Rebell© SC2040

240 Function 10-Digit Dual Line LCD Scientific Calculator

Basics and Examples

Contents

IMPORTANT SAFEGUARDS

Signal Word Definitions

NOTE: These are general definitions only and may not pertain to the actual product purchased.

DANGER – Indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury. Usage of this signal word is limited to the most extreme situations.

WARNING – Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

CAUTION – Indicates a potentially hazardous situation, which, if not avoided, may result in minor/moderate injury or product/property damage. It also alerts against unsafe practices.

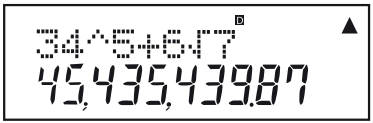
READ ALL INSTRUCTIONS BEFORE USE.

CAUTION– To reduce the risk of personal injury or product/property damage:

- This product is intended for personal, non-commercial, non-industrial use only.
- Do not press the product's buttons with a ballpoint pen or other pointed object.
- Do not immerse the product in water or other liquids.
- Do not expose the product to direct sunlight for lengthy periods.
- Do not expose the product to extreme temperatures.
- To avoid damage to internal circuitry, do not expose the product to excessive humidity or dust.
- Do not drop the product or subject it to a strong impact.
- Do not twist or bend the product.

SAVE THESE INSTRUCTIONS FOR FUTURE REFERENCE

Two-line display



The two-line display allows the calculation and its result to be shown simultaneously.

- The upper line shows the calculation.
- The lower line shows the result.

When the mantissa (result displayed) consists of more than three digits, a separation symbol is shown after every three digits of the whole number value.

Before first use

■ **Modes**

Before you begin a calculation, you must select the correct mode, as shown in the following table:

For this type of calculation:	Press this button sequence:	To select this mode:
Basic arithmetic calculations	MODE 1	COMP
Standard deviation	MODE 2	SD
Regression calculations	MODE 3	REG

- The mode to be selected for particular calculations is shown at the top of each chapter.

Example:

- Press the MODE button several times for additional settings. These settings are described in the parts of this manual that pertain to their use.

Tips!

- To reset the calculation mode and the settings to the original values, as described below, press the following buttons:
  SHIFT CLR 2 (MODE) =

Calculation mode:	COMP
Angle proof:	Deg
Exponential display format:	Norm 1
Fraction display format:	a b/c
Decimal point symbol:	Dot

- The mode is shown in the upper part of the display.
  Note: No mode indicator displays when in COMP Mode.
- Before beginning a calculation, always check the current calculation mode (SD, REG, COMP) and the setting of the angle proof (Deg (degrees), Rad (arc measurement), Gra (grade).
  Note: The angle proof indicators display as Deg: D, Rad: R, and Gra: G.

■ Input capacity

- The calculator can remember 79 steps. Each input number or arithmetic operation (+ − × ÷) is one step.

  Pressing SHIFT or ALPHA does not use a step; e.g., entering SHIFT $\sqrt[3]{\ }$ only counts as one step.
- You can input up to 79 steps in one calculation. When you input the 72nd step in a calculation, the cursor changes from "_" to "■", to show that the memory is almost full. If you need to input more than 79 steps, you will have to split the calculation into two or more parts, which can be done by pressing Ans. Doing so will show the last result, which can then be used for further calculation.
  For more information about the use of the Ans button, see the "Answer memory" chapter.

■ Making a correction while inputting

- Use the ◀ and ▶ buttons to move the cursor to the desired position for deleting, replacing, or inserting an item.
  - Press DEL to delete the character at the current position.
  - Press SHIFT INS to change to the insert cursor ⌐¬, which allows you to insert a character without erasing anything. Input the desired character(s) and press = or SHIFT INS to return to the regular cursor.
  - To replace a character, simply input the correct character, which will replace the incorrect character.

■ Repeat function

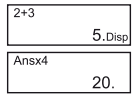
- Each time a calculation is made, the repeat function saves the calculation and its result in the repeat memory. Press ▲ repeatedly to scroll through the saved calculations (from last to first).
- When a calculation in the repeat memory is shown, press ◀ or ▶ to switch to the editor display. The editor display allows you to edit a previous calculation using the methods in the previous secton. When finished editing, press = to total the new calculation and exit the editor display.
  Notes:
  - The editor display is not useful for editing part of a continuing calculation, which uses the last result as the new calculation's starting point.
  - Pressing ◀ or ▶ immediately after finishing a calculation keeps the editor display for the calculation.
- The capacity of the repeat memory is 128 bytes for saving results and variables (A, B, Y, etc).
- Pressing AC does not delete what has been saved in the repeat memory.
- The repeat memory can be erased by one of the following methods:
  - Pressing ON.
  - Initializing the mode and settings by pressing SHIFT CLR 2 (or 3) =.
  - Changing from one calculation mode to another.
  - Switching off the calculator.

■ Multiple instructions

A multiple instruction is a term that consists of two or more smaller terms, connected by a colon (:).

