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How to Operate

≈Read Before Using≈

This operation guide has been written based on the EL-W531, EL-W531G, and EL-W531H models. Some functions described here are not featured on other models. In addition, key operations and symbols on the display may differ according to the model.

1. KEY LAYOUT

- **Mode key**
  - This calculator can operate in three different modes as follows.
  - **Normal mode**
    - Mode = 0; normal mode for performing normal arithmetic and function calculations.
  - **STAT mode**
    - Mode = 1; mode for performing 1- or 2-variable statistical calculations. To select the statistical sub-mode, press the corresponding number key after **MODE 1**.
  - **Drill mode**
    - Mode = 2; mode for performing drill calculations. To select the drill sub-mode, press the corresponding number key after **MODE 2**.

- **2nd function, ALPHA keys**
  - Pressing these keys will enable the functions written in orange (2nd F) or green (ALPHA) above the calculator buttons.

- **ON/C, OFF key**
  - Written in orange above the ON/C key
  - **Direct function**: 
    - **ON/C**: Power on
    - **OFF**: Power off
  - **2nd function**: 
    - **2ndF**: Written in orange above the ON/C key
2. RESET SWITCH

If the calculator fails to operate normally, press the reset switch on the back to reinitialise the unit. The display format and calculation mode will return to their initial settings.

**NOTE:**
Pressing the reset switch will erase any data stored in memory.

3. DISPLAY PATTERN

![Display Pattern Diagram]

The actual display does not appear like this. This illustration is for explanatory purposes only.

4. DISPLAY FORMAT AND DECIMAL SETTING FUNCTION

For convenient and easy operation, this model can be used in one of five display modes. The selected display status is shown in the lower left part of the display (Format Indicator).

**Note:** If more 0's (zeros) than needed are displayed when the ON/C key is pressed, check

- **Floating decimal point format (N**\(^1\)/N**2** is displayed)**
  Valid values beyond the maximum range are displayed in the form of [10-digit (mantissa) + 2-digit (exponent)]

- **Fixed decimal point format (FIX is displayed)**
  Displays the fractional part of the calculation result according to the specified number of decimal places.

- **Scientific notation (SCI is displayed)**
  Frequently used in science to handle extremely small or large numbers.

- **Engineering scientific notation (ENG is displayed)**
  Convenient for converting between different units.

**Example**
Let's compare the display result of \(10000 \div 8.1 =\) in each display format.

/specifies normal mode

**Initial display**

\[
\begin{array}{c}
\text{NORMAL MODE} \\
10000 \div 8.1 =
\end{array}
\]

\[
\begin{array}{c}
\text{10000} \\
\frac{1234.62}{8.1}
\end{array}
\]
5. EXPONENT DISPLAY

The distance from the earth to the sun is approx. 150,000,000 (1.5 x 10^8) km. Values such as this with many zeros are often used in scientific calculations, but entering the zeros one by one is a great deal of work and it's easy to make mistakes. In such cases, the numerical values are divided into mantissa and exponent portions, displayed and calculated.

*Example*  What is the number of electrons flowing in a conductor when the electrical charge across a given cross-section is 0.32 coulombs. (The charge on a single electron = 1.6 x 10^{-19} coulombs).

0.32 ÷ 1.6 Exp 19 =

2.0 x 10^{-20}
6. ANGULAR UNIT

Angular values are converted from DEG to RAD to GRAD with each push of the DRG key. This function is used when doing calculations related to trigonometric functions or coordinate geometry conversions.

Degrees (DEG is shown at the top of the display)
A commonly used unit of measure for angles. The angular measure of a circle is expressed as 360°.

Radians (RAD is shown at the top of the display)
Radians are different from degrees and express angles based on the circumference of a circle. 180° is equivalent to \( \pi \) radians. Therefore, the angular measure of a circle is 2\( \pi \) radians.

Grads (GRAD is shown at the top of the display)
Grads are a unit of angular measure used in Europe, particularly in France. An angle of 90 degrees is equivalent to 100 grads.

