HP 10s+ Scientific Calculator

User Guide

First Edition: June 2012

Part number: 697634-001

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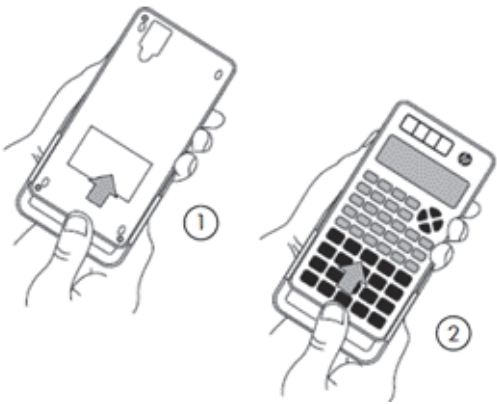
Using the Protective Case

1. Before using the calculator, slide the unit out of the protective case as shown in step 1.
2. After using the calculator, slide the unit out of the cover as shown in step 2. To use the protective case, slide it over the keyboard side of the unit.



Safety Precautions

Before using the calculator, please read the following safety precautions carefully. Keep this manual handy so that you can refer to it when needed.

The representations of the display and the keys in this manual are for explanatory purposes only and may not exactly match what you see on the calculator.

Notice ⚠

This symbol indicates that there is a risk of injury or damage if the specified safety precautions are ignored.

Battery

- Keep battery out of reach of children. If a battery is swallowed, seek urgent medical advice.
- Do not charge, attempt to disable, short circuit, or apply heat to the battery.
- When installing a new battery, orient it such that the positive sign is facing upwards.
- Use only the battery specified in this manual.

Disposing of the Calculator

- Do not dispose of this calculator in an incinerator. It might explode and cause injury or fire.

Other Precautions

- Before using this calculator for the first time, press the ON key.
- The battery may lose some charge between the time the calculator leaves the factory and the time when it is purchased. Thus the original battery may not last as long as a new battery.
- When battery power is very low, the calculator's memory may become corrupted or be lost completely. To avoid loss of important information, keep a copy of it elsewhere.
- Avoid storing or using the calculator under extreme conditions.

  Low temperature will slow the calculator's response time, cause the display to appear incomplete, and shorten the life of the battery. In addition, do not directly expose the calculator to the sun or place near a heater. High temperature

may cause the casing to fade, distort the casing, or damage the internal circuitry.

- Avoid storing or using the calculator in damp conditions or when there is high humidity or excessive dust. Doing so will damage the internal circuitry.
- Do not drop the calculator or allow it to be subjected to extreme force.
- Do not twist, bend or otherwise distort the calculator.
- Note: Carrying the calculator in a pocket could cause it to twist or bend.
- Do not use a pen or other pointed object to press the calculator's keys.
- Use a soft, dry cloth to clean the calculator. Opening the calculator casing voids the warranty.

  If the calculator is very dirty, a neutral household cleanser diluted in water can be used to clean it. Dip a cloth in the solution and wring it out before applying it to the calculator. Do not use benzine, a diluting agent or any other volatile solvent to clean the calculator. Doing so may damage the casing and the keys.

Two-Line Display

The calculator shows both the expression being calculated and the result of the calculation. These appear in a two-line display.

- The expression being calculated is shown on the upper line.
- The result is shown on the lower line.

If the result has more than three digits, a separator appears before each group of three digits.

Preparing to Use the Calculator

Modes

Choose the appropriate mode before performing a calculation.

Type of Calculation	Operation	Calculation mode
Basic Calculation	MODE 1	COMP
Standard Deviation	MODE 2	SD
Calculation using Regression	MODE 3	REG

- Press the MODE key to display each settings screen in turn. Each settings screen is described later in this guide.
- Throughout this manual, the mode setting required for each type of calculation is given when the calculation is explained.

Notes:

- To return the calculator to its default settings, as indicated below press [CLR] [2] (Mode) [=] in that order. The default settings are:

  Calculation mode: COMP
  Angle unit: Deg
  Exponent display format: Norm 2
  Fraction display: a b/c
  Decimal point character: Dot

- The mode indicator appears in the upper part of the display.
- Before calculating, check the current mode setting (COMP, REG, or SD) and the angle unit (Deg, Rad, or Grad).

Input Limit

- The memory of the calculator can accommodate 79 steps in any one calculation. When you press a number key or an arithmetic operator key ([+], [−], [×], [÷]), it occupies on step. Pressing or [ALPHA] does not occupy a step. So pressing [∛], for example, takes up only one step.
- When you input the 73rd set of any calculation, the cursor changes from "_" to "■" to alert you to the fact that the capacity of the memory is almost used up. If what you want to input contains more than 79 steps, separate the calculation into two or more smaller calculations and then combine them as you go.
- Press [Ans] to recall the previous result, which can then be used in the next calculation. Please see the section on *Key Memory* for more information about the [Ans] key.

Error Correction When Entering

- Press [◄] or [►] to move the cursor to the position needed.
- Press [DEL] to delete the digit or function at the position of the cursor.
- Press the [INS] keys to activate the insertion cursor [ ]. Whatever you insert now will appear at the cursor's current position.
- Press the [INS] key to return the cursor to its normal functioning.

