hp 9s
Scientific Calculator

General Operations

Power Supply

On or Off

To turn the calculator on, press [ON/C].

To turn the calculator off, press [2ndF] [OFF].

Auto power-off function

The calculator automatically turns off if it has not been used for approximately 9 minutes. Power can be restored by pressing the [ON/C] key again. Memory contents and the current mode setting (STAT, DEG, CPLX, Base-n,etc) are retained when you turn off the power and when the calculator automatically turns off.

Battery replacement

The calculator is powered by two alkaline button batteries (GP76A or LR44). If the display becomes dim and difficult to read, the batteries should be replaced as soon as possible.

To replace the batteries:

1. Slide the battery cover off and remove the old batteries.
2. Insert new batteries, with positive polarity facing outward.
3. Replace the battery cover and press [ON/C] to turn on the power.

The keyboard

Most of the keys can perform two functions.

2nd function ——— $\sin^{-1}$
1st function —— sin

1st functions

These are functions that are executed when you press a key without first pressing [2ndF]. The function performed is indicated by the label on the key.

2nd functions

These are functions that are executed when you press a key after first pressing [2ndF]. The function performed is indicated by the label above the key.

When you press [2ndF], the **2ndF** indicator appears in the display to indicate that you will be selecting the second function of the next key you press. If you press [2ndF] by mistake, simply press [2ndF] again to remove the **2ndF** indicator.

Note: [A], [B], [C], [D], [E], [F] are 1st functions in HEX mode.

Display Symbols

The following symbols, shown on the display, indicate the status of the calculator.

DEG or **RAD** or **GRAD**: degrees, radians or grads angular unit

M	A value is in memory	**CPLX**	Complex number mode
E	Overflow or error	**STAT**	Statistical mode
–	Minus	**2ndF**	[2ndF] key pressed
( )	Parentheses calculation	**CP**	Precision capability
BIN	Binary mode	**CPK**	Process capability
OCT	Octal mode	**σ**	Deviation
HEX	Hexadecimal mode	**USL**	Setting upper limit
ED	Edit mode	**LSL**	Setting lower limit
HYP	Hyperbolic mode		

Display Formats

The calculator can display numbers in four formats: floating point, fixed point, scientific, and engineering.

Floating point format

The floating point format displays numbers in decimal form, using up to 10 digits. Any trailing zeros are truncated.

If the result of a calculation is too large to be represented by 10 digits, the display automatically switches to scientific format. If the result of a later calculation is small enough to be displayed in less than 10 digits, the calculator returns to floating point format.

To set the display to floating point display format:

1. Press [2ndF] [FIX] [•] — DEG 0.

Fixed point format

The fixed point, scientific, and engineering formats use a fixed number of decimal places to display numbers. If more than the specified number of decimal places is keyed, the entry will be rounded to the correct number of decimal places.

Ex. 1: Fix the display at 2 decimal places, then key in 3.256

1. Press [2ndF] [FIX] 2 — DEG 0.00
2. Key in 3.256 [ENTER] — DEG 3.26

If fewer than the set number of decimal places is keyed, the entry will be padded with trailing zeros.

Ex. 2: Fix the display at 4 decimal places, then key in 4.23

1. Press [2ndF] [FIX] 4 — DEG 0.0000
2. Key in 4.23 [ENTER] — DEG 4.2300

Scientific format

In scientific format, the number 891500 is shown as 8.915×10^{05}, where 8.915 is the mantissa and 5 is the exponent of 10.

Ex. 3: To display 7132 × 125 in scientific format:

1. Key in 7132 [×] 125 [ENTER] — DEG 891500.
2. Press [F↔E] — DEG 8.915^{05}

You can convert an entry to scientific notation by pressing [EXP] after entering the mantissa.

Ex. 4: Key the number 4.82296×10^{5}

1. Key in 4.82296 [EXP] 5 — DEG 4.82296^{05}

Engineering format

Engineering format is similar to scientific format, except that the mantissa can have up to three digits to the left of the decimal and the exponent is always a multiple of three. This is useful if you have to convert units that are based on multiples of 10^{3}.