The relationships between the three types of angular units can be expressed as right:

\[
90^\circ \text{ (DEG)} = \frac{\pi}{2} \text{ (RAD)} = 100 \text{ (GRAD)} = \]

<Example> Check to confirm 90 degrees equalling \( \pi/2 \) radians equalling 100 grads. (\( \pi=3.14159\ldots \))
~Functions and Key Operations~

**ON/OFF, Entry**

**Correction Keys**

- **ON/C** Turns the calculator on or clears the data. It also clears the contents of the calculator display and voids any calculator command; however, coefficients in 3-variable linear equations and statistics, as well as values stored in the independent memory in normal mode, are not erased.

- **OFF** Turns the calculator off.

- **CA** Clears all internal values, including the last answer (ANS) and statistics. Values stored in memory in normal mode are not erased.

- **▲ ▼** These arrow keys are useful for Multi-Line playback, which lets you scroll through calculation steps one by one.

- **◄ ► BS DEL** These keys are useful for editing equations. The ▲ key moves the cursor to the left, and the ► key moves the cursor to the right. The BS key deletes the symbol/number at the left of the cursor, and the DEL key deletes the symbol/number at the cursor.
Data Entry Keys

0 to 9 Numeric keys for entering data values.

Decimal point key. Enters a decimal point.

Enters the minus symbol.
The subtraction key \((-\)\) is not used for entering negative numbers.

Pressing \(\pi\) automatically enters the value for \(\pi\) (3.14159...).
The constant \(\pi\), used frequently in function calculations, is the ratio of the circumference of a circle to its diameter.

Pressing this key switches to scientific notation data entry.

<Example> Provided the earth is moving around the sun in a circular orbit, how many kilometers will it travel in a year?

* The average distance between the earth and the sun being 1.496 \(\times 10^8\) km.

Circumference equals diameter \(\times \pi\); therefore,
1.496 \(\times 10^8\) \(\times 2 \times \pi\)

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.496 (\exp) 8 (\times) 2 (\times) (\pi) (\equiv)</td>
<td>1.496(\exp) 8(\times)2(\times)(\pi) (\equiv) 939964522.</td>
</tr>
</tbody>
</table>
Random Key

**RANDOM**

Generates random numbers.
Random numbers are three-decimal-place values between 0.000 and 0.999. Using this function enables the user to obtain unbiased sampling data derived from random values generated by the calculator. (Using line mode is preferable since in W-View mode, the numbers are generated by fractions.)

**<Example>**

2ndF RANDOM 0 = 0.*** (A random number is generated.)

**[Random Dice]**
To simulate a die-rolling, a random integer between 1 and 6 can be generated by pressing 2ndF RANDOM 1 2. To generate the next random dice number, press 2ndF RANDOM 2 2.

**[Random Coin]**
To simulate a coin flip, 0 (heads) or 1 (tails) can be randomly generated by pressing 2ndF RANDOM 2 2. To generate the next random coin number, press 2ndF RANDOM 3 2.

**[Random Integer]**
An integer between 0 and 99 can be generated randomly by pressing 2ndF RANDOM 3 2. To generate the next random integer, press 2ndF RANDOM 4 2.

**APPLICATIONS:**
- Building sample sets for statistics or research.
Modify Key  

**MDF**

**MDF** Function to round calculation results. Even after setting the number of decimal places on the display, the calculator performs calculations using a larger number of decimal places than that which appears on the display. By using this function, internal calculations will be performed using only the displayed value.

**<Example>** FIX mode TAB = 1 (normal calculation)

\[
\begin{align*}
5 \div 9 &= 0.6 \text{ (internally, 0.5555…)} \\
\times 9 &= 5.0
\end{align*}
\]

**Rounded calculation (MDF)**

\[
\begin{align*}
5 \div 9 &= 0.6 \text{ (internally, 0.5555…)} \\
\times 9 &= 5.4
\end{align*}
\]

(In W-View mode, press to show the answer in decimal.)