- **Example:** 2 + 3 are to be added, and the result multiplied by 4.

  2 + 3 ALPHA : Ans × 4 =

■ Exponential display format

This calculator can display up to 10 digits for the whole number / decimal value. Larger values are shown in exponential format. Example: $1234567890 \times 10 = 1.23456789 \times 10^{10}$.

There are two exponential display formats. The Norm setting is used to change the exponential display format. For details and directions on changing the Norm setting, see page 7.

- **Decimal point and separation symbols**
  You can use the display setting (Disp) to specify the symbols you wish to use for the decimal point and the separation symbol after every three digits:
  1. Press MODE repeatedly until the display below is shown.

  2. Press 1 ▶
  3. Press the number button (1 or 2) that corresponds to the desired setting:
     1 (Dot): Decimal point, comma as separation symbol
     2 (Comma): Comma instead of decimal point, dot as separation symbol.

■ Initializing the calculator

- Enter the following button sequence to reset the calculation mode to COMP Mode, reset the settings, and erase the repeat memory and the variables: SHIFT MODE 3 =. "Reset all" will display. Press AC or ON for the input display.

Basic calculations

COMP

■ Arithmetic calculations

For basic calculations, use COMP Mode. Press MODE 1 to enter COMP Mode.

- Negative values in calculations must be in brackets. For details see "Priority sequence of operations."
- A negative exponent does not have to be in brackets.

sin 2,34 x 10^{-5} ⟶ sin 2.34 EXP (−) 5

- **Example 1:** 3 x (5 x 10^{-9}) = ***1,5 x 10⁻⁸***

  3 × 5 EXP (−) 9 =
- **Example 2:** 5 x (9 + 7) = ***80***

  5 × (9 + 7) =

Note: The) button can be left out if it is the last character before =.

■ **Fraction calculations**

- **Example 1:** $\frac{2}{3}+\frac{1}{5}=\frac{13}{15}$

  2 a⅔ 3 + 1 a⅔ 5 = | 13⌟15. |
- **Example 2:** $3\frac{1}{4}+1\frac{2}{3}=4\frac{11}{12}$

  3 a⅔ 1 a⅔ 4 +

  1 a⅔ 2 a⅔ 3 = | 4⌟11⌟12. |
- **Example 3:** $\frac{2}{4}=\frac{1}{2}$ 2 a⅔ 4 =
- The results of mixed fraction/decimal calculations are always shown in decimal format.
- **Example 4:** $\frac{1}{2}$ + 1,6 = ***2,1*** 1 a⅔ 2 + 1.6 =
- Results are shown in decimal format if the sum of the digits of a fraction (total number + numerator + denominator + separation symbol) is more than 10.
- **Converting between fractions ↔ decimals**
- Use the following method to change the calculation result between decimals and fractions. It may take up to two seconds to do this.

  - **Example 1:**

    2,75 = $2\frac{3}{4}$ (Decimal → fraction) = $\frac{11}{4}$

    2.75 = | 2.75 |

    a⅔ | 2⌟3⌟4. |

    SHIFT d/c | 11⌟4. |
  - **Example 2:**

    $\frac{1}{2}$ ↔ 0,5 (Fraction ↔ decimal)

    1 a⅔ 2 = | 1⌟2. |

    a⅔ | 0.5 |

    a⅔ | 1⌟2. |

- **Converting between mixed fractions ↔ improper fractions**
  - **Example:**

    $1\frac{2}{3}\leftrightarrow\frac{5}{3}$

    1 a⅔ 2 a⅔ 3 = | 1⌟2⌟3. |

    SHIFT d/c | 5⌟3. |

    d/c | 1⌟2⌟3. |
- When the result of a fraction calculation is greater than 1, the "Disp" setting can be used to specify the display format of the result. To change the fraction display format:
  1. Press MODE until | Disp 1 | displays.
  2. Press 1 to view the fraction display settings.
  3. Press the number button (1 or 2) that corresponds to the desired setting:
     1 (a$\frac{b}{c}$): Mixed fraction
     2 (d/c): Improper fraction
     Note: An error will occur if you try to input a mixed fraction while the improper fraction display format is selected.

■ **Percent calculations**

- **Example 1:** To calculate 12% of 1500 ***(180)***

  1500 × 12 SHIFT % =
- **Example 2:** What percentage is 660 of 880? **(75)**

  660 ÷ 880 SHIFT % =
- **Example 3:** Increase of 15% on 2,500 **(2875)**

  2500 + 2500 × 15 SHIFT % =
- **Example 4:** Decrease of 25% on 3,500 **(2625)**

  3500 − 3500 × 25 SHIFT % =

■ **Sexagesimal calculations - Calculations with degrees, minutes and seconds**

- You can do sexagesimal calculations with degrees (hours), minutes, and seconds. You can also convert between sexagesimal values and decimal values.
- **Example 1:** Convert the decimal value 2.258 into a sexagesimal value and then back to a decimal value:

  2.258 = | 2.258 |

  SHIFT ° ' " | 2°15°28.8 |

  ° ' " | 2.258 |

- **Example 2:**

  12°34'56" x 3.45

  12 ° ' " 34 ° ' " 56 ° ' " × 3.45 = | 43°24°31.2 |

■ FIX, SCI, NORM

1. To change the setting for the number of decimal places, the number of the highest value digit, or the exponential display format, press [MODE] until the display below is shown:

Fix	Sci	Norm
1	2	3

2. Press the number button (1, 2 or 3) that corresponds to the setting you wish to change.
   1 (Fix): Number of decimal places
   2 (Sci): Number of the highest value digit
   3 (Norm): Exponential display format

3. Press a number button to make a selection:
   - For Fix or Sci, press 0 - 9 as desired to select the number of decimal places or the number of the highest value digit.
   - For Norm, press 1 or 2 to choose Norm 1 or Norm 2.
     - **Norm 1**
       Note: All the example calculations in these instructions use Norm 1. Norm 1 means that the exponential format is used for total values having more than 10 digits, and for decimal values with more than two decimal places.
     - **Norm 2**
       Norm 2 means that the exponential format is used for total values with more than 10 digits, and for decimal values with more than nine decimal places.

- Example: [200] [÷] [7] [×] [14]
  Fix 3 is selected (specifies three decimal places)

200 + 7 × 14 =	400.
[MODE]..... [1] (Fix) [3]	FIX 400.000

- Rounding in Fix [3] Mode
  The following button sequence will carry out the same calculation as above using internal rounding:

200 + 7 =	28.571
[SHIFT] [Rnd]	28.571
× 14 =	399.994

  (Internal rounding)

- Press [MODE]... [3] (Norm) [1] to delete the Fix specification.
- Example: [1] [÷] [3]
  Sci 2 is selected (the result will show the two highest digits).

[MODE].....[2](Sci)[2] 1 ÷ 3 =	SCI $3.3_{\times 10^{-01}}$

- Press [MODE]... [3] (Norm) [1] to delete the Sci specification.

Memory calculations

COMP

Memory calculations are done in COMP Mode. Press [MODE] [1] to enter COMP MODE.

■ Answer memory

- After inputting a value or term and pressing [=], the result is saved in the answer memory.
- Items and numbers that don't result from calculations can also be saved in the answer memory when attached to variables. To attach an item to a variable and save it into the answer memory, first input the desired character, then press [SHIFT] [STO] followed by the letter of the variable (A-F, M, X, or Y).
  Note: The content of the answer memory is not updated if pressing the above button sequence causes an error to occur.
- To show/scroll through the content of the answer memory, press the ▲▼ arrows.
- To exit the answer memory, press [AC].
- To clear the answer memory, press [On].
- The answer memory can save 10 digits for the whole number/ decimal value and two digits for the exponent.

■ Continuing calculations

- The result displayed (and saved in the answer memory) can be used as the first value for the next calculation. Pressing an operation button while a result is shown changes the value shown to [Ans], indicating that it is the value currently saved in the answer memory.
- The result of a calculation can also be used in a function of types A (x^2, x^3, x^{-1}, $x!$, DRG ▶) as well as +, -, ^($x_{(y)}$), $\sqrt[x]{\ }$, x, ÷, nPr and nCr.

■ Independent memory

- Values can be input directly into the memory, added to the memory, or subtracted from the memory. The independent memory is particularly useful for the calculation of cumulative sums.
- The independent memory uses the same memory area as the M variable.

- To erase the independent memory (M), press [0] [SHIFT] [STO] [M+] / [M-]
- **Example:**

```
   23 + 9 = 32
   53 – 6 = 47
–) 45 X 2 = 90
   (Sum) –11
```

23 + 9 [SHIFT] [STO] [M] (M+)
53 [−] 6 [M+]
45 [×] 2 [SHIFT] [M-]
[RCL] [M] (M+)

■ Variables

- Nine variables (A to F, M, X and Y) can be used for saving data, constants, results, and other values.
- Use the following operation to erase the data assigned to a specific variable: [0] [SHIFT] [STO] [A]. This operation erases the data assigned to variable A.
- Press the following button sequence to erase the data assigned to all variables:
  [SHIFT] [CLR] [1] (Mcl) [=]

Example: 193,2 ÷ 23 = *8,4*
193,2 ÷ 28 = *6,9*

193.2 [SHIFT] [STO] [A] [÷] 23 [=]
[ALPHA] [A] [÷] 28 [=]

Calculations with scientific functions COMP

Scientific function calculations are done in COMP Mode. Press [MODE] [1] to enter COMP Mode.