Recalling a Previous Calculation

- Each calculation and its result is kept in memory. Press [▲] to recall the previous calculation and its results. Press the [▲] key again to recall the next previous calculation, and so on.
- When a previous calculation is recalled, you can activate editing mode by pressing [◄] or [►].
- After any calculation, the calculation can be edited by pressing [◄] or [►] immediately.
- Pressing [AC] does not clear the calculation memory. Therefore, when you press [AC] again, the previous calculations are still available.
- The capacity of the calculation memory to store expressions and calculation results is 128 bytes.
- The calculation memory is cleared if the:
  - [ON] key is pressed
  - [CLR] [2] (or [3]) [=] are pressed (which initializes the calculator)
  - calculation mode is changed
  - power supply is turned off

Error Indicator

If an error occurs, press [◄] or [►]. The calculation reappears and the cursor is located where the error is.

Multi-statement

A multi-statement is an expression consisting of two or more smaller expressions. The expressions are separated by a colon (:).

Exponent Display Format

The calculator can display up to 10 digits. Values needing more than 10 digits will automatically be displayed in exponent notation. Two exponent formats are available.

- To change the display format, press [MODE] repeatedly until the appropriate settings screen appears.

Fix	Sci	Norm
1	2	3

- For an exponent setting, press [3]. In the settings screen that appears, press [1] to choose Norm 1 or [2] to choose Norm 2.
- Norm 1

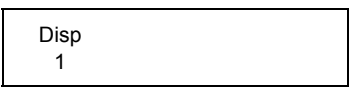
  Exponent notation is applied automatically to any number whose absolute value is greater than or equal to 10^{10} or less than 10^{-2}.
- Norm 2

  Exponent notation is applied automatically to any number whose absolute value is greater than or equal to 10^{10} or less than 10^{-9}.
- In this manual, results are expressed in Norm 1 format.

Decimal Point and Separator

The display setting (Disp) screen is used to specify the required decimal mark and the character to use before groups of three digits.

- To change these settings, press [MODE] repeatedly until the settings screen appears.



- Press [1] [►] to display the settings screen.
- Press the number key ([1] or [2]) corresponding to the setting you want:

  [1] (Dot): Decimal point and comma separator
  [2] (Comma): Decimal comma and point separator

Initializing the Calculator

- To initialize the calculator (which clears the memory and all variables, and resets all modes to their default settings) press: [CLR] [3] (ALL) [=]

Basic Calculations

Arithmetic Operations

To perform a basic calculation, select COMP mode by pressing [MODE].
COMP.....[MODE] [1]

- When raising negative values to powers, make sure that the negative sign is inside the parentheses around the value. Please see the section “Sequence of Operations” on page 33 for more information.

- A negative exponent does not need to be in parentheses.

  $\sin 4.56 \times 10^{-8}$ → [sin] 4.56 [EXP] [(-)] 8

- Example 1: $3 \times (4 \times 10^{-7}) = 1.2 \times 10^{-6}$

  3 [×] 4 [EXP] [(-)] 7 [=]

- Example 2: $2 \times (3 \times 4) = 14$

  2 [×] [(] 3 [+] 4 [)] [=]

- You can omit the [)] at the end of an expression if the next key you press is [=].

Calculations with Fractions

- A value is automatically displayed in decimal format if the total number of digits of the fraction (integer + numerator + denominator + semicolon) is greater than 10.

- Example 1: $\frac{1}{3} + \frac{2}{5} = \frac{11}{15}$

  1 [a b/c] 3 [+] 2 [a b/c] 5 [=] | 11⌟15

- Example 2: $3\frac{1}{2} + 2\frac{3}{4} = 6\frac{1}{4}$

  3 [a b/c] 1 [a b/c] 2 [+]

  2 [a b/c] 3 [a b/c] 4 [=] | 6⌟1⌟4

- Example 3: $\frac{6}{9} = \frac{2}{3}$

  6 [a b/c] 9 [=]

- Example 4: $\frac{1}{4} + 1.8 = 2.05$

  1 [a b/c] 4 [+] 1.8 [=]

- A calculation involving a fraction and a decimal generally yields a decimal result.

Converting Between Decimal and Fractional Display

- Example 1: $3.25 \leftrightarrow 3\frac{1}{4}$ (Decimal ↔ Fraction)

3.25 [=]	3.25
[ab/c]	3⌟1⌟4
[d/c]	13⌟4

- Example 2: $\frac{1}{5} \leftrightarrow 0.2$ (Fraction ↔ Decimal)

1 [ab/c] 5 [=]	1⌟5
[ab/c]	0.2
[ab/c]	1⌟5

Converting Between Mixed and Improper Fractions

- Example: $2\frac{3}{4} \leftrightarrow \frac{11}{4}$

2 [ab/c] 3 [ab/c] 4 [=]	2⌟3⌟4
[d/c]	11⌟4
[d/c]	2⌟3⌟4

- To change the fraction display format, press [MODE] repeatedly until the following screen appears.

```
Disp
 1
```

- Press [1] to display the settings screen.

- Press the number key (1 or 2) corresponding to the setting required:

  1 (a b/c) : Mixed fraction

  2 (d/c) : Improper fraction

- If you choose the d/c display format and enter a mixed fraction, an error will occur.