**APPLICATIONS:**

- Frequently used in scientific and technical fields, as well as business, when performing chained calculations.
The four basic operators. Each is used in the same way as a standard calculator:
+ (addition), - (subtraction), x (multiplication), and ÷ (division).

Finds the result in the same way as a standard calculator.

Used to specify calculations in which certain operations have precedence. You can make addition and subtraction operations have precedence over multiplication and division by enclosing them in parentheses.
Percent

For calculating percentages. Four methods of calculating percentages are presented as follows.

1) $125 increased by 10%...137.5
   \[125 + 10 \times 2nd \ F \ \% \]
   \[125 + 10\% \]
   \[137.5\]

2) $125 reduced by 20%...100
   \[125 - 20 \times 2nd \ F \ \% \]
   \[125 - 20\% \]
   \[100\]

3) 15% of $125...18.75
   \[125 \times 15 \times 2nd \ F \ \% \]
   \[125 \times 15\% \]
   \[18.75\]

4) When $125 equals 5% of X, X equals...2500
   \[125 \div 5 \times 2nd \ F \ \% \]
   \[125 \div 5\% \]
   \[2500\]

\(\text{Percent} \ \%\)
Inverse, Square, Cube, xth Power of y, Square Root, Cube Root, xth Root of y

- $x^{-1}$: Calculates the inverse of the value on the display.
- $x^2$: Squares the value on the display.
- $x^3$: Cubes the value on the display.
- $y^x$: Calculates exponential values.
- $\sqrt{}$: Calculates the square root of the value on the display.
- $3\sqrt{}$: Calculates the cube root of the value on the display.
- $x\sqrt{}$: Calculates the $x^{th}$ root of $y$.

<Example>

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2 \times 2 \times 2 \times 2 = $</td>
<td>$2 \times 2 \times 2 \times 2 = 16$</td>
</tr>
<tr>
<td>$2 \ y^x \ 4 = $</td>
<td>$2^4 = 16$</td>
</tr>
<tr>
<td>$4 \ ndF \ x\sqrt{} \ 16 = $</td>
<td>$\sqrt[4]{16} = 2$</td>
</tr>
</tbody>
</table>
10 to the Power of $x$, Common Logarithm, Logarithm of $x$ to Base $a$

$10^x$  Calculates the value of 10 raised to the $x$th power.

$\log$  Calculates the logarithm, the exponent of the power to which 10 must be raised to equal the given value.

$log_x$  Calculates the logarithm of $x$ to power $a$.

<Example>

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2^{nd}F\ 10^x\ 3\ \Rightarrow$</td>
<td>$10^3=1000.$</td>
</tr>
<tr>
<td>$\log\ 1000\ \Rightarrow$</td>
<td>$\log_{10}1000=3.$</td>
</tr>
<tr>
<td>$2^{nd}F\ \log\ x\ 3\ \Rightarrow\ 45\ \Rightarrow$</td>
<td>$\log_3(45)=3.464973521.$</td>
</tr>
</tbody>
</table>
e to the Power of x, Natural Logarithm $e^x \quad \ln$

$e^x$ Calculates powers based on the constant e (2.718281828).

ln Computes the value of the natural logarithm, the exponent of the power to which e must be raised to equal the given value.

<Example>

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2\text{ndF} \quad e^x \quad 5 \quad =$</td>
<td>$e^5 = \begin{array} {c} \approx 148.4131591 \end{array}$</td>
</tr>
<tr>
<td>$\ln \quad 10 \quad =$</td>
<td>$\ln 10 = \begin{array} {c} \approx 2.302585093 \end{array}$</td>
</tr>
</tbody>
</table>
Factorials $n!$

The product of a given positive integer $n$ multiplied by all the lesser positive integers from 1 to $n-1$ is indicated by $n!$ and called the factorial of $n$.