- Some calculations will take a long time.
- Wait until the result appears on the display before begining the next calculation.
- **π** = 3,141592654

■ Trigonometric functions / inverse trigonometric functions (arc functions)

- To change the current angle proof (degrees, radian, grads), press the [MODE] button repeatedly until the following display is shown:

Deg	Rad	Gra
1	2	3

- Press ([1], [2], or [3]) as appropriate for the desired angle proof.
  ($90^o = \frac{\pi}{2}$ radian = 100 grads)
- **Example 1:** sin 63°52'41" = *0,897859012*
  [MODE] ····· [1] (Deg)
  [sin] 63 [°'"] 52 [°'"] 41 [°'"] [=]
- **Example 2:** $\cos\left(\frac{\pi}{3}\ \text{rad}\right)$ = *0,5*
  [MODE] ····· [2] (Rad)
  [cos] [(] [SHIFT] [π] [÷] 3 [)] [=]
- **Example 3:** $\cos^{-1}\frac{\sqrt{2}}{2}$ = *0.25* π (rad) = $\frac{\pi}{4}$ (rad) = *0,785398163*
  [MODE] ····· [2] (Rad)
  [SHIFT] [cos⁻¹] [(] [√] 2 [÷] 2 [)] [=]
- **Example 4:**
  $\tan^{-1}$ 0,741 = *36,53844577*°
  [MODE] ····· [1] (Deg)
  [SHIFT] [tan⁻¹] 0.741 [=]

■ Hyperbolic functions / inverse hyperbolic functions (area funtions)

- **Example 1:** sinh 3,6 = *18,28545536*
  [hyp] [sin] 3.6 [=]
- **Example 2:** $\sinh^{-1}$ 30 = *4,094622224*
  [hyp] [SHIFT] [sin⁻¹] 30 [=]

■ Common and natural logarithms / anti-logarithms

- **Example 1:** log 1,23 = *0,089905111*
  [log] 1.23 [=]
- **Example 2:** ln 90 (=$\log_e$90) = *4,49980967*
  [ln] 90 [=]
  ln *e* = *1*
  [ln] [ALPHA] [e] [=]
- **Example 3:** e^{10} = *22026,46579*
  [SHIFT] [eˣ] 10 [=]
- **Example 4:** $10^{1.5}$ = *31,6227766*
  [SHIFT] [10ˣ] 1.5 [=]
- **Example 5:** 2^{-3} = *0,125*
  2 [^] [(−)] 3 [=]
- **Example 6:** $(-2)^4$ = *16*
  [(] [(−)] 2 [)] [^] 4 [=]
- Negative values in calculations must be in brackets. For details see “Priority sequence of operation”.

■ Square roots, cube roots, roots, squares, cubes, reciprocal values, factorials, random numbers, π, and permutations/combinations

- **Example 1:** $\sqrt{2}+\sqrt{3}\times\sqrt{5}$ = ***5,287196909***

  √ 2 + √ 3 × √ 5 =

- **Example 2:** $\sqrt[3]{5}+\sqrt[3]{-27}$ = ***-1,290024053***

  SHIFT √ 5 + SHIFT √ ((−) 27) =

- **Example 3:** $\sqrt[7]{123}$ $(=123^{\frac{1}{7}})$ = ***1,988647795***

  7 SHIFT ∜ 123 =

- **Example 4:** $123+30^2$ = ***1023***

  123 + 30 x^2 =

- **Example 5:** 12^3=***1728***

  12 x^3 =

- **Example 6:** $\frac{1}{\frac{1}{3}-\frac{1}{4}}=12$

  1 ÷ (3 x^{-1} − 4 x^{-1}) =

- **Example 7:** 8! = 40320

  8 SHIFT $x!$ =

- **Example 8:** To generate a random number between 0.000 and 0.999:

  SHIFT Ran# = 0.664

- **Example 9:** 3π = 9,424777961

  3 SHIFT π =

- **Example 10:** To determine how many different four-digit numbers can be generated with the numbers 1 to 7:

  (840)

  7 SHIFT nPr 4 =

  Note: The numbers may not be doubled within a four-digit number (1234 is allowed, but not 1123).

- **Example 11:** To determine how many different groups with four members each can be formed from a group of 10 people:

  (210)

  10 nCr 4 =

■ Conversion of the angle unit

1. Press SHIFT DRG▸ to view the following menu:

   D R G
   1 2 3

2. Press 1, 2, or 3 to select the desired angle proof.

- **Example:** To convert 4.25 in arc measurement into degrees.

  MODE ··· 1 (Deg)

  4.25 SHIFT DRG▸ 2 (R) =

  4.25 r
  243.5070629

■ Coordinate conversion (Pol (*x*, *y*), Rec (*r*, *θ*))

- These calculation results are assigned to the E and F variables.
- **Example 1:** To convert polar coordinates (r =2, θ =60º) into the Cartesian coordinates (x, y) (Deg):

  x = 1 SHIFT Rec(2 , 60) =

  y = 1,732050808 RCL F

- The button sequence RCL E or RCL F shows the values for x and y.
- **Example 2:** To convert the Cartesian coordinates $(1, \sqrt{3})$ into the polar coordinates (r, θ) (Rad):

  r = 2 Pol(1 , √ 3) =

  θ = 1,047197551 RCL F

- The button sequence RCL E or RCL F shows the values for r and θ.

