   |   |   |   |   |   |   |           |     |       |

- Logical operation.

| Example            | Key in operation   | Display |      |   |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
|--------------------|--|---------|------|---|---|---|---|------|---|---|---|--|-------------|----------|----------|---|---|------------------|-----|----------|
| 123ABC Xnor 149278 | <table border="1"> <tr><td>1</td><td>2</td><td>3</td><td>A</td><td>B</td></tr> <tr><td>C</td><td>Func</td><td>4</td><td>1</td><td>4</td></tr> <tr><td>9</td><td>2</td><td>7</td><td>8</td><td>=</td></tr> </table> | 1       | 2    | 3 | A | B | C | Func | 4 | 1 | 4   | 9  | 2           | 7        | 8        | = | <table border="1"> <tr><td>123ABCxnor149278</td></tr> <tr><td>HEX</td></tr> <tr><td>FFF9573B</td></tr> </table> | 123ABCxnor149278 | HEX | FFF9573B |
| 1                  | 2  | 3       | A    | B |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| C                  | Func   | 4       | 1    | 4 |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| 9                  | 2  | 7       | 8    | = |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| 123ABCxnor149278   |  |         |      |   |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| HEX                |  |         |      |   |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| FFF9573B           |  |         |      |   |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| Ans or 123ABC      | <table border="1"> <tr><td>Ans</td><td>Func</td><td>2</td><td>1</td><td>2</td></tr> <tr><td>3</td><td>A</td><td>B</td><td>C</td><td>=</td></tr> </table>   | Ans     | Func | 2 | 1 | 2 | 3 | A    | B | C | =   | <table border="1"> <tr><td>Ansor123ABC</td></tr> <tr><td>HEX</td></tr> <tr><td>FFFB7FBF</td></tr> </table> | Ansor123ABC | HEX      | FFFB7FBF |   |   |                  |     |          |
| Ans                | Func   | 2       | 1    | 2 |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| 3                  | A  | B       | C    | = |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| Ansor123ABC        |  |         |      |   |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| HEX                |  |         |      |   |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| FFFB7FBF           |  |         |      |   |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| Neg 123ABC         | <table border="1"> <tr><td>Func</td><td>6</td><td>1</td><td>2</td></tr> <tr><td>3</td><td>A</td><td>B</td><td>C</td><td>=</td></tr> </table>   | Func    | 6    | 1 | 2 | 3 | A | B    | C | = | <table border="1"> <tr><td>Neg(123ABC</td></tr> <tr><td>HEX</td></tr> <tr><td>FFEDC544</td></tr> </table> | Neg(123ABC   | HEX         | FFEDC544 |          |   |   |                  |     |          |
| Func               | 6  | 1       | 2    |   |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| 3                  | A  | B       | C    | = |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| Neg(123ABC         |  |         |      |   |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| HEX                |  |         |      |   |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |
| FFEDC544           |  |         |      |   |   |   |   |      |   |   |   |  |             |          |          |   |   |                  |     |          |

- Specifying the number mode of a particular input value.

| Example   | Key in operation   | Display  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
|---|--|--|-----------------|------|------|---|------|---|---|------|---|---|---|---|---|--|----------------|-----|---|
| Calculate $10_{10}+10_{16}+10_2+10_8$ and display the result as a decimal value   | <table border="1"> <tr><td>CA</td><td>DEC</td><td>Func</td><td>▼</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>+</td><td>Func</td></tr> <tr><td>▼</td><td>2</td><td>1</td><td>0</td><td>+</td></tr> </table> | CA   | DEC             | Func | ▼    | 1 | 1    | 0 | + | Func | ▼ | 2 | 1 | 0 | + | <table border="1"> <tr><td>d10+h10+</td></tr> <tr><td>DEC</td></tr> <tr><td>0</td></tr> </table>       | d10+h10+       | DEC | 0 |
|   | CA   | DEC  | Func            | ▼    |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
|   | 1  | 1  | 0               | +    | Func |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| ▼   | 2  | 1  | 0               | +    |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| d10+h10+  |  |  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| DEC   |  |  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| 0   |  |  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| <table border="1"> <tr><td>Func</td><td>▼</td><td>3</td><td>1</td><td>0</td></tr> <tr><td>+</td><td>Func</td><td>▼</td><td>4</td><td>1</td></tr> <tr><td>0</td><td></td><td></td><td></td><td></td></tr> </table> | Func   | ▼  | 3               | 1    | 0    | + | Func | ▼ | 4 | 1    | 0 |   |   |   |   | <table border="1"> <tr><td>◀0+h10+b10+o10</td></tr> <tr><td>DEC</td></tr> <tr><td>0</td></tr> </table> | ◀0+h10+b10+o10 | DEC | 0 |
| Func  | ▼  | 3  | 1               | 0    |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| +   | Func   | ▼  | 4               | 1    |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| 0   |  |  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| ◀0+h10+b10+o10  |  |  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| DEC   |  |  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| 0   |  |  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| <table border="1"> <tr><td>=</td></tr> </table>   | =  | <table border="1"> <tr><td>d10+h10+b10+o10</td></tr> <tr><td>DEC</td></tr> <tr><td>36</td></tr> </table> | d10+h10+b10+o10 | DEC  | 36   |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| =   |  |  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| d10+h10+b10+o10   |  |  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| DEC   |  |  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |
| 36  |  |  |                 |      |      |   |      |   |   |      |   |   |   |   |   |  |                |     |   |

Equation Calculations (EQN)

- Press **MODE** **[5]** to enter the equation mode.

- 1:  $a_nX+b_nY=c_n$
- 2:  $a_nX+b_nY+c_nZ=d_n$
- 3:  $aX^2+bX+c=0$
- 4:  $aX^3+bX^2+cX+d=0$

| Equation Item            | Description                                       |
|--------------------------|---|
| [1] $a_nX+b_nY=c_n$      | Simultaneous Linear Equations with two unknowns   |
| [2] $a_nX+b_nY+c_nZ=d_n$ | Simultaneous Linear Equations with three unknowns |
| [3] $aX^2+bX+c=0$        | Quadratic Equation, degree 2 equation             |
| [4] $aX^3+bX^2+cX+d=0$   | Cubic Equation, degree 3 equation                 |