Ex. 5: Convert 15V to 15000mV (V = Volts)

1. Key in 15 — DEG 15.
2. Press [ENG] twice. — DEG $15000.^{-03}$

Ex. 6: Convert 15V to 0.015KV (V = Volts)

1. Key in 15 — DEG 15.
2. Press [2ndF] [←] [2ndF] [←] — DEG 0.015^{03}

Order of Operations

Each calculation is performed in the following order of precedence:

1. Operations in parentheses.
2. Functions that require pressing the function key before entering a value, for example, [DATA] in statistics mode, and [EXP].
3. Functions that require values to be entered before pressing the function key, for example, cos, sin, tan, $\cos^{-1}$, $\sin^{-1}$, $\tan^{-1}$, log, ln, x^2, x^{-1}, $\sqrt{\ }$, π, $\sqrt[3]{\ }$, x!, %, RND, ENG, →o,,, , o,,→, and the unit conversion functions.
4. Fractions.
5. +/–
6. x^y, $\sqrt[x]{\ }$
7. nPr, nCr
8. ×, ÷
9. +, –

Corrections

If you have made a mistake when entering a number and you have not yet pressed an arithmetic operator key, just press [CE] to clear the last entry. You can then input the desired number again. Alternatively,you can delete digits one at a time by pressing the backspace key: [00→0].

Ex. 7: Change 12385 to 789

1. Key in 12385
2. Press [CE] 789 — DEG 789.

Ex. 8: Change 12385 to 123

1. Key in 12385
2. Press [00→0] twice. — DEG 123.

In a series of calculations, you can correct errors in intermediate results by pressing [ON/C]. This clears the calculation without clearing memory.

If you press the wrong arithmetic operation key, just press [CE] and then the correct arithmetic key.

Exchange key

Pressing [2ndF] [X↔Y] changes the currently displayed value to the previously displayed value.

123 + 456 = ?	123 [+] 456 [ENTER]	DEG 579.00
	[2ndF] [X↔Y]	DEG 456.00
	[2ndF] [X↔Y]	DEG 579.00

Accuracy and Capacity

Accuracy: ±1 in the 10th digit.

Capacity: In general, calculations can be displayed as a mantissa of up to 10 digits, a 10-digit mantissa together with a 2-digit exponent up to $10^{\pm 99}$, or as an integer between –9999999999 and 9999999999.

Numbers used as input to a particular function must be within the allowable range for that function (as set out in the following table):