■ Calculations with technical symbols

- **Example 1:** To change 56.088 meters into kilometers:

  56,088 x 10^3 (km) 56088 = ENG

- Example 2: To change 0.08125 grams into milligrams:

  81,25 x 10^{-3} (mg) 0.08125 = ENG

Statistical calcuations

SD
REG

Statistical calcuations

SD

Statistical calculations are done in SD Mode. Press MODE 2 to enter the SD Mode.

- In SD and REG Modes, press the M+ button to perform the function of the DT (data) button.
- To erase the statistical memory and begin data input, press SHIFT CLR 1 = .
- After erasing the statistical memory, input data by entering the data and then pressing DT (See next example).
- The input data is used to calculate the values for n, $\sum x$, $\sum x^2$, $\bar{x}$, $x\sigma_n$ and $x\sigma_{n-1}$, which can then be displayed using the following button sequences:

To display this value:	Use this button sequence:
$\sum x^2$	SHIFT S-SUM 1
$\sum x$	SHIFT S-SUM 2
n	SHIFT S-SUM 3
$\bar{x}$	SHIFT S-VAR 1
$x\sigma_n$	SHIFT S-VAR 2
$x\sigma_{n-1}$	SHIFT S-VAR 3

- **Example:** To calculate $x\sigma_{n-1}$, $x\sigma_n$, $\bar{x}$, n, $\sum x$, and $\sum x^2$ for the following data: 55, 54, 51, 55, 53, 53, 54, 52 in the SD Mode:

  SHIFT CLR 1 = (Stat clear)

  55 DT

  SD
  n= 1.

Each time the DT button is pressed to register an input, the quantity of data inputs already entered is displayed as the n value.

54 DT 51 DT 55 DT
53 DT DT 54 DT 52 DT

Random test standard deviation ($x\sigma_{n-1}$) = 1,407885953

[SHIFT] [S-VAR] [3] [=]

Total standard deviation ($x\sigma_n$) = 1,316956719

[SHIFT] [S-VAR] [2] [=]

Arithmetical mean ($\bar{x}$) = 53,375

[SHIFT] [S-VAR] [1] [=]

Quantity of data inputs (n) = 8

[SHIFT] [S-SUM] [3] [=]

Sum of the values ($\sum x$) = 427

[SHIFT] [S-SUM] [2] [=]

Sum of Squares of values ($\sum x^2$) = 22805

[SHIFT] [S-SUM] [1] [=]

Tips for data input

- Pressing [DT] [DT] will enter the same data value twice.
- You can also input the same data value several times by using [SHIFT] [;]. For example, input 110 ten times, press 110 [SHIFT] [;] 10 [DT].
- Note: This button sequence can be carried out in any order.
- While inputting data, or after you have finished inputting data, the [▲] and [▼] buttons can be used to scroll through the input data. If you have input the same data values several times, separate displays will be shown for the data posts and the data frequency (freq), which is the number of times the select data has been posted.
- The displayed data can be edited. Input a new value and press [=] to replace the old value with the new value. This also means that you should always press the [AC] button to leave the data display before carrying out another operation (calculation, displaying statistical calculation results, etc.).
- If you press the [DT] button instead of the [=] button after changing a value in the display, the input value is registered as a new data post, and the old value remains unchanged.
- A value that has been displayed by pressing the [▲] and [▼] buttons can be erased by pressing [SHIFT] [CL]. Erasing a data value will move up all the values after it.
- The data values registered are normally stored in the calculation memory. However, if there is no more space for saving data, "Data Full" will display, and no more data can be input. In this case, press the [=] button to show the display below.

```
Edit OFF ESC
1          2
```

- Press [2] to exit without registering the value that has just been input.
- Press [1] to register the value without saving it in the memory. This means that the input data cannot be displayed or edited.

- After inputting the statistical data in SD or REG Mode, the individual data posts cannot be displayed or edited after you have carried out one of the following operations:
  - Switched to a different mode
  - Changed the regression type (Lin, Log, Exp, Pwr, Inv, Quad)

Regression calculations [REG]

Statistcal calculatiions with regressions are done in REG Mode.
Press [MODE] [3]
to enter REG Mode.

- In SD and REG Modes the [M+] button acts as the [DT] button.
- Switching to REG Mode will display the following:

```
Lin  Log  Exp →
1    2    3
```

[▶] [⇄] [◀]

```
← Pwr  Inv  Quad
  1    2    3
```

- Press the number button ([1], [2], or [3]) that corresponds to the desired regression type.