- Simultaneous Linear Equations

Simultaneous Linear Equations with two unknowns:

$$a_1x+b_1y=c_1$$

$$a_2x+b_2y=c_2$$

Simultaneous Linear Equations with three unknowns:

$$a_1x+b_1y+c_1z=d_1$$

$$a_2x+b_2y+c_2z=d_2$$

$$a_3x+b_3y+c_3z=d_3$$

| Example in Maths mode | Key in operation | Display |
|-----------------------|------------------|---------|
|                       |                  |         |



|  |                              |  |
|--|------------------------------|--|
| Solve the simultaneous equation with three unknowns:<br>2x+4y-4z=20<br>2x-2y+4z=8<br>5x-2y-2z=20 | MODE 5 2 (3unknowns)         |  |
|  | 2 = 4 = (-) 4<br>= 2 0 =     |  |
|  | 2 = (-) 2 = 4<br>= 8 =       |  |
|  | 5 = (-) 2 = (-)<br>2 = 2 0 = |  |
|  | =                            |  |
|  | =                            |  |
|  | =                            |  |

■ Quadratic and Cubic Equations

Quadratic equation:  $ax^2 + bx + c = 0$  (a second-order polynomial equation with a single variable x)

Cubic equation :  $ax^3 + bx^2 + cx + d = 0$  (an equation with cubic polynomial)

| Example in Maths mode                               | Key in operation             | Display |
|---|------------------------------|---------|
| Solve the cubic equation $5x^3 + 2x^2 - 2x + 1 = 0$ | MODE 5 4<br>(Cubic equation) |         |
|   | 5 = 2 = (-) 2<br>= 1 =       |         |
|   | =                            |         |
|   | =                            |         |
|   | =                            |         |

NOTE:

- For Quadratic and Cubic equations, the variable name starts with "X1".

Matrix Calculations (MATRIX)

- Before starting matrix calculations, you have to create one matrix or a maximum of four matrices named A, B, C and D at one time. The matrix dimension can be up to 3x3.
- The matrix calculation results are stored into the MatAns memory automatically. You can use the matrix MatAns memory for any subsequent matrix calculation.
- Creating a matrix
  - Press MODE 6 to enter Matrix mode.

```
Matrix?
1:MatA  2:MatB
3:MatC  4:MatD
```

- Press CA Func to use the Matrix application; press ↓ or ▲ for next/previous page.

```
1:Dim   2:Data
3:MatA  4:MatB
5:MatC  6:MatD
7:MatAns
```

press ↓ / ▲

```
1:Det   2:Trn
3:Adj
```

| Matrix ITEM      | DESCRIPTION   |
|------------------|---|
| [1] Dim          | Specify the Matrix Name A to D, and specify the dimension (up to 3x3) |
| [2] Data         | Specify the Matrix A-D for editing and corresponding Matrix elements. |
| [3] MatA to MatD | Select Matrix A to D.   |
| [4] MatAns       | Calculation Answer of Matrix stored into MatAns.                      |
| [5] Det          | Determinate function of Matrix A-D                                    |
| [6] Trn          | Transposed data in Matrix A-D   |
| [7] Adj          | Adjoint to Matrix   |

- Press **CA** to exit the matrix creating screen.
- Editing Matrix Data
  - Press **CA** **Func** **[2]** (Data), then specify the matrix A, B, C or D for editing and the corresponding matrix element indicator will be displayed.
  - Input the new value and press **=** to confirm the edit.
  - Press **CA** to exit the matrix editing screen.
- Matrix Addition, Subtraction and Multiplication

| Example  | Key in operation   | Display   |
|--|--|---|
| MatA as<br>$\begin{bmatrix} 1 & 3 \\ 5 & 6 \end{bmatrix}$<br>MatB as<br>$\begin{bmatrix} 2 & 4 \\ 7 & 9 \end{bmatrix}$<br>Calculate<br>MatA + MatB | <b>CA</b> <b>Func</b> <b>[1]</b> <b>[1]</b> <b>[5]</b><br>$1 = 3 =$<br>$5 = 6 =$ | MatA: $2 \times 2$<br>$\begin{bmatrix} 1 & 3 \\ 5 & 6 \end{bmatrix}$<br>6     |
|  | <b>CA</b> <b>Func</b> <b>[1]</b> <b>[2]</b> <b>[5]</b><br>$2 = 4 =$<br>$7 = 9 =$ | MatB: $2 \times 2$<br>$\begin{bmatrix} 2 & 4 \\ 7 & 9 \end{bmatrix}$<br>9     |
|  | <b>CA</b> <b>Func</b> <b>[3]</b> <b>[+]</b> <b>Func</b><br>$4 =$                 | MatA+MatB<br>$\begin{bmatrix} 3 & 7 \\ 12 & 15 \end{bmatrix}$<br>0            |
|  | $=$  | MatAns: $2 \times 2$<br>$\begin{bmatrix} 3 & 7 \\ 12 & 15 \end{bmatrix}$<br>3 |

**NOTE:**

- Matrices which will be added, subtracted or multiplied must be the same size. An error occurs if you try to add, subtract or multiply matrices whose dimensions are different from each other. For example, you cannot add or subtract a 2x3 to or from a 2x2 matrix.
- Obtain the Scalar Product of a Matrix  
 Each position in the matrix is multiplied by a single value, resulting in a matrix of the same size.

| Example   | Key in operation   | Display  |
|---|--|--|
| Multiply MatC<br>$= \begin{bmatrix} 2 & -1 \\ -5 & 3 \end{bmatrix}$<br>By 3 | <b>CA</b> <b>Func</b> <b>[1]</b> <b>[3]</b> <b>[5]</b><br>$2 = (-) 1 =$<br>$(-) 5 = 3 =$ | MatC: $2 \times 2$<br>$\begin{bmatrix} 2 & -1 \\ -5 & 3 \end{bmatrix}$<br>3    |
|   | <b>CA</b> <b>Func</b> <b>[5]</b> <b>[x]</b> <b>[3]</b><br>$=$                            | MatAns: $2 \times 2$<br>$\begin{bmatrix} 6 & -3 \\ -15 & 9 \end{bmatrix}$<br>6 |

- Obtain the Determinant of a Matrix

| Example  | Key in operation  | Display  |
|--|---|--|
| Obtain the<br>Determinant of<br>MatD=<br>$\begin{bmatrix} 10 & -5 & 3 \\ -4 & 9 & 2 \\ 1 & 7 & -3 \end{bmatrix}$ | <b>CA</b> <b>Func</b> <b>[1]</b> <b>[4]</b> <b>[1]</b>                    | MatD: $3 \times 3$<br>$\begin{bmatrix} 10 & -5 & 3 \\ -4 & 9 & 2 \\ 1 & 7 & -3 \end{bmatrix}$<br>$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ |
|  | $10 = 0 = (-) 5 =$<br>$3 = (-) 4 = 9 =$<br>$= 2 = 1 = 7 =$<br>$= (-) 3 =$ | MatD: $3 \times 3$<br>$\begin{bmatrix} 10 & -5 & 3 \\ -4 & 9 & 2 \\ 1 & 7 & -3 \end{bmatrix}$<br>$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ |
|  | <b>CA</b> <b>Func</b> <b>[v]</b> <b>[1]</b> <b>Func</b><br>$6 = (-) =$    | Det(MatD)<br>-471  |

**NOTE:**

- An error occurs if you obtain the determinant of a non-square matrix.

