

# HP 30S

## Scientific Calculator

### Basic operation

**On and Off** **[ON]** turns the calculator on; **[2nd] [OFF]** turns it off.

The calculator automatically turns off if no key is pressed for 9 minutes. Press **[ON]** to reactivate the calculator. The display, memory, and settings are retained.

**Display** The display comprises the entry line, the result line, and indicators.

**Entry Line** You can enter up to 80 characters. Your entry scrolls to the left—and the **◀** indicator is displayed—when you enter 11 or more characters.

By default, the calculator is in **overwrite mode**. In overwrite mode the cursor is the underscore character (**\_**) and any digit you enter appears at the cursor's position. If there is a digit below the cursor, that digit is replaced by your new entry.

You can also set the calculator to **insert mode**. In insert mode the cursor appears as **◀** and any digit you enter is inserted to the left of the cursor. To activate insert mode, place the cursor where you want to insert a character and press **[2nd] [INS]**. To deactivate insert mode, press an arrow key or **[2nd] [INS]** again.

Press **▶** or **◀** to move the cursor through an entry. To go directly to the first character, press **[2nd] ◀**. To go directly to the last character, press **[2nd] ▶**. To delete a digit, press **[DEL]** (or, in overwrite mode, just type over the digit).

**Negative Numbers** To enter a negative number, press **[ $\frac{1}{x}$ ]** before entering the digits.

**Result Line** The result of a calculation is displayed on the result line (the bottom line of the display). Up to 10 digits can be displayed, as well as a negative sign, decimal point, the  $\times 10$  indicator, and a positive or negative exponent. Calculation accuracy is up to 24 decimal places.

**Indicators** These are displayed to indicate certain selections, states, or settings (see table below).

Indicator	Meaning
2 <sup>nd</sup>	2nd set of function keys is active (see below).
MODE	Mode selection is active.
STAT	Statistics mode is active.
ENG	Numbers are displayed in engineering notation.
SCI	Numbers are displayed in scientific notation.
DEG, RAD, OR GRAD	Angle setting is degrees, radians, or gradians respectively.
FIX	Number of decimal places displayed is fixed.
HYP	Hyperbolic trig function will be calculated.
L <sup>S</sup> SOLV	Linear equation solver is active.
Q <sup>S</sup> SOLV	Quadratic equation solver is active.
◀ ▶	There are digits to the left or right of the display.
↑ ↓	There are earlier or later results that can be displayed.
M	A number is stored in running memory.
–	Result is negative, or the entry line is full.
K	A constant expression can be defined or used.
$\times 10$	Result is displayed in scientific or engineering notation. Exponent is displayed above indicator.
'	Thousands separator (for numbers $\geq 1000$ ).

**Order of Entry** You enter numbers and operators in the same order as you write them in traditional arithmetic.

**2<sup>nd</sup> Functions** Functions represented by the labels on the faceplate are selected by first pressing **[2nd]** and then the key below the label. For example, to select the % function, press **[2nd] [%]**. (In this guide, labels are enclosed in square brackets. For example, an instruction to select the % function is indicated by **[2nd] [%]**.)

**Menus** Many functions and settings are available on menus. A menu is a list of options displayed across the entry line. For example, pressing **[2nd] [SCI/ENG]** displays the menu for choosing the number display.

Choose an item from a menu by pressing **▶** or **◀** until the item is underlined, and then press **[ENTER]**.

To cancel a menu without choosing an item, press **[CL]**.

**Modes** There are four modes (or operating environments):

- 0. Home (the default mode, used for common calculations)
- 1. Statistics (STAT)
- 2. Linear equation solver (L SOLV)
- 3. Quadratic equation solver (Q SOLV).

Press **[MODE]** to display the Modes menu. To select a mode, press the number of the mode. Alternatively, press **▶** or **◀** until the mode you want is underlined and then press **[ENTER]**.

**Contrast** To change the display contrast, press **[MODE]** and then **▲** or **▼** as many times as is necessary. Press **[CL]** to close the Modes menu.