**<Example>**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 (2ndF) $n!$</td>
<td>7! = 5,040</td>
</tr>
</tbody>
</table>

C.f
$n! = 1 \times 2 \times 3 \times ... \times n$

**APPLICATIONS:**
Used in statistics and mathematics. In statistics, this function is used in calculations involving combinations and permutations.
Permutations, Combinations \( nPr \ nCr \)

\( nPr \)  This function finds the number of different possible orderings in selecting \( r \) objects from a set of \( n \) objects. For example, there are six different ways of ordering the letters ABC in groups of three letters—ABC, ACB, BAC, BCA, CAB, and CBA. The calculation equation is \( {}_3P_3 = 3 \times 2 \times 1 = 6 \) (ways).

\( nCr \)  This function finds the number of ways of selecting \( r \) objects from a set of \( n \) objects. For example, from the three letters ABC, there are three ways we can extract groups of two different letters—AB, AC, and CB. The calculation equation is \( {}_3C_2 \).

<Example>

\[
\begin{array}{c|c}
\text{Operation} & \text{Display} \\
\hline
6 \ 2\text{ndF} \ 6Pr \ 4 & 6P4:= \frac{5!}{3!} = 60 \text{ ways} \\
6 \ 2\text{ndF} \ 6Cr \ 4 & 6C4:= \frac{3!}{2!} = 15 \text{ ways} \\
\end{array}
\]

APPLICATIONS:
Used in statistics (probability calculations) and in simulation hypotheses in fields such as medicine, pharmaceutics, and physics. Also, can be used to determine the chances of winning in lotteries.
Time Calculation

\[ \text{\(\leftrightarrow\ \text{DEG}\ \ \text{D}'\text{M}''\text{S}''\)} \]

Converting a sexagesimal value displayed in degrees, minutes, seconds to
decimal notation. Also, converts a decimal value to sexagesimal notation
(degrees, minutes, seconds).

\[ \text{\(\text{D}'\text{M}''\text{S}''\)} \]

Inputs values in sexagesimal notation (degrees, minutes, seconds).

\<Example\> Convert 24° 28’ 35” (24 degrees, 28 minutes, 35 seconds)
to decimal notation. Then convert 24.476° to sexagesimal
notation.

\begin{center}
\begin{tabular}{|c|c|}
\hline
\textbf{Operation} & \textbf{Display} \\
\hline
24 D-M-S 28 D-M-S 35 2nd F \(\leftrightarrow\ \text{DEG}\) & 24° 28’ 35” = 24.476° \\
\hline
\begin{array}{c}
\text{24° 28’ 35”} \\
\text{24.476°}
\end{array} & \text{CHANGE} \\
\hline
\begin{array}{c}
\text{24° 28’ 35”} \\
\text{24.476°}
\end{array} & \text{CHANGE} \\
\hline
\begin{array}{c}
\text{24° 28’ 35”} \\
\text{24.476°}
\end{array} & \text{2nd F} \(\leftrightarrow\ \text{DEG}\) \\
\hline
\begin{array}{c}
\text{24° 28’ 35”} \\
\text{24.476368899°}
\end{array} & \text{ANS=}
\end{array}
\end{center}

Repeat last key operation to return to the previous display.

\textbf{APPLICATIONS:}

Used in calculations of angles and angular velocity in physics, and
latitude and longitude in geography.
Fractional Calculations \( \frac{a}{b} \) \( ab\% \)

- **\( \frac{a}{b} \)**: Inputs proper or improper fractions which consist of a numerator and denominator.
- **\( ab\% \)**: Inputs a mixed fraction.