- Transpose a Matrix

| Example | Key in operation | Display |
|---------|------------------|---------|
|---------|------------------|---------|

|  |   |  |
|--|---|--|
| Transpose<br>MatB =<br>$\begin{bmatrix} 9 & 5 \\ 6 & 2 \\ 8 & 4 \end{bmatrix}$ | $\text{CA}$ $\text{Func}$ 1 2 2<br>$\text{9}$ $\text{=}$ $\text{5}$ $\text{=}$ $\text{6}$ $\text{=}$<br>$\text{2}$ $\text{=}$ $\text{8}$ $\text{=}$ $\text{4}$ $\text{=}$ | MatB: $3 \times 2$<br>$\begin{bmatrix} 9 & 5 \\ 6 & 2 \\ 8 & 4 \end{bmatrix}$<br>4   |
|  | $\text{CA}$ $\text{Func}$ $\downarrow$ 2 $\text{Func}$<br>$\text{4}$ $\text{)}$   | $\text{Trn(MatB)}$<br>0  |
|  | $\text{=}$  | MatAns: $2 \times 3$<br>$\begin{bmatrix} 9 & 5 \\ 6 & 2 \\ 8 & 4 \end{bmatrix}$<br>9 |

■ Adjoint of Matrix

| Example  | Key in operation  | Display   |
|--|---|---|
| Calculate the<br>Adjoint of<br>MatA=<br>$\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$ | $\text{CA}$ $\text{Func}$ 1 1 5<br>$\text{2}$ $\text{=}$ $\text{3}$ $\text{=}$<br>$\text{4}$ $\text{=}$ $\text{5}$ $\text{=}$ | MatA: $2 \times 2$<br>$\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$<br>5     |
|  | $\text{CA}$ $\text{Func}$ $\downarrow$ 3 $\text{Func}$<br>$\text{3}$ $\text{)}$   | $\text{Adj(MatA)}$<br>0   |
|  | $\text{=}$  | MatAns: $2 \times 2$<br>$\begin{bmatrix} 5 & -3 \\ -4 & 2 \end{bmatrix}$<br>5 |

■ Invert a Matrix

| Example   | Key in operation  | Display   |
|---|---|---|
| Inverting MatC=<br>$\begin{bmatrix} 8 & 2 \\ 3 & 6 \end{bmatrix}$ | $\text{CA}$ $\text{Func}$ 1 3 5<br>$\text{8}$ $\text{=}$ $\text{2}$ $\text{=}$<br>$\text{3}$ $\text{=}$ $\text{6}$ $\text{=}$ | MatC: $2 \times 2$<br>$\begin{bmatrix} 8 & 2 \\ 3 & 6 \end{bmatrix}$<br>6                           |
|   | $\text{CA}$ $\text{Func}$ 5 $\text{x}^{-1}$   | $\text{MatC}^{-1}$<br>0   |
|   | $\text{=}$  | MatAns: $2 \times 2$<br>$\begin{bmatrix} 0.0476 & -0.0476 \\ -0.0714 & 0.1904 \end{bmatrix}$<br>1.7 |

■ Determine the Absolute Value of a Matrix

| Example  | Key in operation   | Display   |
|--|--|---|
| To determine<br>the absolute<br>value of the<br>matrix C<br>produced by<br>the inversion in<br>the previous<br>example | $\text{CA}$ $\text{Shift}$ $\text{Abs}$ $\text{Func}$<br>$\text{7}$ $\text{)}$ | $\text{Abs(MatAns)}$<br>0   |
|  | $\text{=}$   | MatAns: $2 \times 2$<br>$\begin{bmatrix} 0.0476 & 0.0476 \\ 0.0714 & 0.1904 \end{bmatrix}$<br>1.7 |

Function (X, Y) Table Calculations (TABLE)

- Input f(x) function to generate the function table for x & f(x),
- Steps to generate a Number Table

1. Enter TABLE Mode

- Press  $\text{MODE}$   $\text{7}$  to enter the Table function calculation,

2. Function Input screen

- Input function with X variable ( $\text{Alpha}$   $\text{x}$ ) to generate Function Table Result.
- All other variables (A,B,C,D, E, F, Y) and independent memory (M) act as the value.
- Pol, Rec, I-Div function not able to use in Function Input screen.
- The Function Table Calculation will change X-variable.

3. Input the start, end & step information

- Input the value press  $\text{=}$  to confirm on the following screens
- Input expression and display result value in following screens are in Line mode status
- There are maximum of 30 x-values for generate function table, the "insufficient MEM Error" Will be shown if you input the start, end, step value combination is more than 30 x-values.

| Display screen | You should input:-   |
|----------------|--|
| Start?         | Input the lower limit of X (Default =1).   |
| End?           | Input the upper limit of X (Default =5).<br>*End value must be greater than the start value. |
| Step?          | Input the increment step (Default =1).   |

- In Function Table Result screen, you cannot edit the content, and press  $\text{CA}$  return to Function input screen.  
 Example:  $f(x)=x^3+3x^2-2x$  to generate the function table for the range  $1 \leq x \leq 5$  incremented in steps of 1.

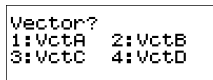
| Key in operation   | Display  |   |      |  |   |    |  |   |     |  |   |     |   |
|--|--|---|------|--|---|----|--|---|-----|--|---|-----|---|
| <b>MODE</b> <b>7</b>   | f(x)=  |   |      |  |   |    |  |   |     |  |   |     |   |
| <b>Alpha</b> <b>x</b> <b>Shift</b> <b>X<sup>3</sup></b> <b>+</b> <b>9</b><br><b>Alpha</b> <b>X</b> <b>X<sup>2</sup></b> <b>-</b> <b>2</b> <b>Alpha</b><br><b>x</b> | f(x)=X <sup>3</sup> +3X <sup>2</sup> -2X   |   |      |  |   |    |  |   |     |  |   |     |   |
| <b>=</b> <b>1</b> <b>=</b> <b>5</b> <b>=</b> <b>1</b> <b>=</b>   | <table border="1"> <tr> <td>X</td> <td>F(X)</td> <td></td> </tr> <tr> <td>1</td> <td>2</td> <td></td> </tr> <tr> <td>2</td> <td>16</td> <td></td> </tr> <tr> <td>3</td> <td>48</td> <td>1</td> </tr> </table>    | X | F(X) |  | 1 | 2  |  | 2 | 16  |  | 3 | 48  | 1 |
| X  | F(X)   |   |      |  |   |    |  |   |     |  |   |     |   |
| 1  | 2  |   |      |  |   |    |  |   |     |  |   |     |   |
| 2  | 16   |   |      |  |   |    |  |   |     |  |   |     |   |
| 3  | 48   | 1 |      |  |   |    |  |   |     |  |   |     |   |
| <b>▼</b> <b>▼</b> <b>▼</b> <b>▼</b>  | <table border="1"> <tr> <td>X</td> <td>F(X)</td> <td></td> </tr> <tr> <td>3</td> <td>48</td> <td></td> </tr> <tr> <td>4</td> <td>104</td> <td></td> </tr> <tr> <td>5</td> <td>190</td> <td>5</td> </tr> </table> | X | F(X) |  | 3 | 48 |  | 4 | 104 |  | 5 | 190 | 5 |
| X  | F(X)   |   |      |  |   |    |  |   |     |  |   |     |   |
| 3  | 48   |   |      |  |   |    |  |   |     |  |   |     |   |
| 4  | 104  |   |      |  |   |    |  |   |     |  |   |     |   |
| 5  | 190  | 5 |      |  |   |    |  |   |     |  |   |     |   |