Functions	Allowable input range
sin x, cos x, tan x	Deg: $\lvert x \rvert < 4.5 \times 10^{10}$ deg Rad: $\lvert x \rvert < 2.5 \times 10^{8} \pi$ rad Grad: $\lvert x \rvert < 5 \times 10^{10}$ grad Also, for tan x: Deg: $\lvert x \rvert \neq 90$ (2n +1) Rad: $\lvert x \rvert \neq \frac{\pi}{2}(2n+1)$ Grad: $\lvert x \rvert \neq 100$ (2n +1) where *n* is an integer.
$\sin^{-1} x$, $\cos^{-1} x$	$\lvert x \rvert \leqq 1$
$\tan^{-1} x$	$\lvert x \rvert < 1 \times 10^{100}$
sinh x, cosh x	$\lvert x \rvert \leqq 230.2585092$
tanh x	$\lvert x \rvert < 1 \times 10^{100}$
$\sinh^{-1} x$	$\lvert x \rvert < 5 \times 10^{99}$
$\cosh^{-1} x$	$1 \leqq x < 5 \times 10^{99}$
$\tanh^{-1} x$	$\lvert x \rvert < 1$
log x, ln x	$1 \times 10^{-99} \leqq x < 1 \times 10^{100}$
10^x	$-1 \times 10^{100} < x < 100$
e^x	$-1 \times 10^{100} < x \leqq 230.2585092$
$\sqrt{x}$	$0 \leqq x < 1 \times 10^{100}$
x^2	$\lvert x \rvert < 1 \times 10^{50}$
x^{-1}	$\lvert x \rvert < 1 \times 10^{100}$, $X \neq 0$
$\sqrt[3]{x}$	$\lvert x \rvert < 1 \times 10^{100}$
X!	$0 \leqq x \leqq 69$, where *x* is an integer.
R→P	$\sqrt{x^2+y^2} < 1 \times 10^{100}$
P→R	$0 \leqq r < 1 \times 10^{100}$ Deg : $\lvert \theta \rvert < 4.5 \times 10^{10}$ deg Rad : $\lvert \theta \rvert < 2.5 \times 10^{8} \pi$ rad Grad : $\lvert \theta \rvert < 5 \times 10^{10}$ grad Also, for tan x: Deg : $\lvert \theta \rvert \neq 90$ (2n+1) Rad : $\lvert \theta \rvert \neq \frac{\pi}{2}$ (2n+1) Grad : $\lvert \theta \rvert \neq 100$ (2n+1) where *n* is an integer.
→o,,,	$\lvert$ DD $\rvert$, MM, SS.SS $< 1 \times 10^{100}$, $0 \leqq$ MM, SS.SS
o,,,→	$\lvert x \rvert < 1 \times 10^{100}$
x^y	$x > 0$: $-1 \times 10^{100} < y \log x < 100$ $x = 0$: $y > 0$ $x < 0$: y = n, 1/(2n+1) where *n* is an integer but $-1 \times 10^{100} < \frac{1}{y} \log \lvert x \rvert < 100$
$\sqrt[x]{Y}$	$y > 0$: $x \neq 0$, $-1 \times 10^{100} < \frac{1}{x} \log y < 100$ $y = 0$: $x > 0$ $y < 0$: x =2n+1, l/n where *n* is an integer other than 0 but $-1 \times 10^{100} < \frac{1}{x} \log \lvert y \rvert < 100$
a^b/c	Input : The integer, numerator, denominator and fraction symbols must in total be no more than 10 digits. Result : Displayed as a fraction when the integer, numerator and denominator are each less than 1×10^{10}.
nPr, nCr	$0 \leqq r \leqq n$, $n \leqq 9999999999$; *n*, *r* are integers.
STAT	$\lvert x \rvert < 1 \times 10^{50}$, $\lvert \Sigma x \rvert < 1 \times 10^{100}$ $0 \leqq \lvert \Sigma x^2 \rvert < 1 \times 10^{100}$; n, r are integer $\bar{x}$: n≠0, S : n>1, σ : n>0 Range = 1 ~ r, $1 \leqq n \leqq r$, $80 \leqq r \leqq 20400$
→DEC	$0 \leqq X \leqq 9999999999$ (for zero or positive) $-9999999999 \leqq X \leqq -1$ (for negative)
→BIN	$0 \leqq X \leqq$ 0111111111 (for zero or positive) 1000000000 $\leqq X \leqq$ 1111111111 (for negative)
→OCT	$0 \leqq X \leqq$ 3777777777 (for zero or positive) 4000000000 $\leqq X \leqq$ 7777777777 (for negative)
→HEX	$0 \leqq X \leqq$ 2540BE3FF (for zero or positive) FDABF41C01 $\leqq X \leqq$ FFFFFFFFF (for negative)

Overflow and Error Conditions

The symbol **E** appears when any of the following conditions occur. Press [ON/C] to remove the overflow or error indicator.

- When you attempt to perform a function calculation with a number outside the allowable input range.
- When you attempt to divide a number by 0.
- When you have pressed the [( ] key more than 15 times in a single expression.
- When any result (whether intermediate or final) or the accumulated total in memory is outside $\pm 9.999999999 \times 10^{99}$
- When there are more than six pending operations.

If the calculator becomes locked and pressing keys has no effect, press [M+] and [ENG] at the same time. This unlocks the calculator and returns all settings to their default values.

Basic Calculations

The following examples of basic calculations assume that your calculator is in decimal base and with floating point display.