<Example> Add \( 3 \frac{1}{2} \) and \( \frac{5}{7} \), and convert to decimal notation.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 (2nd F ) ( ab% ) 1 ( \Rightarrow ) 2 ( \Rightarrow ) + 5 ( \frac{a}{b} ) ( \Rightarrow ) 7 ( \Rightarrow )</td>
<td>( \frac{21}{4} + \frac{5}{7} = )</td>
</tr>
<tr>
<td>( \Rightarrow )</td>
<td>( 4.31 )</td>
</tr>
</tbody>
</table>

Convert to an improper fraction

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Rightarrow )</td>
<td>( \frac{21}{4} + \frac{5}{7} = )</td>
</tr>
<tr>
<td>( \Rightarrow )</td>
<td>( \frac{50}{14} )</td>
</tr>
</tbody>
</table>

Convert to decimal notation

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Rightarrow )</td>
<td>( \frac{21}{4} + \frac{5}{7} = )</td>
</tr>
<tr>
<td>( \Rightarrow )</td>
<td>( 4.214285714 )</td>
</tr>
</tbody>
</table>

**APPLICATIONS:**
There is a wide variety of applications for this function because fractions are such a basic part of mathematics. This function is useful for calculations involving electrical circuit resistance.
Memory Calculations

STO  Stores displayed values in memories A~F, X, Y, M.
RCL  Recalls values stored in A~F, X, Y, M.
M+ Adds the displayed value to the value in the independent memory M.
M− Subtracts the displayed value from the value in the independent memory M.

Temporary memories

Operation  Display

A~F X Y

<Example 1>

25 × 27 M+

7 × 3 M+

RCL M

<Example 2>

C tallates $/¥ at the designated exchange rate.
$1 = ¥110
¥26,510 = $?
$2,750 = ¥?

110 STO Y

26510 ÷ RCL Y =

2750 × RCL Y =
Last Answer Memory

ANS

Automatically recalls the last answer calculated by pressing \( = \)

\(<\text{Example}>\) Solve for \(x\) first and then solve for \(y\) using \(x\).

\[
x = \sqrt{2} + 3 \quad \text{and} \quad y = 4 \div x
\]

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sqrt{2} + 3 = )</td>
<td>( \sqrt{2} + 3 = ) (3 + \sqrt{2} )</td>
</tr>
<tr>
<td>( 4 \div \text{ANS} = )</td>
<td>( 4 \div \text{ANS} = ) (\frac{12 - 4 \sqrt{2}}{2} )</td>
</tr>
<tr>
<td>( 4 \div \text{ANS} = )</td>
<td>( 4 \div \text{ANS} = ) (0.906163678 )</td>
</tr>
</tbody>
</table>
**User-Defined Functions**  

**D1 ~ D4**  
Recall a function that was defined by the user.

<Example>

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>STO D1</td>
<td>STORING D1</td>
</tr>
<tr>
<td>2ndF hyp sin⁻¹</td>
<td>SELECT FUNCTION</td>
</tr>
<tr>
<td>D1 26 =</td>
<td>NORMAL MODE</td>
</tr>
</tbody>
</table>

**APPLICATIONS:**
- Functions that you have previously defined, including those using common 2nd Function buttons, can be stored in D1 ~ D4 for later use, thus saving time on keystrokes.
Absolute Value  \texttt{abs}

\texttt{abs} \quad \text{Returns an absolute value.}

<Example>

\begin{align*}
\text{Operation} & \quad \text{Display} \\
\text{2ndF} \quad \texttt{abs} \quad 3 \quad \times & \quad \text{13} \times -41 = \\
-4 \quad (\text{-}) \quad 4 \quad = & \quad 12.
\end{align*}
**Trigonometric Functions**

Trigonometric functions determine the ratio of three sides of a right triangle. The combinations of the three sides are sin, cos, and tan. Their relations are:

- **sin** \( \sin \theta = \frac{b}{a} \)
- **cos** \( \cos \theta = \frac{c}{a} \)
- **tan** \( \tan \theta = \frac{b}{c} \)

<Example>
The angle from a point 15 meters from a building to the highest floor of the building is 45°. How tall is the building?