Calculating Percentages

About Calculating Percentages

- Example 1: Calculate 15% of 1000? (150)

  1000 × 15 %

- Example 2: What percentage of 440 is 330? (75%)

  330 ÷ 440 %

- Example 3: 1000 plus 15%? (1150)

  1000 × 15 % +

- Example 4: 1000 minus 15%? (850)

  1000 × 15 % −

- Example 5: If the original weight of a sample is 400g and a further 100g is added to it, what is the new weight as a percentage of the old weight? (125%)

  100 + 400 %

- Example 6: If the temperature increases from 60°C to 66°C, what is the percentage increase? What is it when the temperature increases to 69°C? (10%, 15%)

  66 − 60 % ► ► 9 =

Calculations Involving Degrees, Minutes, and Seconds

You can convert between sexagesimal and decimal numbers.

- Example 1: Convert the decimal number 1.234 to its sexagesimal equivalent and then back to a decimal number again.

1.234 [=]	1.234
[⇆]	1º 14º 2.4
[º’’’]	1.234

- Example 2: Calculate 12º 34’ 56” × 7.89

12 [º’’’] 34 [º’’’] 56 [º’’’] [×] 7.89 [=]	99º16º25.44

FIX, SCI, RND

- To change the display format settings, press [MODE] repeatedly until the screen below appears.

Fix	Sci	Norm
1	2	3

- Press the number key ([1], [2], or [3]) corresponding to the setting you want to change.

  [1] (Fix): To set the number of decimal places

  [2] (Sci): To set the number of significant digits

  [3] (Norm): To set the display format to normal

- Example 1: 100 ÷ 3 × 15

100 [÷] 3 [×] 15 [=]	500.

(Now specify that you want numbers displayed with 3 decimal places.)

[MODE] ··· ··· [1] (Fix) [3]	Fix 500.000

(Note that only the display precision gets fixed to 3 digits. The calculations are still performed with the complete number.)

100 ÷ 3 =	33.333
× 15 =	500.000

(Note that you can also force the calculator to round a number to the number of decimal places you have specified.)

100 ÷ 3 =	33.333
(Internally Rounded) Rnd	33.333
× 15 =	499.995

- Press MODE ··· ··· 3 (Norm) 1 to cancel the settings.
- Example 2: 2 ÷ 3

  Display the result with two significant digits (Sci 2)
  MODE ··· ··· 2 (Sci) 2

2 ÷ 3 =	SCI 6.7×10^{-01}

  You can also display result in 10 significant digits (Sci 10) using (Sci) 0

- Press MODE ··· ··· 3 (Norm) 1 to cancel settings.

Calculations Involving the Memory

To perform a calculation involving the memory, press [MODE] to enter COMP mode.
COMP.....[MODE] [1]

Ans Memory

- The Ans memory is updated with each new calculation when you press [=].
- It is also updated when you press [%], [M+], [M−] or [STO] after a letter (A to F, or M, X, or Y.)
- Pressing [Ans] recalls the contents of the Ans memory.
- The Ans memory can only store one value at a time.
- The Ans memory is not updated if an error occurs when you use any of the above mentioned keys for a calculation.

Continuous Calculation

- The result currently displayed can be used as the first value in the next calculation. Simply press an operator key. Ans appears on the screen, indicating that the last answer obtained is to be used in the calculation.
- The previous result can also be used by the following functions: (x^2, x^3, x^{-1}, $x!$, DRG▶),+,-, ^x^y, $\sqrt[x]{}$, ×, ÷, ${}_nP_r$, or ${}_nC_r$.

Variable M

- You can use the variable M to compute accumulated totals which can be put into the variable M directly, or they can also be added to or subtracted from the number stored in variable M.
- To clear all the numerical values in the separate variable M, press [0] [STO] [M] (M+)

12 + 3 = 15	12 [+] [STO] [M] (M=)
45 - 6 = 39	45 [−] 6 [M+]
- 38 x 2 = 76	38 [×] 2 [M−]
(Total) -22	[RCL] [M] (M+)

Variables

- There are 9 variables. A to F, M, X, and Y. These are used for storing data, constants, calculation results, and other numerical values.
- To clear a single variable, store zero into it. For example, [0] [STO] [A]. This clears variable A.
- To clear the values of all variables, press [CLR] [1] (Mcl) [=].
- Example:

  1234 ÷ 20 = *61.7*

  1234 ÷ 25 = *49.36*

  1234 [STO] [A] [÷] 20 [=]

  [ALPHA] [A] [÷] 25 [=]

Scientific Functions

To perform a scientific calculation, press [MODE] to enter COMP mode.
COMP.....[MODE] [1]

- Some scientific calculations may take longer than other types of calculations.
- You can start the next calculation after the after the calculation result displays on screen.
- π = 3.14159265359

Trigonometric and Inverse Trigonometric Functions

- To change the current angle units (degrees, radians, or grads), press [MODE] repeatedly until the following screen appears.