Mixed Arithmetic Calculations

1 + 2 × 3 = ?	1 [+] 2 [×] 3 [ENTER]	DEG 7.
–3.5 + 8 ÷2 = ?	3.5 [+/–] [+] 8 [÷] 2 [ENTER]	DEG 0.5

Parentheses Calculations

Operations inside parentheses are always executed first. You can specify up to 15 levels of parentheses in a single calculation. When you enter the first parenthesis, the **( )** indicator appears on the display and remains until each opening parenthesis has a corresponding closing parenthesis.

(5–2 × 1.5) × 3 + 0.8 × (– 4) = ?	[( ) 5 [–] 2 [×] 1.5 [ )] [×] 3 [+] 0.8 [×] 4 [+/–] [ENTER]	DEG 2.8
2 × (7 + 6 × (5 + 4)) = ?	2 [×] [( ) 7 [+] 6 [×] [( ) 5 [+] 4 [ENTER]	DEG 122.

Note: It is not necessary to press [ )] before [ENTER].

Repeating a Calculation

You can repeat the last number entered, or the last operation executed, by pressing [ENTER].

Repeating the last number

3 × 3 = ? 3 × 3 × 3 = ? 3 × 3 × 3 × 3 = ?	3 [×] [ENTER]	DEG 9.
	[ENTER]	DEG 27.
	[ENTER]	DEG 81.

Repeating the last arithmetic operation

321 + 357 = ? 654 + 357 = ?	321 [+] 357 [ENTER]	DEG 678.
	654 [ENTER]	DEG 1011.
579 – 159 = ? 456 – 159 = ?	579 [–] 159 [ENTER]	DEG 420.
	456 [ENTER]	DEG 297.
18 × 45 = ? 18 × 23 = ? 18 × (0.5×10^2) = ?	3 [×] 6 [×] 45 [ENTER]	DEG 810.
	23 [ENTER]	DEG 414.
	0.5 [EXP] 2 [ENTER]	DEG 900.
96 ÷ 8 = ? 75 ÷ 8 = ? (1.2×10^2) ÷ 8 = ?	96 [÷] 8 [ENTER]	DEG 12.
	75 [ENTER]	DEG 9.375
	1.2 [EXP] 2 [ENTER]	DEG 15.

Percentage Calculations

30% of 120 = ? 70% of 120 = ?	120 [×] 30 [2ndF] [%] [ENTER]	DEG 36.
	70 [2ndF] [%] [ENTER]	DEG 84.
88 is 55% of what number?	88 [÷] 55 [2ndF] [%] [ENTER]	DEG 160.
30% mark up of 120 = ?	120 [+] 30 [2ndF] [%] [ENTER]	DEG 156.
30% discount of 120 = ?	120 [–] 30 [2ndF] [%] [ENTER]	DEG 84.

Memory Calculations

- The **M** indicator appears when a number is stored in memory.
- Recalling from memory does not delete the contents of memory.
- The memory is not available when you are in statistics mode.
- To copy the displayed number to memory, press [X→M].
- To clear the memory, press [0] [X→M], or [CE] [X→M], in that order.

3 × 5 + 56 ÷ 7 + 74 – 8 × 7 Total = ?	[CE] [X→M]	DEG 0.
	3 [×] 5 [M+]	M DEG 15.
	56 [÷] 7 [M+]	M DEG 8.
	74 [–] 8 [×] 7 [M+]	M DEG 18.
	[MR]	M DEG 41.
	0 [X→M]	DEG 0.

Common Math Calculations

The following example calculations assume that your display is fixed at 2 decimal places.