### Order of Operations

1st	Expressions inside parentheses.
2nd	Conversion of coordinate notation.
3rd	Functions that are entered before their argument (such as LN, cos).
4th	Functions that are entered after their argument (such as $x^2$ ).
5th	Roots ( $\sqrt{x}$ ) and exponentiation ( $x^y$ ).
6th	Fractions.
7th	$\pi$ , random numbers, and physical constants.
8th	+/-
9th	Implied multiplication preceding functions that are entered before their argument.
10th	Combinations (nCr) and permutations (nPr).
11th	Multiplication, other implied multiplication, and division.
12th	Addition and subtraction.
13th	All other conversions.

### System Memory

**Previous Entries** The HP 30S keeps a record of all the entries you make (up to a maximum of 320 characters). These entries are retained even if you turn off the calculator.

Press **▲** or **▼** to scroll through the entries. You can reuse or edit a previous entry when it is on the entry line.

**Last answer** The last answer is stored automatically in memory. It is kept even if you turn the calculator off.

To retrieve the last answer, press **[2nd] [ANS]**. *Ans* appears on the entry line. Press **[ENTER]** to see the value of the last answer.

You can also use the last answer in a new calculation by first pressing an operator key (**[+]**, **[−]**, etc). *Ans* appears on the entry line followed by the operator. You then complete the entry as you would normally.

**Linear Solutions** The results of solving a set of linear equations are stored in the variables **X** and **Y**.

**Quadratic Solutions** The results of solving a quadratic equation are stored in the variables **X<sub>1</sub>** and **X<sub>2</sub>**, or **Y<sub>1</sub>** and **Y<sub>2</sub>**.

### User Memory

**Memory variables** There are five memory variables: **A**, **B**, **C**, **D**, and **EQN**. You can store real numbers in variables **A–D**, and store an expression in **EQN**.

You can also store real numbers in **X**, **Y**, **X<sub>1</sub>**, **X<sub>2</sub>**, **Y<sub>1</sub>**, and **Y<sub>2</sub>**; however, the values in these variables are replaced with linear equation and quadratic solutions.

You store a number or expression in a variable by entering it, pressing **[STO]**, selecting the variable from the Variables menu, and pressing **[ENTER]**.

**Constant expression [K]** A constant expression is any combination of operators, functions, variables, and numbers that can be added to the end of an entry and be evaluated. A constant expression is useful if you want to apply the same operation many times to different inputs.

To define (or modify) the constant expression, press **[2nd] [K]**, enter the operators, functions, and numbers that you need, and press **[ENTER]**.

To use the constant expression, the **K** indicator needs to be displayed. (If it is not displayed, press **[2nd] [K]**.) Pressing **[ENTER]** will now attach the constant expression to your input and evaluate the result. For example, if your constant expression is  $+\sin(30^\circ)$ , entering 2 and pressing **[ENTER]** yields 2.5, that is,  $2 + \sin(30^\circ)$ .

To return to normal operation, press **[2nd] [K]** again. The constant expression is retained for later use.

**Running memory** Press **[M+]** to add a result to running memory. Press **[M−]** to subtract the value on the result line from running memory. To recall the value in running memory, press **[MRC]**. To clear running memory, press **[MRC]** twice.

### Recalling and Reusing Variables

You can recall, and reuse, the variables **A**, **B**, **C**, **D**, **EQN**, **X**, **Y**, **X<sub>1</sub>**, **X<sub>2</sub>**, **Y**, **Y<sub>1</sub>**, and **Y<sub>2</sub>**, or the values in these variables.

- To recall the value of a variable, press **[2nd] [RCL]** and **▶** until the variable is underlined.
- To recall the variable, press **[VRCL]** and **▶** until the variable is underlined.

To copy the variable or value to the entry line, press **[ENTER]**.

### Expressions

You can create an expression using the variables **A**, **B**, **C**, **D**, **X**, **X<sub>1</sub>**, **X<sub>2</sub>**, **Y**, **Y<sub>1</sub>**, and **Y<sub>2</sub>**—for example,  $3A^2 + 4B$ —and store that expression in the variable **EQN**.

You store an expression in the same way that you store a value, but always store it in the variable named **EQN**.

To evaluate a stored expression, press **[VRCL] ◀ [ENTER] [ENTER]**. You are prompted to specify a value for each variable in the expression. Enter a value and press **[ENTER]**. The expression is evaluated and the answer displayed on the result line.