**Vector Calculations (VECTOR)**

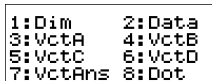
- Before starting vector calculations, you have to create one or more vectors named A, B, C and D (maximum three vectors at one time).
- The vector calculation results are stored into VctAns memory automatically. You can use the vector VctAns memory for any subsequent vector calculations.

Creating a Vector

- Press **MODE** **8** (VECTOR) to enter the Vector Mode.



- Press **CA** **Func** to use the Vector tool.



| Vector ITEM      | DESCRIPTION   |
|------------------|---|
| [1] Dim          | Specify the Vector Name A to D, and specify the dimension (up to 3D)  |
| [2] Data         | Specify the Vector A-D for editing and corresponding Vector elements. |
| [3] VctA to VctD | Select Vector A to D.   |
| [4] VctAns       | Calculation Answer of Vector stored into VctAns.                      |
| [5] Dot          | Input the "*" command for obtaining the inner product of two Vectors  |

- Press **CA** to exit the Vector creating screen.
- Editing Vector Elements.
  - Press **CA** **Func** **2** (Data), then specify the matrix A,B,C or D for editing, and the corresponding vector element indicator will be displayed.
  - Input the new value and press **=** to confirm the edit.
  - Press **CA** to exit the Vector editing screen.
- Vector Addition and Subtraction.

| Example   | Key in operation  | Display  |
|---|---|--|
| Vector A = (2,5), Vector B = (9,3), Vector A - Vector B = ? | <b>MODE</b> <b>8</b> <b>1</b> <b>2</b>  | VctA: $\begin{bmatrix} 2 \\ 5 \end{bmatrix}$ VctB: $\begin{bmatrix} 9 \\ 3 \end{bmatrix}$<br>0 |
|   | <b>2</b> <b>=</b> <b>5</b> <b>=</b>   | VctA: $\begin{bmatrix} 2 \\ 5 \end{bmatrix}$ VctB: $\begin{bmatrix} 2 \\ 5 \end{bmatrix}$<br>5 |
|   | <b>CA</b> <b>Func</b> <b>1</b> <b>2</b> <b>2</b><br><b>9</b> <b>=</b> <b>3</b> <b>=</b> | VctA: $\begin{bmatrix} 2 \\ 5 \end{bmatrix}$ VctB: $\begin{bmatrix} 9 \\ 3 \end{bmatrix}$<br>3 |
|   | <b>CA</b> <b>Func</b> <b>3</b> <b>-</b>   | VctA: $\begin{bmatrix} 2 \\ 5 \end{bmatrix}$ VctB: $\begin{bmatrix} 9 \\ 3 \end{bmatrix}$<br>0 |
|   | <b>Func</b> <b>4</b> <b>=</b>   | VctAns: $\begin{bmatrix} -7 \\ 2 \end{bmatrix}$<br>-7  |

**NOTE:**

- An error occurs if you try to add or subtract vector whose dimensions are different from each other. For example Vector A(a, b, c) cannot add or subtract to or from Vector B (d, e).
- Obtain the Scalar Product of a Vector  
Each position in the vector is multiplied by a single value, resulting in a vector of same size:  $s \times \text{VctA}(a,b)=\text{VctB}(axs,bxs)$ .

| Example | Key in operation | Display |
|---------|------------------|---------|
|---------|------------------|---------|

|                                       |                 |                                  |
|---------------------------------------|-----------------|----------------------------------|
| To multiply Vector C= (4, 5, -6) by 5 | CA Func 1 3 1   | VctC: 3<br>[ 4 5 -6 ]<br>0       |
|                                       | 4 = 5 = (-) 6 = | VctC: 3<br>[ 4 5 -6 ]<br>-6      |
|                                       | CA Func 5 x 5 = | VctAns: 3<br>[ 20 25 -30 ]<br>20 |

- Calculate the Inner Product of two Vector

| Example   | Key in operation             | Display                    |
|---|------------------------------|----------------------------|
| Vector A = (15, 12),<br>Vector B = (4, 5),<br>Vector A • Vector B = ? | CA Func 1 1 2<br>1 5 = 1 2 = | VctA: 2<br>[ 15 12 ]<br>12 |
|   | CA Func 1 2 2<br>4 = 5 =     | VctB: 2<br>[ 4 5 ]<br>5    |
|   | CA Func 3 Func 8<br>Func 4 = | VctA • VctB<br>120         |

- Calculate the Outer Product of two Vector

| Example   | Key in operation                 | Display                         |
|---|----------------------------------|---------------------------------|
| Vector A = (2,5,-4), Vector B =(-6,8,7),<br>Vector A x Vector B = ? | CA Func 1 1 1<br>2 = 5 = (-) 4 = | VctA: 3<br>[ 2 5 -4 ]<br>-4     |
|   | CA Func 1 2 1 (-)<br>6 = 8 = 7 = | VctB: 3<br>[ -6 8 7 ]<br>7      |
|   | CA Func 3 x<br>Func 4            | VctA x VctB<br>0                |
|   | =                                | VctAns: 3<br>[ 10 46 67 ]<br>67 |

**NOTE:**

- An error occurs if you try to obtain an inner or outer product of two vectors whose dimensions are different from each other..