[DEG mode]

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
</table>
| tan 45 × 15 | \[ \tan 45 \times 15 + 1.5 = \]
| + 1.5 - | \[ 16 \frac{1}{2} \] |

**APPLICATIONS:**
Trigonometric functions are useful in mathematics and various engineering calculations. They are often used in astronomical observations, civil engineering and in calculations involving electrical circuits, as well as in calculations for physics such as parabolic motion and wave motion.
Arc Trigonometric Functions

Arc trigonometric functions, the inverse of trigonometric functions, are used to determine an angle from ratios of a right triangle. The combinations of the three sides are $\sin^{-1}$, $\cos^{-1}$, and $\tan^{-1}$. Their relations are:

- **$\sin^{-1}$** (arc sine) Determines an angle based on the ratio $b/a$ of two sides of a right triangle.
  \[ \theta = \sin^{-1} \frac{b}{a} \]

- **$\cos^{-1}$** (arc cosine) Determines an angle based on the ratio $c/a$ for two sides of a right triangle.
  \[ \theta = \cos^{-1} \frac{c}{a} \]

- **$\tan^{-1}$** (arc tangent) Determines an angle based on the ratio $b/c$ for two sides of a right triangle.
  \[ \theta = \tan^{-1} \frac{b}{c} \]

<Example>
At what angle should an airplane climb in order to climb 80 meters in 100 meters?

[DEG mode]

**Operation**

\[ \begin{align*}
2\text{ndF} & \hspace{1cm} \tan^{-1} (80 \div 100) \\
100 & \hspace{1cm} =
\end{align*} \]

**Display**

\[ \tan^{-1}(80\div100) = 38.65980825 \]
Hyperbolic Functions \( \text{hyp} \) \( \text{arc hyp} \)

The hyperbolic function is defined by using natural exponents in trigonometric functions.

Arc hyperbolic functions are defined by using natural logarithms in trigonometric functions.

**APPLICATIONS:**
Hyperbolic and arc hyperbolic functions are very useful in electrical engineering and physics.
Coordinate Conversion

- $\rightarrow r\theta$ Converts rectangular coordinates to polar coordinates ($x, y \rightarrow r, \theta$)
- $\leftarrow xy$ Converts polar coordinates to rectangular coordinates ($r, \theta \rightarrow x, y$)
- $\to (x, y)$ Splits data used for dual-variable data input.

<Example> Determine the polar coordinates ($r, \theta$) when the rectangular coordinates of Point P are ($x = 7, y = 3$).

[DEG mode]

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
</table>
| $7 \to (x, y) 3$ 2ndF $\rightarrow r\theta$ | $7, 3 \Rightarrow r\theta$
| | $r: 7.615773186$
| | $\theta: 23.19859051$ |
| $7.6 \to (x, y) 23.2$ 2ndF $\leftarrow xy$ | $7.6, 23.2 \Rightarrow xy$
| | $x: 6.985428578$
| | $y: 2.993959513$ |

APPLICATIONS:
Coordinate conversion is often used in mathematics and engineering, especially for impedance calculations in electronics and electrical engineering.
Binary, Pental, Octal, Decimal, and Hexadecimal Operations (N-Base)

This calculator can perform conversions between numbers expressed in binary, pental, octal, decimal, and hexadecimal systems. It can also perform the four basic arithmetic operations, calculations with parentheses and memory calculations using binary, pental, octal, decimal, and hexadecimal numbers. In addition, the calculator can carry out the logical operations AND, OR, NOT, NEG, XOR, and XNOR on binary, pental, octal, decimal, and hexadecimal numbers.

- **BIN** Converts to the binary system. "BIN" appears.
- **PEN** Converts to the pental system. "PEN" appears.
- **OCT** Converts to the octal system. "OCT" appears.
- **HEX** Converts to the hexadecimal system. "HEX" appears.
- **DEC** Converts to the decimal system. "BIN", "PEN", "OCT", and "HEX" disappear from the display.

Conversion is performed on the displayed value when these keys are pressed.