### Clearing Data and Settings

<b>[CL]</b>	<ul style="list-style-type: none"><li>Clears the entry line.</li><li>Clears an error message.</li><li>Clears a menu.</li></ul>
<b>[2nd] [CL-VAR]</b>	Clears all memory variables except <b>EQN</b> .
<b>[2nd] [CL-EQN]</b>	Clears the contents of <b>EQN</b> .
<b>[MODE] 1 ◀ [ENTER]</b>	Clears statistics data.
<b>[2nd] [RESET] ▶ [ENTER]</b>	Returns calculator to its default settings. Clears variables, <b>EQN</b> , pending operations, running memory, constant expression, statistical data, and <b>Ans</b> .

### Notation

**Decimal Places** Press **[2nd] [FIX]** to display the Decimal Places menu. Press **▶** until the number of decimal places you want to see displayed is underlined, and then press **[ENTER]**. (The default setting is F: floating point notation.)

To round a number to the number of decimal places you have fixed, press **[2nd] [RND]**, enter the number (or expression that evaluates to a number), and press **[ENTER]**.

**Number Display** Press **[2nd] [SCI/ENG]** to display the Number Display menu. The items on this menu are FLO (for floating point), SCI (for scientific), and ENG (for engineering). Press **▶** until the type of display you want is underlined, and then press **[ENTER]**.

You can also enter a number in mantissa-and-exponent format (that is, as a number and a power of 10). Enter the number, press **[E]**, enter the power of 10, and press **[ENTER]**.

### Angle Settings

**Changing the Default Setting** Angle units can be degrees, radians, or grads. The initial default setting is degrees. To change this to another setting, press **[DRG]**, select the unit you want, and press **[ENTER]**. The angle setting becomes the new default and remains until you change it again.

**One-Off Change** To override the default angle setting:

- Enter the value.
- Press **[2nd] [DMS]**.
- Select the unit you want.
- Press **[ENTER]**.

The units you can select are degrees ( $^\circ$ ), minutes ( $'$ ), seconds ( $''$ ), radians (r), grads (g), and degrees–minutes–seconds ( $\blacktriangleright$ DMS).

### Angle Conversions

- Change the default angle setting to what you want to convert to.
- Enter the value of the unit to convert.
- Press **[2nd] [DMS]**.
- Choose the units you are converting from.
- Press **[ENTER]** twice.

### Rectangular and Polar Arithmetic

To find the polar attributes ( $r$  or  $\theta$ ) of a rectangular system ( $x$ ,  $y$ ) or vice versa, press **[2nd] [R $\leftrightarrow$ P]** and select an option. You can find  $r$  or  $\theta$  by specifying  $x$  and  $y$ , or  $x$  or  $y$  by specifying  $r$  and  $\theta$ .

### Trigonometry

The HP 30S provides standard trigonometric functions—**[sin]**, **[cos]**, **[tan]**—inverse trigonometric functions—**[2nd] [SIN<sup>−1</sup>]**, **[2nd] [COS<sup>−1</sup>]**, **[2nd] [TAN<sup>−1</sup>]**—and hyperbolic functions—**[2nd] [HYP]** together with **[sin]**, **[cos]**, **[tan]**, **[2nd] [SIN<sup>−1</sup>]**, **[2nd] [COS<sup>−1</sup>]**, and **[2nd] [TAN<sup>−1</sup>]**.

### Fractions

- To enter a fraction, enter the numerator, press **[a $\frac{b}{c}$ ]**, and enter the denominator.
- To enter a mixed fraction, enter the integer part, press **[a $\frac{b}{c}$ ]**, enter the numerator, press **[a $\frac{b}{c}$ ]**, and enter the denominator.
- To convert between a decimal and fractional result, or vice versa, press **[2nd] [F $\leftrightarrow$ D]** and **[ENTER]**.
- To convert a mixed fraction to an improper fraction, or vice versa, press **[2nd] [a $\frac{b}{c}$  $\rightarrow$ d $\frac{e}{f}$ ]** and **[ENTER]**.

### Probability

Pressing **[PRB]** displays the Probability menu, with the following functions:

<b>nPr</b>	Calculates the number of possible permutations of <b>n</b> items taken <b>r</b> at a time.
<b>nCr</b>	Calculates the number of possible combinations of <b>n</b> items taken <b>r</b> at a time.
<b>!</b>	Calculates the factorial of a specified positive integer $n$ , where $n \leq 69$ .
<b>RANDM</b>	Creates a random real number between 0 and 1.
<b>RANDMI</b>	Creates a random integer between (and possibly including one of) two specified integers.