- Determine the Absolute Value of a Vector

| Example                                   | Key in operation             | Display                    |
|---|------------------------------|----------------------------|
| Vector C= (-5, 8, 9),<br>  Vector C   = ? | CA Func 1 3 1<br>(-) 5 = 8 = | VctC: 3<br>[ -5 8 9 ]<br>9 |
|   | CA Shift Abs Func 5<br>) =   | Abs(VctC)<br>13.03840481   |

**Example:** To determine the size of the angle (angle unit: Deg) formed by vectors A= (-1, 4, 6) and B= (5, 2, 8), and a unit vector perpendicular to both A and B.

$$\cos \theta = \frac{(A \cdot B)}{|A||B|}, \text{ which becomes } \theta = \cos^{-1} \frac{(A \cdot B)}{|A||B|}$$

The unit vector perpendicular to both A and B=  $\frac{A \times B}{|A \times B|}$

<Result :  $\frac{VctA \times VctB}{|VctA \times VctB|} = (0.4145133361, 0.7875753387, -0.4559646698)>$

| Example           | Key in operation  | Display   |
|-------------------|---|---|
| $\theta = ?$      | CA Func 1 1 1<br>(-) 1 = 4 = 6<br>=                       | VctA: $\begin{bmatrix} 3 \\ -1 \end{bmatrix}$             |
|                   | CA Func 1 2 1<br>5 = 2 = 8 =                              | VctB: $\begin{bmatrix} 5 \\ 2 \end{bmatrix}$              |
|                   | CA Func 3 Func 8<br>Func 4 =                              | VctA·VctB<br>51   |
|                   | ( ) ( ) Shift Abs Func 3<br>) x Shift Abs Func<br>4 ( ) = | Ans=(Abs(VctA))×<br>0.7264249748                          |
|                   | Shift cos <sup>-1</sup> Ans ( ) =                         | cos <sup>-1</sup> (Ans)<br>43.41248163                    |
| The unit vector=? | Func 3 × Func 4<br>=                                      | VctAns: $\begin{bmatrix} 3 \\ -2 \end{bmatrix}$           |
|                   | Shift Abs Func 7 ( )<br>= Func 7 ( ) Ans<br>=             | VctAns: $\begin{bmatrix} 0.7815 \\ -0.4551 \end{bmatrix}$ |

#### Inequality Calculations (INEQ)

- Press **MODE**  $\downarrow$  **1** (INEQ) to enter the Inequality Mode. Press **1** or **2** to select an Inequality type.

```
1: aX2+bX+c
2: aX3+bX2+cX+d
```

- On the menu, Press **1**, **2**, **3** or **4** to select the Inequality symbol type and orientation.

```
1: f(x)>0
2: f(x)<0
3: f(x)≥0
4: f(x)≤0
```

- Use the Coefficient Editor that appears to input coefficient values. To solve  $x^2 + 2x - 3 < 0$ , for example, input the coefficients a = 1, b = 2, c = -3, by pressing **1** **=** **2** **=** **(-)** **3** **=**.

| Example in Maths mode | Key in operation       | Display  |
|-----------------------|------------------------|--|
| $x^2 - 2x - 8 \geq 0$ | MODE $\downarrow$ 1 1  | 1: f(x)>0<br>2: f(x)<0<br>3: f(x)≥0<br>4: f(x)≤0   |
|                       | 3                      | $\begin{matrix} a & b & c \\ \hline & & \end{matrix}$<br>aX <sup>2</sup> +bX+c≥0               |
|                       | 1 = (-) 2 = (-)<br>8 = | $\begin{matrix} a & b & c \\ \hline 1 & -2 & -8 \end{matrix}$<br>aX <sup>2</sup> +bX+c≥0<br>-8 |
|                       | =                      | X≤A, B≤X<br>X≤-2, 4≤X  |

- "All" appears on the solution screen when the solution of an inequality is all numbers.

| Example in Maths mode | Key in operation        | Display   |
|-----------------------|-------------------------|---|
| $x^2 \geq 0$          | MODE $\downarrow$ 1 1 3 | $\begin{matrix} a & b & c \\ \hline & & \end{matrix}$<br>aX <sup>2</sup> +bX+c≥0<br>0 |

|  |               |  |
|--|---------------|--|
|  | $1 = 0 = 0 =$ |  |
|  | $=$           |  |

- "No-Solution" appears on the solution screen when no solution exists for an inequality (such as  $X^2 < 0$ ).

| Example in Maths mode | Key in operation               | Display |
|-----------------------|--------------------------------|---------|
| $x^2 + 3 \leq 0$      | $\text{MODE} \downarrow 1 1 4$ |         |
|                       | $1 = 0 = 3 =$                  |         |
|                       | $=$                            |         |
|                       | $\text{CA}$                    |         |

**NOTE:**

- The following operations are not supported by the Coefficient Editor,  $\text{M+}$ ,  $\text{Shift M+ (M-)}$ ,  $\text{Shift RCL (STO)}$ ,  $\text{Pol}$ ,  $\text{Red}$ ,  $\text{I-Div}$  and multi-statements also cannot be input with the Coefficient Editor.
- Press  $\text{CA}$  to return to the Coefficient Editor while the solutions are displayed.
- Values cannot be converted to engineering notation on the solution screen.

**Using Verify (VERIFY)**

VERIFY is a function you can use to verify whether an input equality or inequality is true (indicated by TRUE) or false (indicated by FALSE).

- Press  $\text{MODE} \downarrow 2$  (VERIFY) to enter the VERIFY Mode.
- Press  $\text{Func}$  to enter the following screen, press  $1 \sim 6$  to select the equality symbol or inequality symbol that you want to.

|      |      |
|------|------|
| 1: = | 2: ≠ |
| 3: > | 4: < |
| 5: ≥ | 6: ≤ |

| Example in Maths mode                    | Key in operation  | Display |
|--|---|---------|
| verify whether $3\sqrt{36} = 18$ is true | $\text{MODE} \downarrow 2$                                |         |
|  | $3 \sqrt{\square} 3 6 \rightarrow$<br>$\text{Func} 1 1 8$ |         |
|  | $=$   |         |

- You can input the following expressions for verification in the VERIFY mode.
  - Equalities or inequalities that include one relational operator  $4 = \sqrt{16}$ ,  $4 \neq 3$ ,  $\pi > 3$ ,  $1+2 \leq 5$ ,  $(3 \times 6) < (2+6) \times 2$ , etc.
  - Equalities or inequalities that include multiple relational operators  $1 \leq 1 < 1+1$ ,  $3 < \pi < 4$ ,  $2^2 = 2+2=4$ ,  $2+2=4 < 6$ ,  $2+3=5 \neq 2+5=8$ , etc.
- Expression input precautions (the following types of expressions cause a Syntax ERROR and cannot be verified).
  - An expression with nothing on the left side or right side (Example:  $= \sqrt{7}$ ).
  - An expression in which a relational operator is inside of a fraction or function (Example:  $\frac{1=1}{2}$ ,  $\cos(8 \leq 9)$ ).
  - An expression in which a relational operator is enclosed in parentheses (Example:  $8 < (9 < 10)$ ).
  - An expression in which multiple relational operators that are not oriented in the same direction (Example:  $5 \leq 6 \geq 4$ ).
  - An expression that contains two of the following operators in any combination (Example:  $4 < 6 \neq 8$ ).
  - An expression that contains consecutive relational operators (Example:  $5 \geq > 9$ ).