### Example 1

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>2ndF <strong>HEX</strong> 1AC</td>
<td><strong>HEX</strong></td>
</tr>
<tr>
<td>2ndF <strong>BIN</strong></td>
<td><strong>BIN</strong></td>
</tr>
<tr>
<td>2ndF <strong>PEN</strong></td>
<td><strong>PEN</strong></td>
</tr>
<tr>
<td>2ndF <strong>OCT</strong></td>
<td><strong>OCT</strong></td>
</tr>
<tr>
<td>2ndF <strong>DEC</strong></td>
<td><strong>DEC</strong></td>
</tr>
</tbody>
</table>

### Example 2

1011 AND 101 = (BIN) → DEC

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON/C 2ndF <strong>BIN</strong> 1011 AND 101</td>
<td><strong>BIN</strong></td>
</tr>
<tr>
<td>2ndF <strong>DEC</strong></td>
<td><strong>DEC</strong></td>
</tr>
</tbody>
</table>
Statistics Functions

The statistics function is excellent for analyzing qualities of an event. Though primarily used for engineering and mathematics, the function is also applied to nearly all other fields including economics and medicine.

DATA INPUT AND CORRECTION

**DATA**  
Enters data for statistical calculations.

**CD**  
Clears data input.

$\begin{pmatrix} x, y \end{pmatrix}$  
Splits data used for dual-variable data input.  
(Used for dual-variable statistical calculations.)

<Example 1> Here is a table of examination results. Input this data for analysis.

### Data table 1

<table>
<thead>
<tr>
<th>No.</th>
<th>Score</th>
<th>No. of pupils</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>60</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>90</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>100</td>
<td>2</td>
</tr>
</tbody>
</table>

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<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MODE 1 0</strong></td>
<td>Select single-variable statistics mode</td>
</tr>
<tr>
<td>$30 (x,y)$ 2 <strong>DATA</strong></td>
<td></td>
</tr>
<tr>
<td>$100 (x,y)$ 2 <strong>DATA</strong></td>
<td></td>
</tr>
</tbody>
</table>

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<tr>
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<td>70</td>
<td>12</td>
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<td>6</td>
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<td></td>
</tr>
</tbody>
</table>
“ANS” KEYS FOR 1-VARIABLE STATISTICS

- $\bar{x}$ Calculates the average value of the data (sample data $x$).
- $s_x$ Calculates the standard deviation for the data (sample data $x$).
- $\sigma_x$ Calculates the standard deviation of a data population (sample data $x$).
- $n$ Displays the number of input data (sample data $x$).
- $\sum x$ Calculates the sum of the data (sample data $x$).
- $\sum x^2$ Calculates the sum of the data (sample data $x$) raised to the second power.

**NOTE:**
1. Sample data refers to data selected randomly from the population.
2. Standard deviation of samples is determined by the sample data shift from an average value.
3. Standard deviation for the population is standard deviation when the sample data is deemed a population (full data).

Let’s check the results based on the previous data.

- $\text{RCL } \bar{x} \quad 69$ (average value)
- $\text{RCL } s_x \quad 17.75686128$ (standard deviation)
- $\text{RCL } \sigma_x \quad 17.57839583$ (standard deviation of the population)
- $\text{RCL } n \quad 50$ (total count of data)
- $\text{RCL } \sum x \quad 3450$ (total)
DATA CORRECTION

Correction prior to pressing immediately after a data entry: Delete incorrect data with , then enter the correct data.

Correction after pressing : 

Use to display the data previously entered.
Press to display data items in ascending (oldest first) order. To reverse the display order to descending (latest first), press the key. Each item is displayed with \(X:\), \(Y:\), or \(F:\) (n is the sequential number of the data set).

Display the data item to modify, input the correct value, then press . Using , you can correct the values of the data set all at once.

- When or appears, more data items can be browsed by pressing or .
- To delete a data set, display an item of the data set to delete, then press . The data set will be deleted.
- To add a new data set, press and input the values, then press .