Deg	Rad	Gra
1	2	3

- Now press the number key ([1], [2], or [3]) corresponding to the angle unit you want to use.
  (Note that $90^\circ = \frac{\pi}{2}$ radians = 100 grads)
- Example 1: $\sin 12^\circ 34' 56'' = 0.217840422$
  [MODE] ··· ··· [1] (Deg) [sin] 12 [°’’’] 34 [°’’’] 56 [°’’’] [=]
- Example 2: $\cos(\frac{\pi}{3}\text{ rad}) = 0.5$
  [MODE] ··· ··· [2] (Rad) [cos] [(] [π] [÷] 3 [)] [=]
- Example 3: $\cos^{-1}\frac{\sqrt{2}}{2} = 0.25\pi(\text{rad}) (= \frac{\pi}{4}\text{ (rad)})$
  [MODE] ··· ··· [2] (Rad)
  [cos⁻¹] [(] [√] 2 [÷] 2 [)] [=] [Ans] [÷] [π] [=]
- Example 4: $\tan^{-1} 0.789 = 38.27343992$
  [MODE] ··· ··· [1] (Deg) [tan⁻¹] 0.789 [=]

Hyperbolic and Inverse Hyperbolic Functions

- Example 1: sinh4.5 = 45.00301115

  [hyp] [sin] 4.5 [=]

- Example 2: $\cosh^{-1} 60$ = 4.787422291

  [hyp] [cos⁻¹] 60 [=]

Common Logarithms, Natural Logarithms and Antilogarithms

- Example 1: log1.2 = 0.079181246 [log] 1.2 [=]
- Example 2: ln90(=$\log_e 90$) = 4.49980967

  [ln] 90 [=]

  $\ln e = 1$ [ln] [ALPHA] [e] [=]

- Example 3: e^{10} = 22026.46579 [e^x] 10 [=]
- Example 4: $10^{2.5}$ = 316.227766 [10^x] 2.5 [=]
- Example 5: 2^{-5} = 0.03125 2 [y^x] [(-)] 5 [=]
- Example 6: $(-2)^6$ = 64 [(] [(-)] 2 [)] [y^x] 6 [=]
- Note that the negative value is the previous example had to be placed in parentheses. Please see “Sequence of Operations” on page 33” for details.

Square Root, Cube Root, Root, Square Cube, Reciprocal, Factoral, Random Number, Circumference Ratio (π), Permutation and Combination

- Example 1: $\sqrt{2} + \sqrt[3]{3} \times \sqrt{4}$ = 4.878315178

  [√] 2 [+] [∛] 3 [×] [√] 4 [=]

- Example 2: $\sqrt[3]{4} \cdot + \sqrt[3]{-5}$ = -0.122574894

  [∛‾] 4 [+] [∛‾] [(-)] 5 [=]

- Example 3: $\sqrt[4]{123}$ (=$123^{1/4}$) = 3.330245713

  4 [ˣ√‾] 123 [=]

- Example 4: 123 + 45^2=2148 123 [+] 45 [x2] [=]

- Example 5: 54^3 = 157464 54 [x3] [=]

- Example 6: $\frac{1}{\frac{1}{2}-\frac{1}{3}} = 6$

  [(] 2 [x⁻¹] [−] 3 [x⁻¹] [)] [x⁻¹] [=]

- Example 7: 6! = 720 6 [x!] [=]

- Example 8: Generate a random number between 0.000 and 0.999

  [Ran#] [=] 0.654

  (The value shown above is just an example. A different random number is likely to be produced each time)

- Example 9: 2π = 6.283185307 2 [π] [=]

- Example 10: How many different 5-digit numbers can be produced with the digits 1 to 6 if no digit can be repeated (12345 allowed, 11234 not allowed)? (720)

  6 [nPr] 5 [=]

- Example 11: How many different groups of three people can be organized with10 people? (120)

  10 [nCr] 3 [=]

Converting Angular Measurements

- Press the [DRG▸] keys to display the following screen.

D	R	G
1	2	3

- Press [1], [2], or [3] to change the displayed value to the corresponding angle unit.
- Example: Change 2.34 radians to degrees.

[MODE] ··· ··· [1] (Deg)

2.34 [DRG▸] [2] (R) [=]

2.34r
134.0721241

Coordinate Systems (Pol (x, y), Rec (r, θ))

- The result will be stored in variables E and F automatically.
- Example 1: Express the point defined by the polar coordinates (r = 4, θ = 30°) in rectangular coordinates (x, y).
  (Deg)

  x = 3.464101615 [Rec(] 4 [,] 30 [)] [=]

  y = 2 [RCL] [F]

- Press [RCL] [E] to display the value of x or press [RCL] [F] to display the value of y.
- Example 2: Express the point defined by the rectangular coordinates (2, $\sqrt{5}$) in polar coordinates (r, θ).
  (Rad)

  r = 3 [Pol(] 2 [,] [√] 5 [)] [=]

  θ = 0.84106867 [RCL] [F]

- Press [RCL] [E] to display the value of r or press [RCL] [F] to display the value of θ.

Expressing Numbers in Engineering Format

- Example 1: Change 54321 meters to kilometers

  ---> **54.321** $\times 10^3$ (km) 54321 [=] [ENG]

- Example 2: Change 0.01234 grams to milligrams

  --->**12.34** $\times 10^{-3}$ (mg) 0.01234 [=] [ENG]

Statistics

Standard Deviation-SD

Press [MODE] to select SD mode for statistical calculations with standard deviations.
SD.....[MODE] [2]

In SD and REG modes, the [M+] key acts as the [DT] key.