| Example in Maths mode           | Key in operation   | Display |
|---------------------------------|--|---------|
| $\log 2 < \log 3$<br>$< \log 4$ | $\log 2 \text{Func} 4 \log$<br>$3 \text{Func} 4 \log$<br>$4 \text{Func}$ |         |

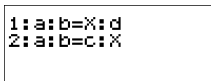
|   |     |  |
|---|-----|--|
|   | $=$ |  |
| $0 < \left(\frac{8}{9}\right)^3 - \left(\frac{8}{9}\right)^2$ |     |  |
|   | $=$ |  |
| $4^2 = 16 = \sqrt{256}$                                       |     |  |
|   | $=$ |  |

**NOTE:**

- The verification result will cause 1 to be assigned to Ans memory when TRUE and 0 when FALSE.
- The input expression can be a total of 99 bytes, including the left side, right side, and relational operators.
- Any variable (A, B, C, D, E, F, X, Y, M) input into an expression is treated as a value, using the value currently assigned to the variable.
- The following operations cannot be used in an expression,  $M+$ ,  $Shift M+$  (M-),  $Shift RCL$  (STO),  $Pol$ ,  $Rec$ ,  $I-Div$ ,  $PFact$ ,  $ENG$ ,  $ENG$ .
- When an expression that don't contains the relational operators and right side, the calculator will add “=0” in the expression.

**Ratio Calculations (Ratio)**

- Press  $MODE$   $\downarrow$   $3$  (RATIO) to enter the RATIO Mode. Press  $1$  or  $2$  to select the ratio type.



- On the Coefficient Editor Screen that appears, input up to 10 digits for each of the required values (a, b, c, d). To solve  $3:8=X:12$  for X, for example, press  $1$  in type screen, and then input the following for the coefficients(a=3,b=8,d=12):  $3 = 8$

| Example in Maths mode                     | Key in operation            | Display |
|---|-----------------------------|---------|
| to calculate in the ratio $2 : 9 = 7 : X$ | $MODE$ $\downarrow$ $3$ $2$ |         |
|   | $2 = 9 = 7 =$               |         |
|   | $=$                         |         |

**NOTE:**

- The following operations are not supported by the Coefficient Editor,  $M+$ ,  $Shift M+$  (M-),  $Shift RCL$  (STO),  $Pol$ ,  $Rec$ ,  $I-Div$  and multi-statements also cannot be input with the Coefficient Editor.
- A Math Error will occur if you perform a calculation while 0 is input for a coefficient.

**Input Range and Error Message**

**Calculation Precision, Input Range**

|   |   |
|---|---|
| Number of Digits for Internal Calculation | Up to 18 digits   |
| Precision *                               | $\pm$ at the 10th digit for a single calculation.<br>$\pm$ at the least significant for exponential display |
| Calculation Range                         | $\pm \times 10^{99}$ to $\pm 9.999999999 \times 10^{99}$ or 0   |

■ **Function Calculation Input Ranges**

| Functions | Input Range |                                |
|-----------|-------------|--------------------------------|
| Sin x     | DEG         | $0 \leq  x  < 9 \times 10^9$   |
|           | RAD         | $0 \leq  x  < 157\ 079\ 632.7$ |



|                      |  |  |
|----------------------|--|--|
|                      | GRA  | $0 \leq  x  < 1 \times 10^{10}$                        |
| Cos x                | DEG  | $0 \leq  x  < 9 \times 10^9$                           |
|                      | RAD  | $0 \leq  x  < 157\,079\,632.7$                         |
|                      | GRA  | $0 \leq  x  < 1 \times 10^{10}$                        |
| Tan x                | DEG  | Same as sinx , except when $ x  = (2n-1) \times 90$    |
|                      | RAD  | Same as sinx , except when $ x  = (2n-1) \times \pi/2$ |
|                      | GRA  | Same as sinx , except when $ x  = (2n-1) \times 100$   |
| Sin <sup>-1</sup> x  | $0 \leq  x  \leq 1$  |  |
| Cos <sup>-1</sup> x  |  |  |
| tan <sup>-1</sup> x  | $0 \leq  x  \leq 9.999\,999\,999 \times 10^{99}$                                 |  |
| Sinh x               | $0 \leq  x  \leq 230\,258\,509.2$  |  |
| cosh x               |  |  |
| Sinh <sup>-1</sup> x | $0 \leq  x  \leq 4.999\,999\,999 \times 10^{99}$                                 |  |
| cosh <sup>-1</sup> x | $1 \leq x \leq 4.999\,999\,999 \times 10^{99}$                                   |  |
| tanh x               | $0 \leq  x  \leq 9.999\,999\,999 \times 10^{99}$                                 |  |
| tanh <sup>-1</sup> x | $0 \leq  x  \leq 9.999\,999\,999 \times 10^{-1}$                                 |  |
| Log x/lnx            | $0 < x \leq 9.999\,999\,999 \times 10^{99}$                                      |  |
| 10 <sup>x</sup>      | $-9.999\,999\,999 \times 10^{99} \leq x \leq 99.999\,999.99$                     |  |
| e <sup>x</sup>       | $-9.999\,999\,999 \times 10^{99} \leq x \leq 230.258\,509.2$                     |  |
| $\sqrt{x}$           | $0 \leq x < 1 \times 10^{100}$   |  |
| x <sup>2</sup>       | $ x  < 1 \times 10^{50}$   |  |
| x <sup>3</sup>       | $ x  \leq 2.154\,434\,69 \times 10^{33}$   |  |
| x <sup>-1</sup>      | $ x  < 1 \times 10^{100}, x \neq 0$  |  |
| $\sqrt[3]{x}$        | $ x  < 1 \times 10^{100}$  |  |
| X!                   | $0 \leq x \leq 69$ (x is an integer)   |  |
| nPr                  | $0 \leq n < 1 \times 10^{10}, 0 \leq r \leq n$ (n, r are integers)               |  |
|                      | $1 \leq \{n! / (n-r)!\} < 1 \times 10^{100}$                                     |  |
| nCr                  | $0 \leq n < 1 \times 10^{10}, 0 \leq r \leq n$ (n, r are integers)               |  |
|                      | $1 \leq n! / r! < 1 \times 10^{100}$ or $1 \leq n! / (n-r)! < 1 \times 10^{100}$ |  |