### Statistics

Press **[MODE] [1]** to display the Statistics menu. The menu options are **1-VAR** (for analyzing data in a single dataset), **2-VAR** (for analyzing paired data from two datasets) and **CLR-DATA** (for clearing all datasets).

**To enter data** for statistical analysis:

- From the Statistics menu, choose 1-VAR or 2-VAR.
- Press **[DATA]**.
- Enter an  $x$ -value and press **▼**.
- Enter the frequency of the  $x$ -value (in 1-VAR mode) or the corresponding  $y$ -value (in 2-VAR mode) and press **▼**.
- To enter more data, repeat from step 3.

Data is retained until you overwrite it or clear it. You clear data by selecting CLR-DATA from the Statistics menu.

**To analyze data** you have entered:

- Press **[SUMM]**. A range of statistical variables (see table below) is displayed on the Statistical Results menu. The first variable ( $n$ ) is underlined and its value is on the result line.
- Press **▶** to scroll through the Statistical Results menu (skipping any error messages that appear). The value of each variable is displayed on the result line.
- To use a value in a calculation, press **[ENTER]** when the value is displayed. The variable is copied to the entry line.
- In 2-VAR mode, to predict a value for  $x$  (or  $y$ ) given a value for  $y$  (or  $x$ ), select the **x'** (or **y'**) variable, press **[ENTER]**, enter the given value, and press **[ENTER]** again.

Variable	Meaning
<b>n</b>	Number of $x$ values or $x$ – $y$ pairs entered.
$\bar{x}$ or $\bar{y}$	Mean of the $x$ values or $y$ values.
<b>Sx</b> or <b>Sy</b>	Sample standard deviation.
$\sigma x$ or $\sigma y$	Population standard deviation.
$\sum x$ or $\sum y$	Sum of all $x$ values or $y$ values.
$\sum x^2$ or $\sum y^2$	Sum of all $x^2$ values or $y^2$ values.
$\sum xy$	Sum of $(x \times y)$ for all $x$ – $y$ pairs.
<b>a</b>	Linear regression $y$ -intercept.
<b>b</b>	Linear regression slope.
<b>r</b>	Correlation coefficient.
<b>x'</b>	Predicted $x$ value given $a$ , $b$ , and a $y$ value.
<b>y'</b>	Predicted $y$ value given $a$ , $b$ , and an $x$ value.

**To view or change data:**

- Press **[DATA]**.
- Press **▼** to scroll through the data you have entered.
- To change an entry, display it and enter the new data. The new data you enter overwrites the old entry. Press **▼** or **[ENTER]** to save the change.

**To exit** the statistics application, press **[MODE]** and choose another option.

### Linear System Solver

To solve a set of linear equations:

- Press **[MODE] [2]**.
- Enter the first equation (pressing **[2nd] [X]** and **[2nd] [Y]** to enter  $x$  and  $y$  respectively).  
The equation can be entered as  $ax+by=c$  or  $y=mx+b$ .
- Press **[2nd] [,]** to separate the two equations.
- Enter the second equation (as  $ax+by=c$  or  $y=mx+b$ ).
- Press **[ENTER]**.

The Solutions menu appears with the  $x$ -value displayed on the result line. Press **▶** to see the corresponding  $y$ -value. These solutions are stored in the variables **X** and **Y**. You can use these variables in further calculations.

You can also select a previous equation to reuse or edit. Press **[CL] ▲** until that equation is on the entry line.

### Quadratic Equation Solver

To solve a quadratic equation with real solutions:

- Press **[MODE] [3]**.
- Enter the equation. Express it in the form  $ax^2 + bx + c = 0$ . You can solve a quadratic equation in  $x$  or in  $y$ . If you are entering an equation in  $x$ , press **[2nd] [X]** to enter  $x$ ; otherwise press **[2nd] [Y]** to enter  $y$ . In both cases, press **[X<sup>2</sup>]** to enter the second-order exponent.
- Press **[ENTER]**.

The Solutions menu appears with the first root (**X<sub>1</sub>** or **Y<sub>1</sub>**) displayed on the result line. Press **▶** to see the second root (**X<sub>2</sub>** or **Y<sub>2</sub>**). These roots are stored in the variables **X<sub>1</sub>** and **X<sub>2</sub>**, or **Y<sub>1</sub>** and **Y<sub>2</sub>**. You can use these variables in further calculations.