Press the [CLR] [1] (Scl) [=] keys to erase the statistics memory before you enter data.

Press the following key to input data.

< x data> [DT]

Input data to calculate $n, \sum x, \Sigma x^2, \bar{x}, x\sigma_n, x\sigma_{n-1}$.

To display this result	Press these keys
Σx^2	S-SUM 1
Σx	S-SUM 2
n	S-SUM 3
$\bar{x}$	S-VAR 1
$x\sigma_n$	S-VAR 2
$x\sigma_{n-1}$	S-VAR 3

Example: Calculate $x\sigma_{n-1}$, $x\sigma_n$, $\bar{x}$, n, Σx, Σx^2 given the following data:

15, 14, 11, 15, 13, 13, 14, 12

In SD mode:

CLR 1 (Scl) = (Stat clear)

15 DT | n= SD 1.

Each time you press DT, the data you have just entered is stored. The n = value shown on the screen indicates the number of data pairs you hove entered.

14 DT 11 DT 15 DT

13 DT DT 14 DT 12 DT

Standard deviation of the sample

$x\sigma_{n-1}$ = 1.407885953 S-VAR 3 =

Standard deviation of the population

$x\sigma_n$ = 1.316956719 S-VAR 2 =

Mean ($\bar{x}$) = 13.375 S-VAR 1 =

Number of data points(n) = 8 S-SUM 3 =

Sum of the data values (Σx) = 107 S-SUM 2 =

Sum of the squares of the data values (Σx^2) = 1445 S-SUM 1 =

Data Entry Hints

- Press [DT] [DT] to enter the same data twice.
- Press [;] to repeat the same data item several times. For example, press 100 [;] 15 [DT] to enter the data value 100 15 times.
- You can perform these operations in any sequence, not necessarily in the same order as in the example above.
- Press [▲] or [▼] to scroll through the entered data.
- Edit the data displayed as desired. The new data replace the old data after inputting new data and pressing the key [=]. Therefore, if you want to perform some other operations (calculation, display calculation result and so on), you must first press the key [AC] to exit from the data displaying screen.
- To change a data value, scroll to it, enter the new value and press [=]. (However, you must press [DT] if you want to add the value as a new data item.)
- To delete a data value displayed by pressing [▲] and [▼], press, [↳CLR].
- The values are stored in the memory. If “Data Full” appears on the screen, there is no more memory available to store new data. In this case, press [=] to display the following menu:

Edit OFF	ESC
1	2

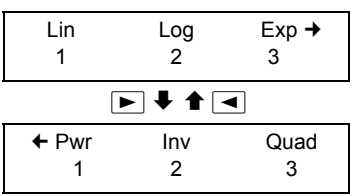
- Press [2] to quit the data input operation without storing the entered data values. Alternatively, press [1] to clear the values but remain in data input mode.

- Press [ON/C] to cancel data input.
- In SD or REG mode, you cannot display or edit data items once you change 10 another mode or choose a different regression type (Lin, Log, Exp, Pwr, Inv, Quad).

Regression-REG

Calculations involving regression require REG mode. Press the [MODE] key to select REG mode.
REG.....[MODE] [3]

- In SD mode and REG mode, the [M+] key acts as the [DT] key.
- When you select REG mode, the following screen appears.



- Press the number key ([1], [2], or [3]) corresponding to the regression type you want to use.

  [1] (Lin) : Linear regression

  [2] (Log) : Logarithmic regression

  [3] (Exp) : Exponential regression

  [►] [1] (Pwr) : Mathematical power regression

  [►] [2] (Inv) : Inverse regression

  [►] [3] (Quad) : Quadratic regression

- Before entering data, press the [CLR] [1] (Scl) [=] keys to clear the statistics memory.
- Press the following key to input data.
  < x data> [,] < y data> [DT]
- The regression calculation result is determined by the data input. The result can be displayed using the following syntax and keys.

To display this result	Press these keys
Σx^2	[S-SUM] [1]
Σx	[S-SUM] [2]
n	[S-SUM] [3]
Σy^2	[S-SUM] [►] [1]
Σy	[S-SUM] [►] [2]
Σxy	[S-SUM] [►] [3]
$\bar{x}$	[S-VAR] [1]
$x\sigma_n$	[S-VAR] [2]
$x\sigma_{n-1}$	[S-VAR] [3]
$\bar{y}$	[S-VAR] [►] [1]
$y\sigma_n$	[S-VAR] [►] [2]
$y\sigma_{n-1}$	[S-VAR] [►] [3]
Regression coefficient A	[S-VAR] [►] [►] [1]
Regression coefficient B	[S-VAR] [►] [►] [2]
With non quadratic regression types:	
Regression coefficient r	[S-VAR] [►] [►] [3]
$\bar{x}$	[S-VAR] [►] [►] [►] [3]
$\bar{y}$	[S-VAR] [►] [►] [►] [2]

- To display quadratic regression calculation results, use the following syntax and keys.