Reciprocal, Factorial

$\frac{1}{1.25}$ = ?	1.25 [2ndF] [x^{-1}] [ENTER]	DEG 0.80
5! = ?	5 [2ndF] [x!] [ENTER]	DEG 120.00

Square, Square Root, Cube Root, Power, Other Roots

$2^2 + 3^4$ = ?	2 [x^2] [+] 3 [x^y] 4 [ENTER]	DEG 85.00
$5 \times \sqrt[3]{27} + \sqrt{34}$ = ?	5 [×] 27 [2ndF] [$\sqrt[3]{\ }$] [+] 34 [$\sqrt{\ }$] [ENTER]	DEG 20.83
$\sqrt[9]{72}$ = ?	72 [2ndF] [$\sqrt[x]{\ }$] 9 [ENTER]	DEG 1.61

Logarithms and Antilogarithms

ln7 + log100 = ?	7 [ln] [+] 100 [log] [ENTER]	DEG 3.95
10^2 = ?	2 [2ndF] [10^x] [ENTER]	DEG 100.00
$e^5 - e^{-2}$ = ?	5 [2ndF] [e^x] [–] 2 [+/–] [2ndF] [e^x] [ENTER]	DEG 148.28

Fraction calculations

Fractions are displayed as follows:

5 ⌟ 12 = $\frac{5}{12}$

56 ∪ 5 ⌟ 12 = $56\frac{5}{12}$

Note : The display is truncated if the integer, numerator, denominator and fraction symbols together are more than 10 digits.

Press [2ndF] [→d/c] to convert the displayed value to an improper fraction.

$\frac{2}{3} + 7\frac{3}{5} = 8\frac{4}{15} = \frac{124}{15}$	2 [a b/c] 3 [+] 7 [a b/c] 3 [a b/c] 5 [ENTER]	DEG 8 ∪ 4 ⌟ 15
	[2ndF] [→d/c]	DEG 124 ⌟ 15

If you press [a b/c] after pressing [ENTER], or if a fraction was combined with a decimal number, the answer is displayed as a decimal number.

$5\frac{4}{9} + 3\frac{3}{4} = 9\frac{7}{36} = 9.19$	5 [a b/c] 4 [a b/c] 9 [+] 3 [a b/c] 3 [a b/c] 4 [ENTER]	DEG 9 ∪ 7 ⌟ 36
	[a b/c]	DEG 9.19
$8\frac{4}{9} + 3.75 = 12.19$	8 [a b/c] 4 [a b/c] 9 [+] 3.75 [ENTER]	DEG 12.19

Where possible, a fraction is reduced to its lowest terms after you press [+], [–], [×], [÷] or [ENTER].

$3\frac{119}{21} = 8\frac{2}{3}$	3 [a b/c] 119 [a b/c] 21 [ENTER]	DEG 8 ∪ 2 ⌟ 3

A result is displayed in decimal format if the integer, numerator, denominator and fraction symbols are together more than 10 digits.

$12345\frac{5}{16} + 5\frac{6}{13}$ = 12350.77	12345 [a b/c] 5 [a b/c] 16 [+] 5 [a b/c] 6 [a b/c] 13 [ENTER]	DEG 12350.77

Converting Angular Units

You can specify an angular unit of degrees (DEG), radians (RAD), or grads (GRAD). You can also convert a value expressed in one angular unit to its corresponding value in another angular unit.

The relation between the angular units is:

180° = π radians = 200 grads

- To change the angular unit setting to another setting, press [DRG] repeatedly until the angular unit you want is indicated in the display.
- After entering the value of an angle, press [2ndF] [DRG→] repeatedly until the value is converted to the desired unit.

90° (deg) = ? (rad) = ? (grad)	90	DEG 90.
	[2ndF] [DRG→]	RAD 1.57
	[2ndF] [DRG→]	GRAD 100.00

Trigonometric and Inverse Trigonometric Functions

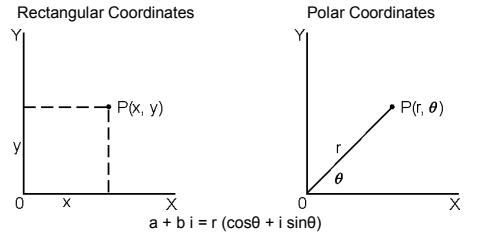
Before undertaking a trigonometric or inverse trigonometric calculation, make sure that the appropriate angular unit is set.