| Functions                         | Input Range  |
|-----------------------------------|--|
| Pol ( x, y )                      | $ x ,  y  \leq 9.999999999 \times 10^{99}$<br>$\sqrt{x^2 + y^2} \leq 9.999999999 \times 10^{99}$   |
| Rec( r, $\theta$ )                | $0 \leq r \leq 9.999999999 \times 10^{99}$<br>$\theta$ : Same as sin x   |
| o , , "                           | $ a , b, c < 1 \times 10^{100}$<br>$0 \leq b, c$<br>The display seconds value is subject to an error of +/- 1 at the second decimal place  |
| ◀ o , , "                         | $ x  < 1 \times 10^{100}$<br>Decimal ↔ Sexagesimal Conversions<br>$0^\circ 0' 0'' \leq  x  \leq 99999999^\circ 59' 59''$   |
| x <sup>■</sup> ( x <sup>y</sup> ) | $x > 0; -1 \times 10^{100} < y \log x < 100$<br>$x = 0; y > 0$<br>$x < 0; y = n, m / (2n+1)$ (m, n are integers)<br>However: $-1 \times 10^{100} < y \log  x  < 100$                         |
| $\sqrt[x]{y}$                     | $y > 0; x \neq 0, -1 \times 10^{100} < 1/x \log y < 100$<br>$y = 0; x > 0$<br>$y < 0; x = 2n+1, (2n+1)/m$ (m ≠ 0; m, n are integers)<br>However: $-1 \times 10^{100} < (1/x) \log  y  < 100$ |
| a b/c                             | Total of integer, numerator, and denominator must be 10 digits or less (including division marks).   |
| I-Rand(a, b)                      | $0 \leq a < 1 \times 10^{10}, 0 \leq b < 1 \times 10^{10}$ (a, b should be positive integers or 0)   |
| Rand                              | Result generates a 3 digits pseudo random number (0.000–0.999)   |
| LCM(x, y, z)                      | $0 < x, y, z \leq 9.999\,999\,999 \times 10^{12}$ (positive integers)<br>Default result when x, y, z=0   |
| GCD(x, y, z)                      | $0 < x, y, z \leq 9.999\,999\,999 \times 10^{12}$ (positive integers)<br>Default result when x, y, z=0   |

|                                      |   |
|--------------------------------------|---|
| I-Div ( x, y)                        | 0<x, y ≦ 9.999 999 999x10 <sup>12</sup> (positive integers)<br>0 ≦ Q ≦ 999 999 9999, 0 ≦ r ≦ 999 999 9999(Q, r are integers)<br>Default result when x=0 |
| Mod(x,y)                             | 0< x,y  ≦ 9.999999999x10 <sup>12</sup><br>Default result=x when y=0   |
| Abs                                  | x <1x10 <sup>100</sup>  |
| One-variable Statistical calculation | x <1x10 <sup>100</sup><br> FREQ <1x10 <sup>100</sup>  |
| Two-variable Statistical calculation | x <1x10 <sup>100</sup><br> y <1x10 <sup>100</sup><br> FREQ <1x10 <sup>100</sup>   |
| PFact                                | x ≦ 9999999999(positive integers)   |
| BIN                                  | Positive: 0-0111 1111 1111 1111 1111 1111 1111 1111<br>Negative: 1000 0000 0000 0000 0000 0000 0000 0000-1111 1111 1111 1111 1111 1111 1111 1111        |
| DEC                                  | Positive: 0-2147483647<br>Negative: -2147483648--1  |
| OCT                                  | Positive: 0-177 7777 7777<br>Negative: 200 0000 0000-377 7777 7777  |
| HEX                                  | Positive: 0-7FFF FFFF<br>Negative: 8000 0000-FFFF FFFF  |
| Σ (f(x), a, b)                       | a and b are integers in the range of -1 · 10 <sup>10</sup> < a ≦ b < 1 · 10 <sup>10</sup> .   |
| Π(f(x), a, b)                        | a and b are integers in the range of -1 · 10 <sup>10</sup> < a ≦ b < 1 · 10 <sup>10</sup> .   |

• Errors are cumulative in the case of consecutive calculations, this is also true as internal consecutive calculation are performed in the case of X ( x y), √, √, √, x!, nPr , nCr . And may become large.

■ **Display of results using √**

Calculation results may be displayed using √ when all of the following cases:

When intermediate and final calculation results are displayed in the following form:

$$\pm \frac{a\sqrt{b} \pm d\sqrt{e}}{c \quad f} \quad \begin{matrix} 0 \leq a < 100, & 1 \leq d < 100 \\ 0 \leq b < 1000, & 1 \leq e < 1000 \\ 1 \leq c < 100, & 1 \leq f < 100 \end{matrix}$$

When the number of terms in the intermediate and final calculation result is one or two.

**Order of Operations**

This calculator will automatically determine the operation priority of each individual command as follows:

|              |   |
|--------------|---|
| 1st Priority | Recall memory (A, B, C, D, E, F,X,Y,M), Rand  |
| 2nd          | Calculation within parentheses ( ) .  |
| 3rd          | Function with parenthesis that request the input argument to the right Pol(, Rec(, d/dx(, ∫ dx(, P(, Q(, R(, Det(, Trn(, Adj(, Arg(, Conj(, sin(, cos(, tan(, sin <sup>-1</sup> (, cos <sup>-1</sup> (, tan <sup>-1</sup> (, sinh(, cosh(, tanh(, sinh <sup>-1</sup> (, cosh <sup>-1</sup> (, tanh <sup>-1</sup> (, log(, ln(, e <sup>x</sup> (, 10 <sup>x</sup> (, √(, √(, Abs(, Round(, I-Rand(, LCM(, GCD(, I-Div(, Mod( |
| 4th          | Functions that come after the input value preceded by values, powers, power roots: X <sup>2</sup> , x <sup>3</sup> , x <sup>-1</sup> , x!, <sup>o</sup> , r, g, <sup>x</sup> √(, Percent %, log <sup>■</sup> , EXP, <sup>t</sup>  |
| 5th          | Fractions: <sup>■</sup> / <sub>■</sub>  |
| 6th          | Prefix symbol: (-)(negative sign), base-n symbols (d, h, b, o, Neg, Not)  |
| 7th          | Metric conversion commands (cm→in,etc.), Statistical estimated value calculation: $\bar{x}$ , $\bar{y}$ , $\bar{x}_1$ , $\bar{x}_2$   |
| 8th          | Multiplication where sign is omitted: Multiplication sign omitted immediately before π, e, variables (2π, 5A, πA, etc.), functions with parentheses ( 2√(3), A sin (30), etc.)  |
| 9th          | Permutations, combinations: nPr, nCr<br>Complex number polar coordinate symbol(∠)   |
| 10th         | Dot : .   |
| 11th         | Multiplication and division: ×, ÷   |
| 12th         | Addition and subtraction: +, -  |
| 13th         | Logical AND(and)  |
| 14th         | Logical OR,XOR,XNOR(or, xor, xnor)  |
| 15th         | Calculation ending instruction: =, M+, M- STO (store memory), <sup>r</sup> <Θ, <sup>a</sup> +bi   |

- In the same precedence level, calculations are performed from left to right.
- Operation enclosed within parentheses is performed first. When a calculation contains an argument that is a negative number, the negative number must be enclosed within parentheses.