To display this result	Press these keys
Σx^3	S-SUM ► ► 1
$\Sigma x^2 y$	S-SUM ► ► 2
Σx^4	S-SUM ► ► 3
Regression coefficient C	S-VAR ► ► 3
$\widehat{x}_1$	S-VAR ► ► ► 1
$\widehat{x}_2$	S-VAR ► ► ► 2
$\widehat{y}$	S-VAR ► ► ► 3

- The statistics values calculated can be stored in variables and used in expressions.

Linear Regression

- The formula for linear regression is y=A+B x
- Example: The relationship between atmospheric pressure and air temperature is given in the following table:

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

The following explains how to calculate the coefficients of the regression formula and how the formula can then be used to determine air temperature at a particular pressure (1000hPa) and the air pressure at a particular temperature (-5°C). In the process, we also determine the coefficient of determination (r^2) and the sample covariance.

In regression (REG) mode: $\left(\frac{\Sigma xy - n \bullet \bar{x} \bullet \bar{y}}{n-1}\right)$

(mode 3) [1] (Lin)

[CLR] [1] (Scl) [=] (Stat clear)

10 [,] 1003 [DT]

REG
n= 1.

Each time you press [DT], the data you have just entered is stored. The n = value shown on the screen indicates the number of data pairs you have entered.

15 [,] 1005 [DT]

20 [,] 1010 [DT] 25 [,] 1011 [DT]

30 [,] 1014 [DT]

Regression coefficient A=997.4 [S-VAR] [►] [►] [1] [=]

Regression coefficient B=0.56 [S-VAR] [►] [►] [2] [=]

Regression coefficient r=0.982607368 [S-VAR] [►] [►] [3] [=]

The atmospheric pressure when the air temperature is -5°C = 994.6 [(] [(-)] 5 [)] [S-VAR] [►] [►] [►] [2] [=]

The air temperature when atmospheric pressure is 1000hPa =4.642857143 1000 [S-VAR] [►] [►] [►] [1] [=]

Coefficient of determination =0.965517241 [S-VAR] [►] [►] [3] [=]

Sample covariance=35 [(] [S-SUM] [►] [3] [−]

[S-SUM] [3] [×] [S-VAR] [1] [×]

[S-VAR] [►] [1] [)] [÷]

[(] [S-SUM] [3] [−] 1 [)] [=]

Logarithmic, Exponential, Mathematical Power and Inverse Regression

- Use these regression types in the same way that you use linear regression (see above).

- The corresponding regression formulas are:

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

Quadratic Regression

- The regression formula for quadratic regression is $y = A+Bx+Cx^2$
- Example: In this example, we perform quadratic regression on the given data to determine the regression formula and then use the formula to calculate $\widehat{y}$ (the estimated value of y) when xi = 16 and the $\widehat{x}$ value (the estimated value of x) when yi = 20.

xi	yi
29	1.6
50	23.5
74	38.0
103	46.4
118	48.0

In regression (REG) mode:

[►] [3] (Quad)

[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 coefficient
A=-35.59856934 [S-VAR] [►] [►] [1] [=]

Regression coefficient
B= 1.495939414 [S-VAR] [►] [►] [2] [=]

Regression coefficient
C=-6.71629667x 10^{-3} [S-VAR] [►] [►] [3] [=]

Estimated value of $\hat{y}$ =-13.38291067 when xi = 16

16 [S-VAR] [►] [►] [►] [3] [=]

Estimated value of $\hat{x}_1$ =47.14556728 when yi = 20

20 [S-VAR] [►] [►] [►] [1] [=]

Estimated value of $\hat{x}_2$ =175.5872105 when yi = 20

20 [S-VAR] [►] [►] [►] [2] [=]

Data Entry Hints

- Press [DT] [DT] to enter the same data twice.
- Press [;] to enter the same data several times. For example, pressing 30 [,] 40 [;] 5 [DT] enters the data pair {30, 40} 5 times.
- The some data entry hints noted for Standard Deviation made (see earlier) also apply in Regression mode.
- When carrying out statistical calculations, do not store any data in variables A to F, X or Y. These variables are used as temporary memory during calculations and thus their contents could get overwritten during a calculation.
- Variables A to F, X and Y are cleared when you select REG mode and choose a regression type (Lin, Log, Exp, Pwr, Inv, Quad). They are also cleared if you switch to another regression type.

Technical Data

Troubleshooting

If the result of a calculation is not what you expected, or if an error occurs please carry out the following steps.

1. Press the [CLR] [2] (Mode) [=] keys in that order to reset all modes and settings.
2. Check that the formula or expression you entered is correct.
3. Selected the correct mode and try the calculation again.

If the problem persists, press [ON]. The calculator will perform a self-check and, if an abnormality is found, clear all stored data. For this reason, you should always have a copy of all important information kept separate from the calculator.

Error Messages

If an error message occurs, the calculator stops running immediately. Press [AC] to clear the error message, or press [◄] or [►] to redisplay the calculation so that you can correct it.

Math ERROR

Causes	• The result exceeds the calculator's computational range. • You tried to enter a value that exceeds the calculator's input range. • The operation requested is not mathematically valid (for example, dividing by 0).
Correction	• Check that the input value is within the allowable input range. If you are using memory variables, check that the stored values will not cause the calculator to exceed its computational range.

Stack ERROR

Causes	• The capacity of the number stack or operator stack has been exceeded. The number stack can have 10 levels while the operator stack can have 24.
Correction	• Simplify the calculation. • Break up the calculation into two or more parts.