3 sin 85° = ?	3 [×] 85 [sin] [ENTER]	DEG 2.99
cos ($\frac{\pi}{4}$ rad) = ?	[2ndF] [π] [÷] 4 [ENTER] [cos]	RAD 0.71
tan 150 grad = ?	150 [tan]	GRAD –1.00
$\sin^{-1}$ 0.5 = ? deg	0.5 [2ndF] [$\sin^{-1}$]	DEG 30.00
$\cos^{-1}(\frac{1}{\sqrt{2}})$ = ? rad	2 [√] [2ndF] [x^{-1}] [2ndF] [$\cos^{-1}$]	RAD 0.79
$\tan^{-1}$ 1 = ? grad	1 [2ndF] [tan $^{-1}$]	GRAD 50.00

Hyperbolic and Inverse hyperbolic functions

cosh1.5+sinh1.5 = ?	1.5 [HYP] [cos] [+] 1.5 [HYP] [sin] [ENTER]	DEG 4.48
$\sinh^{-1}$ 7 = ?	7 [HYP] [2ndF] [$\sin^{-1}$]	DEG 2.64
tanh 1 = ?	1 [HYP] [tan]	DEG 0.76

Rectangular and Polar coordinates



a + b i = r (cosθ + i sinθ)

Note: Before undertaking a coordinates conversion calculation, make sure that the appropriate angular unit is set.

Converting from Rectangular to Polar

If *a* = 5 and *b* = 6, what are *r* and θ ?	5 [a] 6 [b] [2ndF] [R→P]	DEG 7.81
	[b]	DEG 50.19

Converting from Polar to Rectangular

If *r* = 25 and θ = 56°, what are *a* and *b*?	25 [a] 56 [b] [2ndF] [P→R]	DEG 13.98
	[b]	DEG 20.73

Permutations and Combinations

nPr = $\frac{n!}{(n-r)!}$ nCr = $\frac{n!}{r!(n-r)!}$

How many permutations of 4 items can you select from a set of 7 items?	7 [2ndF] [nPr] 4 [ENTER]	DEG 840.00
How many combinations of 4 items can you select from a set of 7 items?	7 [2ndF] [nCr] 4 [ENTER]	DEG 35.00

Sexagesimal ↔ Decimal form Conversions

You can convert a sexagesimal figure (degree, minute and second) to a decimal number by pressing [o,,,→] and convert a decimal number to a sexagesimal figure by pressing [2ndF] [→o,,,].

Sexagesimal figures are displayed as follows:

$12^{\square}45^{\prime}30^{\prime\prime}5$ = 12 degrees, 45 minutes, 30.5 seconds

Note: If the total number of digits in a DD, MM and SS.SS figure exceeds 8, the figure is truncated.

Converting from Sexagesimal to Decimal

12 deg., 45 min., 30.5 sec.= ?	12 [o,,,→] 45 [o,,,→] 30.5 [o,,,→]	DEG 12.76

Converting from Decimal to Sexagesimal

2.12345 = ?	2.12345 [2ndF] [→o,,,]	DEG $2^{\square}7^{\prime}24^{\prime\prime}42$

Base-n Calculations

Converting between bases

You can add, subtract, multiply, and divide binary, octal, and hexadecimal numbers in addition to decimal numbers. Select the number base you want by pressing [→BIN], [→OCT], [→HEX], or [→DEC]. The **BIN**, **OCT**, and **HEX** indicators show you which base you are using. (If none of these indicators is displayed, you are using decimal base.)

The number keys that are active in a particular base are:

Binary base: [0] and [1]

Octal base: [0] to [7]

Decimal base: [0] to [9]

Hexadecimal base: [0] to [9] and [A] to [F]

31 (base 10) = ? (base 2) = ? (base 8) = ? (base 16)	[2ndF] [→DEC] 31	DEG	31.
	[2ndF] [→BIN]	DEG BIN	11111.
	[2ndF] [→OCT]	DEG OCT	37.
	[2ndF] [→HEX]	DEG HEX	1F.
4 × 1B (base 16) = ? (base 2) = ? (base 10) = ? (base 8)	[2ndF] [→HEX] 4 [×] 1B [ENTER]	DEG HEX	6C.
	[2ndF] [→BIN]	DEG BIN	1101100.
	[2ndF] [→DEC]	DEG	108.00
	[2ndF] [→OCT]	DEG OCT	154.