You can also select a previous equation to reuse or edit. Press **[CL] ▲** until that equation is on the entry line.

### Physical Constants

You can use a number of common physical constants in your calculations. To insert a constant at the cursor position:

- Press **[CONST]** to display the Physical Constants menu.
- Press **▶** until the constant you want is underlined (see table below).
- Press **[ENTER]**.

<b>c</b>	speed of light	299792458 m.s <sup>−1</sup>
<b>g</b>	acceleration of gravity	9.80665 m.s <sup>−2</sup>
<b>G</b>	gravitational constant	6.673 $\times 10^{-11}$ m <sup>3</sup> kg <sup>−1</sup> s <sup>−2</sup>
<b>V<sub>m</sub></b>	molar volume of ideal gas	22.413996 $\times 10^{-3}$ m <sup>3</sup> mol <sup>−1</sup>
<b>N<sub>A</sub></b>	Avogadro's number	6.02214199 $\times 10^{23}$ mol <sup>−1</sup>
<b>e</b>	elementary charge	1.602176462 $\times 10^{-19}$ C
<b>m<sub>e</sub></b>	electron mass	9.10938188 $\times 10^{-31}$ kg
<b>m<sub>p</sub></b>	proton mass	1.67262158 $\times 10^{-27}$ kg
<b>m<sub>n</sub></b>	neutron mass	1.67492716 $\times 10^{-27}$ kg
<b>R</b>	molar gas constant	8.314472 J.mol <sup>−1</sup> K <sup>−1</sup>
<b>h</b>	Planck's constant	6.62606876 $\times 10^{-34}$ J.s
<b>k</b>	Boltzmann's constant	1.3806503 $\times 10^{-23}$ J.K <sup>−1</sup>

Source: National Institute of Standards and Technology, <http://physics.nist.gov>

### Unit Conversion

- Enter the value of the measurement you want to convert.
- Press **[CONV]**.
- Press **▼** to scroll to the appropriate units menu. (There are menus covering distances, area, mass, volume, capacity, temperature, energy, and pressure.)
- Press **▶** until the units you are converting from are underlined; then press **[ENTER]**.
- Press **▶** until the units you are converting to are underlined.

### Error Messages

<b>DIVIDE BY 0</b>	Attempt to divide by zero.
<b>DOM</b>	Input is outside allowable limits.
<b>OVERFLOW</b>	Result is outside the calculator's display limits.
<b>STAT</b>	Statistics key pressed but not in statistics mode.
<b>SYN</b>	Syntax error.
<b>ARG</b>	Inappropriate argument.
<b>SAVE</b>	Cannot store variable or EQN in current mode.
<b>FREQ DOMAIN</b>	Frequency is not 0 or a positive integer.
<b>MULTI SOLS</b>	There is more than one solution.
<b>NO SOLUTION</b>	There is no solution.
<b>NO REAL SOL</b>	There is no real solution.
<b>EQU LENGTH</b>	Input plus constant expression is greater than 80 characters.

### Troubleshooting

If the calculator will not turn on, press **[M+][CONST]** together. If the calculator still doesn't turn on, replace the batteries.

If the calculator is on but you get unexpected results, press **[2nd] [RESET] ▶ [ENTER]**. If problems persist, run the self-test.

**Self-test** Press **[2nd] [RESET]**, and hold down **[2nd] [ $\frac{1}{x}$ ]** and **[DEL]**. When the Test menu appears, press **[1]** and then press **[ENTER]** three times. If error messages are displayed during the test, the calculator needs a service. Press **[DRG][ENTER][ENTER]** to cancel the test.

**Replacing batteries** Push down on the battery compartment cover and slide it off. Replace the two button-cell batteries with new batteries. Use LR44 silver oxide batteries. (Equivalent batteries are G13 and 357.) *Do not use rechargeable batteries.*

If problems persist after you have replaced the batteries, the calculator needs a service. For service information, refer to the warranty statement enclosed with this product.

### Faceplates

To install a faceplate, insert the top locating lugs into the holes provided beneath the **[MODE]** and **[ON]** keys, and press down.

To remove a faceplate, press on the snap visible through the opening on the bottom edge of the calculator.

### Disclaimer

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