<Example 2>

Data table 2

\[
\begin{array}{c}
\text{X: 30, 40, 40, 50} \\
\hline \\
\text{X: 30, 45, 45, 45, 60}
\end{array}
\]

<table>
<thead>
<tr>
<th>Operation</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MODE 1 0</strong></td>
<td>Select single-variable statistics mode</td>
</tr>
<tr>
<td><strong>DATA</strong></td>
<td><strong>Stat 0 [SD]</strong></td>
</tr>
<tr>
<td>30</td>
<td><strong>30DATA</strong></td>
</tr>
<tr>
<td>40</td>
<td><strong>40; 2DATA</strong></td>
</tr>
<tr>
<td>50</td>
<td><strong>50DATA</strong></td>
</tr>
</tbody>
</table>
APPLICATIONS:
Single-variable statistical calculations are used in a broad range of fields, including engineering, business, and economics. They are most often applied to analysis in atmospheric observations and physics experiments, as well as for quality control in factories.
Example 3  The table below summarizes the dates in April when cherry blossoms bloom, and the average temperature for March in that same area. Determine basic statistical quantities for data X and data Y based on the data table.

Data table 3

<table>
<thead>
<tr>
<th>Year</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>6.2</td>
<td>7.0</td>
<td>6.8</td>
<td>8.7</td>
<td>7.9</td>
<td>6.5</td>
<td>6.1</td>
<td>8.2</td>
</tr>
<tr>
<td>y</td>
<td>13</td>
<td>9</td>
<td>11</td>
<td>5</td>
<td>7</td>
<td>12</td>
<td>15</td>
<td>7</td>
</tr>
</tbody>
</table>

Select dual-variable statistics mode and linear regression calculation in sub-mode.

Operation

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2</td>
<td>13</td>
<td>DATA</td>
</tr>
<tr>
<td>6.1</td>
<td>15</td>
<td>DATA</td>
</tr>
<tr>
<td>8.2</td>
<td>7</td>
<td>DATA</td>
</tr>
</tbody>
</table>

Display

Stat 1 [LINE]

0.
“ANS” KEYS FOR 2-VARIABLE STATISTICS

In addition to the 1-variable statistic keys, the following keys have been added for calculating 2-variable statistics.

- $\Sigma xy$ Calculates the sum of the product for sample data $x$ and sample data $y$.
- $\Sigma y$ Calculates the sum of the data (sample data $y$).
- $\Sigma y^2$ Calculates the sum of the data (sample data $y$) raised to the second power.
- $\bar{y}$ Calculates the average value of the data (sample data $y$).
- $s_y$ Calculates the standard deviation for the data (sample data $y$).
- $\sigma_y$ Calculates the standard deviation of a data population (sample data $y$).

**NOTE:**
The codes for basic statistical quantities of sample data $x$ and their meanings are the same as those for single-variable statistical calculations.

Let’s check the results based on the previous data.

- $\frac{\Sigma x}{\Sigma y}$ 7.175 (Average for data $x$)
- $\frac{\Sigma x}{\Sigma y}$ 0.973579551 (Standard deviation for data $x$)
- $\frac{\Sigma x}{\Sigma y}$ 0.91070028 (Standard deviation of the population for data $x$)
- $\frac{\Sigma x}{\Sigma y}$ 9.875 (Average for data $y$)
- $\frac{\Sigma x}{\Sigma y}$ 3.440826313 (Standard deviation for data $y$)
- $\frac{\Sigma x}{\Sigma y}$ 3.218598297 (Standard deviation of the population for data $y$)
- $\frac{\Sigma x}{\Sigma y}$ 8 (Total count of data)
- $\frac{\Sigma x}{\Sigma y}$ 57.4 (Sum of data $x$)
- $\frac{\Sigma x}{\Sigma y}$ 418.48 (Sum of data $x$ raised to the second power)
- $\frac{\Sigma x}{\Sigma y}$ 544.1 (Sum of the product of data $x$ and data $y$)
- $\frac{\Sigma x}{\Sigma y}$ 79 (Sum of data $y$)
- $\frac{\Sigma x}{\Sigma y}$ 863 (Sum of data $y$ raised to the second power)