Negative Numbers and Complements

In binary, octal, and hexadecimal bases, negative numbers are expressed as complements. The complement is the result of subtracting that number from 10000000000 in that number's base. You do this by pressing [+/–] in a non-decimal base.

Calculate the complement of binary number 11011	[2ndF] [→BIN] 11011 [+/–]	DEG BIN 1111100101.

Complex Number Calculations

Press [CPLX] to enter complex number mode. The **CPLX** indicator appears on the display. You can add, subtract, multiply, and divide complex numbers.

Complex numbers are generally represented as *a* + *b i*, where *a* is the real part and *bi* is the imaginary part.

(7 – 9 i) + (15 + 10 i) = ?	[2ndF] [CPLX] 7 [a] 9 [+/–] [b] [+] 15 [a] 10 [b] [ENTER]	DEG CPLX	22.00
	[b]	DEG CPLX	1.00

Note: Memory calculation is available in complex number mode.

Random Numbers

Press [2ndF] [RND] to generate a random number between 0.000 and 0.999.

Unit Conversions

The unit conversion keys are [°F↔°C], [mmHg↔Kpa], [gal↔l], [lb↔kg] and [oz↔g]. The following example illustrates the general procedure for converting values from one unit to another.

12 in = ? cm	12 [A→B] [2ndF] [in↔cm]	DEG 30.48
98 cm = ? in	98 [2ndF] [A←B] [2ndF] [in↔cm]	DEG 38.58

Statistics

Press [2ndF] [STAT] to enter statistics mode. The **STAT** indicator appears on the display. In statistics mode you can calculate the following single-variable statistics:

n	number of data items
Σx	sum of the values of all the data items
Σx^2	sum of the squares
$\bar{x}$	mean value
s	sample standard deviation $\sqrt{\frac{\sum x^2 - (\sum x)^2/n}{n-1}}$
σ	population standard deviation $\sqrt{\frac{\sum x^2 - (\sum x)^2/n}{n}}$

Continued on other side

CP precision capability $\frac{USL - LSL}{6\sigma}$

CPK process capability Min(CPU, CPL)

where CPU = $\frac{USL - \bar{x}}{3\sigma}$ CPL = $\frac{\bar{x} - LSL}{3\sigma}$

Note: In statistics mode, all function keys are available except those used for base-n calculations.

Ex. 9: Enter the following data {2, 5, 5, 5, 5, 9, 9, and 9} and calculate Σx, Σx^2, n, $\bar{x}$, S, CP, and CPK, where USL value = 12 and LSL value = 2.

In STAT mode	[2ndF] [STAT]	DEG STAT	0.00
Enter all data	[DATA] 2	DEG STAT	2.
	[DATA] 5	DEG STAT	5.
	[DATA] 5	DEG STAT	5.
	[DATA] 5	DEG STAT	5.
	[DATA] 5	DEG STAT	5.
	[DATA] 9	DEG STAT	9.
	[DATA] 9	DEG STAT	9.
	[DATA] 9	DEG STAT	9.
	[ENTER]	DEG STAT	0.00
$\bar{x}$ = ?	[$\bar{x}$]	DEG STAT	6.13
n = ?	[n]	DEG STAT	8.00
S = ?	[S]	DEG STAT	2.59
Σx = ?	[2ndF] [Σx]	DEG STAT	49.00
Σx^2 = ?	[2ndF] [Σx^2]	DEG STAT	347.00
σ= ?	[2ndF] [σ]	DEG STAT	2.42 σ
CP = ?	[2ndF] [CP] 12	DEG STAT	12. CP_{USL}
	[ENTER] 2	DEG STAT	2. CP_{LSL}
	[ENTER]	DEG STAT	0.69 CP
CPK = ?	[2ndF] [CPK]	DEG STAT	12.00 CPK_{USL}
	[ENTER]	DEG STAT	2.00 CPK_{LSL}
	[ENTER]	DEG STAT	0.57 CPK

Note: The calculator retains the data you have entered until you exit statistics mode. The data is retained even if you turn off the calculator or it automatically turns off.