[1]	(Lin):	Linear regression
[2]	(Log):	Logarithmic regression
[3]	(Exp):	Exponential regression
[▶] [1]	(Pwr):	Power regression
[▶] [2]	(Inv):	Inverse regression
[▶] [3]	(Quad):	Quadratic regression

- Always begin data input with the button sequence [SHIFT] [CLR] [1] (Scl) [=], to erase the statistical memory.
- Input data using the following button sequence:
  (x- data) [,] (y- data) [DT]
- The values from regression calculations depend on the input values, and the results can be shown using the button sequences shown in the following table (see next page):

To display this value:	Use this button sequence:
$\sum x^2$	SHIFT S-SUM 1
$\sum x$	SHIFT S-SUM 2
n	SHIFT S-SUM 3
$\sum y^2$	SHIFT S-SUM ▶ 1
$\sum y$	SHIFT S-SUM ▶ 2
$\sum xy$	SHIFT S-SUM ▶ 3
$\bar{x}$	SHIFT S-VAR 1
$x\sigma_n$	SHIFT S-VAR 2
$x\sigma_{n-1}$	SHIFT S-VAR 3
$\bar{y}$	SHIFT S-VAR ▶ 1
$y\sigma_n$	SHIFT S-VAR ▶ 2
$y\sigma_{n-1}$	SHIFT S-VAR ▶ 3
Regression coefficient A	SHIFT S-VAR ▶ ▶ 1
Regression coefficient B	SHIFT S-VAR ▶ ▶ 2
Except quadratic regression	
Correlation coefficient r	SHIFT S-VAR ▶ ▶ 3
$\hat{x}$	SHIFT S-VAR ▶ ▶ ▶ 1
$\hat{y}$	SHIFT S-VAR ▶ ▶ ▶ 2

- The following table shows the button sequence to be used for displaying results of quadratic regression:

To display this value:	Use this button sequence:
$\sum x^3$	SHIFT S-SUM ▶ ▶ 1
$\sum x^2y$	SHIFT S-SUM ▶ ▶ 2
$\sum x4$	SHIFT S-SUM ▶ ▶ 3
Regression coefficient C	SHIFT S-VAR ▶ ▶ 3
$\hat{x}1$	SHIFT S-VAR ▶ ▶ ▶ 1
$\hat{x}2$	SHIFT S-VAR ▶ ▶ ▶ 2
$\hat{y}$	SHIFT S-VAR ▶ ▶ ▶ 3

- The values in the table above can be used within terms, just as variables are used.

■ Linear regression

- The regression formula for linear regression is $y = A + Bx$.
- **Example:** air pressure and temperature

Temperature	Air pressure
10°C	1003 hPa
15°C	1005 hPa
20°C	1010 hPa
25°C	1011 hPa
30°C	1014 hPa

Carry out the linear regression to determine the terms and the correlation co-efficients of the regression formula for the data shown here. Then use the regression formula to estimate the air pressure at –5°C and the temperature at 1000 hPa.

Finally, calculate the degree of certainty (r^2) and the random test covariance: $\left(\frac{\Sigma xy - n \cdot \bar{x} \cdot \bar{y}}{n-1}\right)$

In REG Mode:

1 (Lin)

SHIFT CLR 1 (Scl) (Stat clear)

10 , 1003 DT

Note: Each time you press DT to register an input, the quantity of data input is displayed as the n value.

15 , 1005 DT

20 , 1010 DT 25 , 1011 DT

30 , 1014 DT

Regression co-efficient A = 997.4 SHIFT S-VAR ▶ ▶ 1 =

Regression co-efficient B = 0.56 SHIFT S-VAR ▶ ▶ 2 =

Correlation co-efficient r = 0.982607368 SHIFT S-VAR ▶ ▶ 3 =

Air pressure at –5 °C = 994.6

((-) 5) SHIFT S-VAR ▶ ▶ ▶ 2 =

Temperature at 1000hPa = 4.642857143

1000 SHIFT S-VAR ▶ ▶ ▶ 1 =

Degree of certainty = 0.965517241

SHIFT S-VAR ▶ ▶ 3 x^2 =

Random test covariance = 35

(SHIFT S-SUM ▶ 3 −

SHIFT S-SUM 3 ▶ SHIFT S-VAR 1 ×

SHIFT S-VAR ▶ 1) ÷

(SHIFT S-SUM 3 − 1) =

■ Logarithmic, exponential, power, and inverse regression

- Use the same button sequence as for linear regression to display the results for these regression types.
- The regression formulas for each regression type are:

Logarithmic regression	$y = A + B \bullet \ln x$
Exponential regression	$y = A \bullet e^{B \cdot x}$ (or $\ln y = \ln A + Bx$)
Power regression	$y = A \bullet x^B$ (or $\ln y = \ln A + B \ln x$)
Inverse regression	$y = A + B \bullet {}^1/x$

■ Quadratic Regression

- The regression formula for quadratic regression is $y = A + Bx + Cx^2$.
- **Example:**

xi	yi
29	1,6
50	23,5
74	38,0
103	46,4
118	48,0

Carry out this quadratic regression to determine the terms of the regression formula for the data shown. Then use the regression formula to estimate the values of $\hat{y}$ (estimated value of y) for $xi = 16$ and $\hat{x}$ (estimated value of x) for $yi = 20$.