Syntax ERROR

Causes	• The number entered or operator selected was not expected or was not in the correct form.
Correction	• Press [◄] or [►] to redisplay the calculation. The cursor will be at the place where the error occurred. Correct the problem and then proceed.

Arg ERROR

Causes	• A parameter you entered was not expected or was not in the correct form.
Correction	• Press [◄] or [►] to redisplay the calculation. The cursor will be at the place where the error occurred. Correct the problem and then proceed.

Input Range

Functions	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	$0 \leqq \lvert x \rvert \leqq 4.9999999999 \times 10^{10}$
$\cos x$	DEG	$0 \leqq \lvert x \rvert \leqq 4.500000008 \times 10^{10}$
	RAD	$0 \leqq \lvert x \rvert \leqq 785398164.9$
	GRA	$0 \leqq \lvert x \rvert \leqq 4.9999999999 \times 10^{10}$
$\tan x$	DEG	Same as $\sin x$, except when $\lvert x \rvert = (2n-1) \times 90$
	GRA	Same as $\sin x$, except when $\lvert x \rvert = (2n-1) \times \frac{\pi}{2}$
	RAD	Same as $\sin x$, except when $\lvert x \rvert = (2n-1) \times 100$
$\sin^{-1} x$	$0 \leqq \lvert x \rvert \leqq 1$	
$\cos^{-1} x$		
$\tan^{-1} x$	$0 \leqq \lvert x \rvert \leqq 9.999999999 \times 10^{99}$	
$\sinh x$	$0 \leqq \lvert x \rvert \leqq 230.2585092$	
$\cosh x$		
$\sinh^{-1} x$	$0 \leqq \lvert x \rvert \leqq 4.999999999 \times 10^{99}$	
$\cosh^{-1} x$	$0 \leqq x \leqq 4.999999999 \times 10^{99}$	
$\tanh x$	$0 \leqq \lvert x \rvert \leqq 9.999999999 \times 10^{99}$	
$\tanh^{-1} x$	$0 \leqq \lvert x \rvert \leqq 4.999999999 \times 10^{-1}$	
$\mathrm{Log}\, x / \ln x$	$0 < \lvert x \rvert \leqq 9.999999999 \times 10^{99}$	

10^x	$-9.999999999 \times 10^{99} \leqq x \leqq 99.999999999$
e^x	$-9.999999999 \times 10^{99} \leqq x \leqq 230.2585092$
$\sqrt{x}$	$0 \leqq x < 1 \times 10^{100}$
x^2	$\lvert x \rvert < 1 \times 10^{50}$
$1/x$	$\lvert x \rvert < 1 \times 10^{100}$; $x \neq 0$
$\sqrt[3]{x}$	$\lvert x \rvert < 1 \times 10^{10}$
$x!$	$0 \leqq x \leqq 69$ (x is an integer)
${}_nP_r$	$0 \leqq n < 1 \times 10^{10}$, $0 \leqq r \leqq n$ (n, r are integers) $1 \leqq \{n!/(n-r)!\} < 1 \times 10^{100}$
${}_nC_r$	$0 \leqq n < 1 \times 10^{10}$, $0 \leqq r \leqq n$ (n, r are integers) $1 \leqq [n!/\{r!(n-r)!\}] < 1 \times 10^{100}$
Pol(x, y)	$\lvert x \rvert$, $\lvert y \rvert \leqq 9.999999999 \times 10^{49}$ $(x^2 + y^2) \leqq 9.999999999 \times 10^{99}$
Rec(r, θ)	$0 \leqq r \leqq 9.999999999 \times 10^{99}$ θ : Same as for $\sin x$
°,,,	$\lvert a \rvert$, b, c $< 1 \times 10^{100}$ $0 \leqq$ b,c
°,,,	$\lvert x \rvert < 1 \times 10^{100}$ Decimal ↔ Sexagesimal Conversions $0° 0° 0° \leqq \lvert x \rvert \leqq 999999° 59°$

$\wedge(x^y)$	x >0 : -1× 10^{100}< $y\log x$ <100 x =0 : y >0 x <0 : $y = n, \frac{1}{2n+1}$ (n is an integer) However, -1× 10^{100}<1/ $y\log\lvert x\rvert$ <100
$\sqrt[x]{y}$	y >0 : $x \neq 0$ -1 × 10^{100}<1/ $x\log y$ <100 y =0: x >0 y <0: $x = 2n+1, \frac{1}{n}$ ($n \neq 0$, n is an integer) However, -1 × 10^{100}<1/ $x\log\lvert y\rvert$ <100
a b/c	The total number of integer, numerator, and denominator digits must be 10 or less (including division marks)
SD (REG)	$\lvert x\rvert$ <1×10^{50} $x\sigma_n$, $y\sigma_n$, $\bar{x}$, $\bar{y}$: $n \neq 0$ $\lvert y\rvert$ <1×10^{50} $x\sigma_{n-1}$, $y\sigma_{n-1}$,A,B, r : $n \neq 0,1$ $\lvert n\rvert$ <1×10^{100}

Each operation is accurate to ±1, in the 10th digit. However, calculations involving multiple operations will cause the error to accumulate. This is also observed with internal calculations involving multiple operations such as $\wedge(x^y)$, $\sqrt[x]{y}$, $x!$, $\sqrt[3]{}$, ${}_nP_r$, ${}_nC_r$ and the like.