Viewing Statistics Data

Press [DATA] or [ENTER] in edit (ED) mode to view the statistics data you have entered. (If you press [DATA] the item number of the data appears briefly before the value.)

Ex.10: View the data entered in Ex. 9.

Method 1

1. Press [2ndF] [EDIT] to enter edit mode.
2. Press [DATA] once to view the first data item.

DEG ED STAT dAtA 1 → 1.5 seconds → DEG ED STAT 2.00

3. Continue pressing [DATA] to display each data item. You will see data 2, 5.00, data 3, 5.00, data 4, 5.00, data 5, 5.00, data 6, 9.00, data 7, 9.00, data 8, 9.00 in sequence.

Method 2

1. Press [ENTER] once to view the first data item.

DEG ED STAT 2.00

2. Continue pressing [ENTER] to display each data item. You will see 5.00, 5.00, 5.00, 5.00, 9.00, 9.00, 9.00 in sequence.

Adding a Data Item

Ex. 11: To add a 9th data item, of value 10, to the Ex. 9 dataset:

1. Press [DATA] 10 — DEG ED STAT 10.

The calculator updates the statistics as you enter data. You can then recall the statistics to get : $\bar{x}$ = 6.56, n = 9.00, S = 2.74, Σx = 59.00, Σx^2 = 447.00 and σ= 2.59.

Editing Statistics Data

Ex.12: Change the value of data item 1 in Ex. 9 from 2 to 3.

Method 1

1. Press 2 [2ndF] [DEL] 3

Method 2

1. Press [2ndF] [EDIT] — DEG ED STAT 0.00
2. Display 2 by pressing [DATA] or [ENTER] — DEG ED STAT 2.00
3. Enter 3 to overwrite 2. — DEG ED STAT 3.
4. Press [ENTER] to make the change.
5. Press [2ndF] [EDIT] to exit edit mode.

Ex.13: Based on Ex.9, delete the first data entry (of value 2).

Method 1

1. Press 2 [2ndF] [DEL] to delete 2.

Method 2

1. Press [2ndF] [EDIT] — DEG ED STAT 0.00
2. Display 2 by pressing [DATA] or [ENTER]. — DEG ED STAT 2.00
3. Press [2ndF] [DEL] — DEG ED STAT 5.00
4. Press [2ndF] [EDIT] to exit edit mode.

Delete Error

If you try to delete a value that is not in the dataset, **dEL Error** appears. (Existing data is not affected.)

Ex.14: Delete 7 from the dataset in Ex.9.

1. Press 7 [2ndF] [DEL] — DEG STAT dEL Error
2. Press any key to clear the message. — DEG STAT 0.00

Ex.15: Delete 5 × 5 from the dataset in Ex.9.

1. Press 5 [×] 5 [2ndF] [DEL] — DEG STAT dEL Error
2. Press any key to clear the message. — DEG STAT 0.00

Weighted Data Entry Method

Instead of entering each data item individually, you can enter the value and the number of occurrences of that value (up to 255). The data from Ex.9 can be entered as follows:

Value	Number of occurrences	Alternative method
2	1	[DATA] 2
5	4	[DATA] 5 [×] 4
9	3	[DATA] 9 [×] 3

where item 1 = 2, items 2 to 5 = 5, and items 6 to 8 = 9.

Error Conditions

The indicator **FULL** appears when any of the following conditions occur. Further data entry is not possible. Press any key to clear the indicator. Providing that you remain in statistics mode, previously entered data entries are unaffected.

- You attempt to enter more than 80 data items.
- The number of occurrences of of any particular data value is greater than 255
- The product of the number of data items and the number of occurrences is greater than 20400.

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