In REG Mode:
▶ 3 (Quad)
SHIFT CLR 1 (Scl) = (Stat clear)

29 , 1.6 DT 50 , 23.5 DT
74 , 38.0 DT 103 , 46.4 DT
118 , 48.0 DT

Regression co-efficient A = -35.59856934 SHIFT S-VAR ▶ ▶ 1 =
Regression co-efficient B = 1.495939414 SHIFT S-VAR ▶ ▶ 2 =
Regression co-efficient C = -6.71629667 x 10^{-3}
SHIFT S-VAR ▶ ▶ 3 =

If xi is 16, $\hat{y}$ = -13.38291067 — 16 SHIFT S-VAR ▶ ▶ ▶ 3 =
If yi is 20, $\hat{x}$1 = 47.14556728 — 20 SHIFT S-VAR ▶ ▶ ▶ 1 =
If yi is 20, $\hat{x}$2 = 175.5872105 — 20 SHIFT S-VAR ▶ ▶ ▶ 2 =

■ Precautions to note when inputting data

- Pressing DT DT will input the same data value twice.
- Pressing SHIFT ; will also input the same data value twice.
  For example, to input the data "20 and 30" five times, use the button sequence 20 , 30 SHIFT ; 5 DT.
- The above can be carried out in any order.
- The precautions for editing the data input for standard deviation also apply for regression calculations.
- Do not save data to the variables A to F, M, X, or Y input data when carrying out statistical calculations. These variables are used for temporary memory in statistical calculations, meaning that in data assigned to these variables can be replaced with other data during statistical calculations.
- By switching to REG Mode and selecting a regression type (Lin, Log, Exp, Pwr, Inv, Quad), the variables A to F, M, X and Y are erased. These variables are also erased if you switch from one regression type to another within the REG Mode.

Technical Information

■ Priority sequence of operations

Calculation operations are carried out in the following order:

① Coordinate conversion: Pol (x, y), Rec (r, θ)
② Type A functions:
For these functions, the function key is pressed when the value is input.
x^3, x^2, x^{-1}, $x!$, °' "
$\hat{x}$, $\hat{x}1$, $\hat{x}2$, $\hat{y}$
Conversions of the angle unit (DRG ▶)
③ Powers and roots: ^(x^y), $\sqrt[x]{\ }$
④ a^b/c
⑤ Abbreviated multiplication format for π, e (base of the natural logarithm), memory symbol, or variable symbol: 2π, 3e, 5A, πA etc.
⑥ Type B functions:
For these functions, the value is input when the function button is pressed. Function buttons include: $\sqrt{\ }$, $\sqrt[3]{\ }$, log, ln, e^x, 10^x, sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$, $\tanh^{-1}$, and (-).
⑦ Abbreviated multiplication format for Type B functions:
$2\sqrt{3}$, Alog2 etc.
⑧ Permutations and combinations: nPr, nCr
⑨ ×, ÷
⑩ +, -

- Operations of the same priority are carried out from right to left $e^x\ln\sqrt{\ }120 \rightarrow e^x\{\ln(\sqrt{\ }120)\}$.
- Other operations are carried out from left to right.
- Operations in brackets are carried out first.
- If a calculation contains an argument that is a negative number, the number must be placed in brackets. The negative sign (-) is treated as a Type B function, so that particular care is given if the calculation contains a Type A function with high priority or power or root operations.
  Example: $(-2)^4 = 16$
  $-2^4 = -16$

■ Stacks

This calculator uses memory areas ('stacks') to temporarily store values (numerical stacks) and commands (command stacks), independent of their priority sequence, during the calculation. The numerical stack has 10 levels and the command stack has 24 levels. A stack ERROR occurs if you attempt a calculation that is so complicated it exceeds the capacity of one of these stacks.

- **Example:**

2 x ((3 + 4 x (5 + 4) ÷ 3) ÷ 5) + 8 =
① ① ② ③ ④ ⑤
1 2 3 4 5 6 7

Numerical stack

①	2
②	3
③	4
④	5
⑤	4
⋮	

Command stack

1	x
2	(
3	(
4	+
5	x
6	(
7	+
⋮	

- The calculations are carried out according to the priority sequence of operations. The commands and values are erased from the stack when the calculation is complete.

■ Input ranges

Internal places: 12

Accuracy*: The accuracy is ±1 at the 10th digit.