**Example:**

(-) 3 x<sup>2</sup> =

-3<sup>2</sup>=-9

$$\boxed{(-)} \boxed{3} \boxed{)} \boxed{x^2} \boxed{=} \quad (-3)^2=9$$

- When same priority commands are mixed into one calculation.

**Example 1:**

$$\boxed{1} \boxed{\div} \boxed{2} \boxed{\text{Shift}} \boxed{\pi} \boxed{=} \quad 1 \div 2\pi = 0.1591549431$$

**Example 2:**

$$\boxed{2} \boxed{\text{Shift}} \boxed{\text{STO}} \boxed{(-)} \quad 2 \rightarrow A$$

$$\boxed{1} \boxed{\div} \boxed{2} \boxed{\text{Alpha}} \boxed{A} \boxed{=} \quad 1 \div 2A = 4$$

#### Calculation Stacks

- This calculator uses memory areas, called "stacks", to temporarily store numeric value (numbers) and commands (+, -, x,.....) according to their precedence during calculations.
- The numeric stack has 10 levels and command stack has 128 levels. A stack error [Stack ERROR] occurs whenever you try to perform a calculation that exceeds the capacity of stacks.
- Calculations are performed in sequence according to "Order of Operations". After the calculation is performed, the stored stack values will be released.

#### Error Messages and Error Locator

The calculator is locked up while an error message is shown on the display to indicate the cause of the error.

- Press  $\boxed{\text{CA}}$  to clear the error message, then return to the initial display of latest mode.
- Press  $\boxed{\leftarrow}$  or  $\boxed{\rightarrow}$  to display input expression with the cursor positioned next to the error.
- Press  $\boxed{\text{ON}}$  to clear the error message, clear the replay memory history and return to the initial display of the latest mode.

| Error Message                                       | Cause   | Action  |
|---|---|---|
| <b>Math ERROR</b>                                   | <ul style="list-style-type: none"> <li>The intermediate or final result is outside the allowable calculation range.</li> <li>An attempt to perform a calculation using a value that exceeds the allowable input range.</li> <li>An attempt to perform an illogical operation (division by zero, etc.).</li> </ul> | <ul style="list-style-type: none"> <li>Check the input values and make sure they are all within the allowable ranges.</li> <li>Pay special attention to values in any using memory areas.</li> </ul>  |
| <b>Stack ERROR</b>                                  | <ul style="list-style-type: none"> <li>The capacity of the numeric stack or operator stack is exceeded.</li> </ul>  | <ul style="list-style-type: none"> <li>Simplify the calculation.</li> <li>Divide the calculation into two or more separate parts.</li> </ul>  |
| <b>Syntax ERROR</b>                                 | <ul style="list-style-type: none"> <li>An attempt to perform an illegal mathematical operation.</li> </ul>  | <ul style="list-style-type: none"> <li>Press <math>\boxed{\leftarrow}</math> or <math>\boxed{\rightarrow}</math> to display the cursor at the location of the error, make appropriate corrections.</li> </ul>   |
| <b>Insufficient MEM ERROR</b>                       | <ul style="list-style-type: none"> <li>The calculation result of Function Table mode parameters caused more than 30 x-values to be generated for a table.</li> </ul>  | <ul style="list-style-type: none"> <li>Narrow the table calculation range by changing the start, end, and step values, and try again.</li> </ul>  |
| <b>Dimension ERROR (only in Matrix and Vector )</b> | <ul style="list-style-type: none"> <li>In Matrix and Vector mode, the dimension (row, column) is over three.</li> <li>An attempt to perform an illegal matrix/vector operation.</li> </ul>  | <ul style="list-style-type: none"> <li>Specify the dimension of the matrix or vector and then perform the calculation again.</li> <li>Check the dimensions specified for the matrices or vectors to see if they are compatible with the calculation.</li> </ul> |
| <b>Variable ERROR (SOLVE feature only)</b>          | <ul style="list-style-type: none"> <li>You did not specify a solution variable, and there is no X variable in the equation you input.</li> <li>The solution variable that you specified is not included in the equation you input.</li> </ul>   | <ul style="list-style-type: none"> <li>The equation you input must include an X variable when you do not specify the solution variable.</li> <li>Specify a variable that is included in the equation you input as the solution variable.</li> </ul>             |
| <b>Can't Solve ERROR (SOLVE feature only)</b>       | <ul style="list-style-type: none"> <li>The calculator could not obtain a solution.</li> </ul>   | <ul style="list-style-type: none"> <li>Check for errors in the equation that you input.</li> <li>Input a value for the solution variable that is close to the expected solution and try again.</li> </ul>   |
| <b>Time Out ERROR</b>                               | <ul style="list-style-type: none"> <li>The current differential or integration calculation ends without the ending condition being fulfilled.</li> </ul>  | <ul style="list-style-type: none"> <li>Try increasing the tol value. Note that this also decreases solution precision.</li> </ul>   |
| <b>Argument ERROR</b>                               | <ul style="list-style-type: none"> <li>There is a problem with the argument of the calculation you are performing</li> </ul>  | <ul style="list-style-type: none"> <li>Make necessary corrections</li> </ul>  |

#### Battery Replacement

When the display characters are dim, turn the calculator off and replace the battery immediately. Please replace the battery using the following procedures.

- Press  $\boxed{\text{Shift}} \boxed{\text{OFF}}$  to power off the calculator.
- Remove the screw that securely fixes the battery cover in place.
- Remove battery cover.
- Remove the old battery with ball pen or similar sharp object.
- Load the new battery with positive "+" side facing up.

---

6. Replace the battery cover, screw, and press **ON** , **Shift** **CLR** **3** **=** **CA** to initialize the calculator.

**Caution:** Risk of explosion if battery is replaced by an incorrect type. Dispose of used battery at your local collection point.

- Electromagnetic interference or electrostatic discharge may cause the display to malfunction or the contents of the memory to be lost or altered. When this occurs, press **ON** , **Shift** **CLR** **3** **=** **CA** to restart the calculator.

#### Specifications

|                     |                           |
|---------------------|---------------------------|
| Power Supply:       | LR44 x 1 (1.5V)           |
| Power Consumption:  | 0.0015 W                  |
| Battery Life:       | Approx. 3 years           |
| Auto power off:     | 5-9 minutes               |
| Usable Temperature: | 0-40°C                    |
| Size:               | L153 x W80 x H14 mm       |
| Weight:             | 115g (include hard cover) |

#### Producer

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