Note that the error may be greater near an inflection point of a function.

Sequence of Operations

Calculations are carried out in the following order:

1. Coordinate transformations:Pol(x, y),Rec(r, θ)
2. A-type functions: These are functions where a value must be entered before you press a function key.

x^3, x^2, x^{-1}, $x!$, $^{\circ\prime\prime}$, $\widehat{x}$, $\widehat{x_1 x_2 y}$

Converting angular values (DRG▶)

3. Mathematical power and root: ^(x^y), $\sqrt[x]{}$
4. a b/c
5. Inπ, e(base of natural logarithm), implied multiplication involving a memory or variable name: 2π, 3e, 5A, πA, etc.
6. B-type functions

   These are functions where a function key must be pressed before a value is entered.

   $\sqrt{}$, $\sqrt[3]{}$, log, ln, e^x, 10^x, sin, cos, tan, $\sin^{-1}$ $\cos^{-1}$, $\tan^{-1}$, sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$, $\tanh^{-1}$, (-)
7. Implied multiplication preceding a B-type function: 2$\sqrt{3}$, Alog2, etc
8. Permutations and combinations: ${}_nP_r$, ${}_nC_r$
9. ×, ÷
10. +,-

- In an expression where two components have the same priority, the calculation is performed from right to left.

  e^x ln √120 ⟶ e^x (ln(√120))

- Other calculations will be carried out from left to right.
- Calculations in parentheses are performed first.
- If the calculation includes a parameter with a negative number, the negative number should be in parentheses. Since a minus sign (-) is considered a B-type function, care is needed when

negative numbers are included in A.type functions, mathematical powers or root operations.

Example: $(-3)^4 = 81$

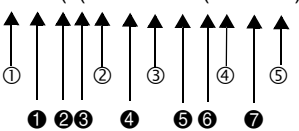
$-3^4 = -81$

Stack

This “stack” is an area of memory used to temporarily save values (the number stack) and the order of operations (the operator stack) during the calculation. The number stock has a maximum capacity of 10 while the operator stack has a maximum capacity of 24. If a calculation exceeds the stack capacity, a Stack ERROR will occur.

Example:

2 × ((3 + 4 × (5 + 6) ÷ 7) ÷ 8) + 9 =



①	2
②	3
③	4
④	5
⑤	6
⋮	

❶	×
❷	(
❸	(
❹	+
❺	×
❻	(
❼	+

- The calculation will be carried out in the order described in Sequence of Operations. During the course of a calculation, the number and order stacks are cleared.

Automatic Power-Saver

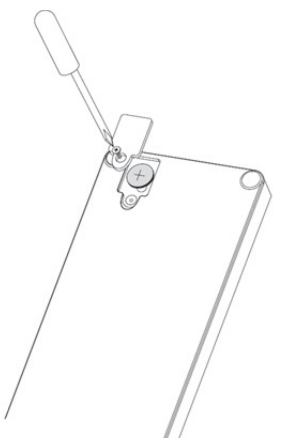
If you have not used the calculator for 5 minutes, it will automatically turn off. Press [ON] to turn it on again.

Replacing the Battery

This calculator is powered by solar with a LR44 battery backup.

Replace the battery as soon as possible when the display becomes dim. A dim display indicates that battery power is low.

1. Press [AC] (OFF).
2. Remove the screw that secures the battery cover, and then remove the battery cover.
3. Remove the old battery.
4. Insert a new battery positive side upward.
5. Replace the battery cover and secure it with the screw.
6. Press the following keys to reset all modes and settings:
   [CLR] [2] (Mode) [=]



Specifications

Power:

- Solar Cell: Built into the front of the calculator
- Button Cell: One (1) Alkaline button battery (LR44)

Battery Life: Standby (ON but no calculation) about 3 years; OFF about 5 years.

Dimensions: 147.0 x 77.2 x 15.0 mm (unit)
149.5 X 82.2 X 19.5 mm (with protective case)

Weight: 93g (unit)
123g (with protective case)

Operating Temperature: 0°C ~ 40°C

Regulatory Notices

European Union Regulatory Notice

Products bearing the CE marking comply with the following EU Directives:

- Low Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC
- Ecodesign Directive 2009/125/EC, where applicable

CE compliance of this product is valid if powered with the correct CE-marked AC adapter provided by HP.

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For EU non-harmonized telecommunications products (if applicable, a 4-digit notified body number is inserted between CE and ! (the exclamation mark).

Please refer to the regulatory label provided on the product.

The point of contact for regulatory matters is:

Hewlett-Packard GmbH, Dept./MS: HQ-TRE, Herrenberger Strasse 140, 71034 Boeblingen, GERMANY.

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This calculator's Memory Backup battery may contain perchlorate and may require special handling when recycled or disposed in California.

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根据中国《电子信息产品污染控制管理办法》

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCA	X	O	O	O	O	O
外壳部件	O	O	O	O	O	O

O：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T 11363-2006 标准规定的限量要求以下。

X：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T 11363-2006 标准规定的限量要求。

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