Function		Input range
$\sin x$	DEG	$0 \leqq \lvert x \rvert \leqq 4{,}499999999 \times 10^{10}$
	RAD	$0 \leqq \lvert x \rvert \leqq 785398163{,}3$
	GRA	$0 \leqq \lvert x \rvert \leqq 4{,}999999999 \times 10^{10}$
$\cos x$	DEG	$0 \leqq \lvert x \rvert \leqq 4{,}500000008 \times 10^{10}$
	RAD	$0 \leqq \lvert x \rvert \leqq 785398164{,}9$
	GRA	$0 \leqq \lvert x \rvert \leqq 5{,}000000009 \times 10^{10}$
$\tan x$	DEG	Same as $\sin x$, except when $[x] = (2n\text{-}1) \times 90$.
	RAD	Same as $\sin x$, except when $[x] = (2n\text{-}1) \times \pi/2$.
	GRA	Same as $\sin x$, except when $[x] = (2n\text{-}1) \times 100$.
$\sin^{-1} x$		$0 \leqq \lvert x \rvert \leqq 1$
$\cos^{-1} x$		
$\tan^{-1} x$		$0 \leqq \lvert x \rvert \leqq 9{,}999999999 \times 10^{99}$
$\sinh x$		$0 \leqq \lvert x \rvert \leqq 230{,}2585092$
$\cosh x$		
$\sinh^{-1} x$		$0 \leqq \lvert x \rvert \leqq 4{,}999999999 \times 10^{99}$
$\cosh^{-1} x$		$1 \leqq x \leqq 4{,}999999999 \times 10^{99}$
$\tanh x$		$0 \leqq \lvert x \rvert \leqq 9{,}999999999 \times 10^{99}$
$\tanh^{-1} x$		$0 \leqq \lvert x \rvert \leqq 9{,}999999999 \times 10^{-1}$
$\log x / \ln x$		$0 < x \leqq 9{,}999999999 \times 10^{99}$
10^x		$-9{,}999999999 \times 10^{99} \leqq x \leqq 99{,}99999999$
e^x		$-9{,}999999999 \times 10^{99} \leqq x \leqq 230{,}2585092$
$\sqrt{x}$		$0 \leqq x < 1 \times 10^{100}$
x^2		$\lvert x \rvert < 1 \times 10^{50}$
$1/x$		$\lvert x \rvert < 1 \times 10^{100}$; $x \neq 0$
$\sqrt[3]{x}$		$\lvert x \rvert < 1 \times 10^{100}$

Function	Input range
$x!$	$0 \leqq x \leqq 69$ (x is a whole number)
${}_nP_r$	$0 \leqq n < 1 \times 10^{10}$, $0 \leqq r \leqq n$ (n, r are whole numbers) $1 \leqq \{n!/(n-r)!\} < 1 \times 10^{100}$
${}_nC_r$	$0 \leqq n < 1 \times 10^{10}$, $0 \leqq r \leqq n$ (n, r are whole numbers) $1 \leqq [n!/\{r!(n-r)!\}] < 1 \times 10^{100}$
$\mathrm{Pol}(x, y)$	$\lvert x \rvert$, $\lvert y \rvert \leqq 9{,}999999999 \times 10^{49}$ $(x^2+y^2) \leqq 9{,}999999999 \times 10^{99}$
$\mathrm{Rec}(r, \theta)$	$0 \leqq r \leqq 9{,}999999999 \times 10^{99}$ θ: Same as $\sin x$
°' "	$\lvert a \rvert$, b, $c < 1 \times 10^{100}$ $0 \leqq b, c$
← °' "	$\lvert x \rvert < 1 \times 10^{100}$ Decimal <-> sexagesimal conversion $0°0'0'' \leqq \lvert x \rvert \leqq 999999°59'$
$\wedge(x^y)$	$x > 0$: $-1 \times 10^{100} < y \log x < 100$ $x = 0$: $y > 0$ $x < 0$: $y = n$, $\frac{1}{2n+1}$ (n is a whole number) However: $-1 \times 10^{100} < y \log \lvert x \rvert < 100$
$\sqrt[x]{y}$	$y > 0$: $x \neq 0$ $-1 \times 10^{100} < 1/x \log y < 100$ $y = 0$: $x > 0$ $y < 0$: $x = 2n + 1, \frac{1}{n}$ ($n \neq 0$; n is a whole number) However: $-1 \times 10^{100} < 1/x \log \lvert y \rvert < 100$
$a\,b/c$	The sum of the characters for whole numbers, numerators and denominators may not be more than 10 digits (including separation symbols)
SD (REG)	$\lvert x \rvert < 1 \times 10^{50}$ $x\sigma_n$, $y\sigma_n$, $\bar{x}$, $\bar{y}$: $n \neq 0$ $\lvert y \rvert < 1 \times 10^{50}$ $x\sigma_{n-1}$, $y\sigma_{n-1}$, A, B, r $\lvert n \rvert < 1 \times 10^{100}$ $n \neq 0, 1$

* For a single calculation, the calculation error is ±1 at the 10th digit. (For the exponential display, the calculation error is ±1 at the lowest value digit.) The errors sum increases as the calculations continue and may therefore become large. (This also applies to internal, continuous calculations, e.g., in the cases of $\wedge(x^y)$, $\sqrt[x]{y}$, $x!$, $\sqrt[3]{\ }$, ${}_nP_r$, ${}_nC_r$, etc.) Close to the single point of a function, and the point of inflection, the errors sum may become large.