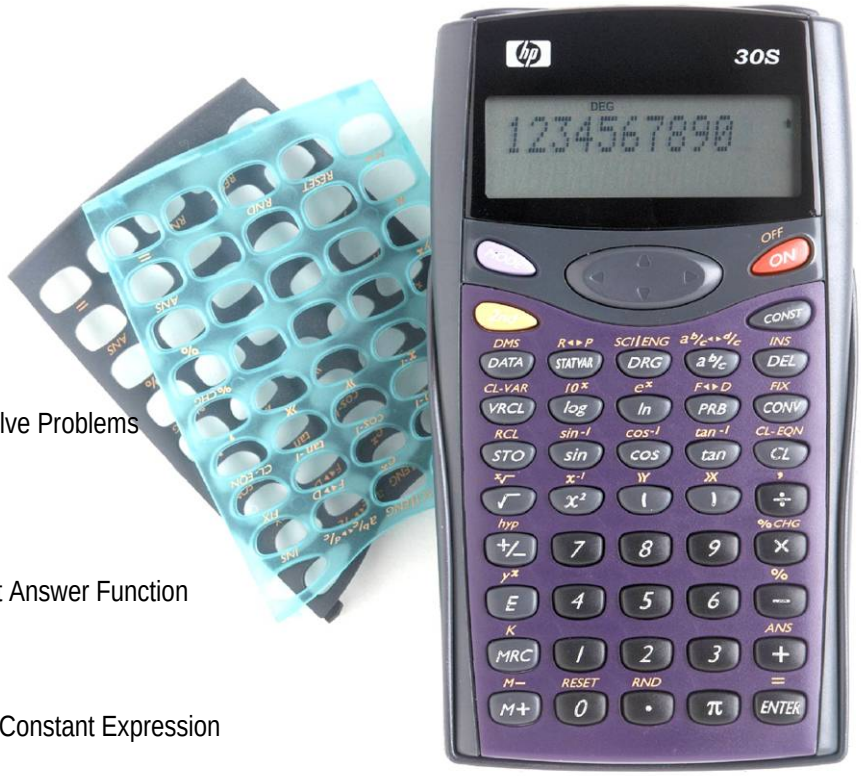
hp calculators



HP 30S Using Memories to Solve Problems

The History Stack and the Last Answer Function

The Memory Variables

The Running Memory and the Constant Expression

Practice Using Memories to Solve Problems

The history stack and the last answer function

The history stack is a record of all the entries made by the user, up to a maximum 320 characters, that is available in any operating mode (except in STAT mode, where only the latest entry is recorded). The main purpose of the history stack is to save you having to type in previous calculations again when reusing or editing them. Use the cursor keys ▲ and ▼ to scroll through the entries. Pressing 2nd ▲ retrieves the oldest entry, whereas 2nd ▼ displays the latest . Be warned that changing the operating mode clears the history stack.

The Last Answer function (2nd ANS) returns the last answer appeared on the result line. This is a most useful function in chain calculations and repetitive evaluations, etc. In addition to the HP 30S learning modules *Basic Arithmetic* and *Solving Problems Involving Percents* which demonstrate the use of this function, there are a few more applications in the examples below.

The memory variables

Pressing VRCL displays a menu with 11 variables, namely A, B, C, D, x_1, x_2, X, Y, y_1, y_2, and EQN. Except EQN, all these variables are meant to store (e.g. 1 STO ENTER stores 1 into A) and recall numbers. To put the name of a variable into the entry line, press VRCL , select the desired variable and then press ENTER (this last step is not necessary if the next keystroke is a numeric or function key). While the two pairs of variables x_1, x_2 and y_1, y_2 , and the X and Y variables are used for keeping the results of solving a quadratic equation or a linear system, respectively, all these variables can also be used by the user provided that it is borne in mind that their values will be replaced by linear and quadratic equation solutions!

The EQN variable is a special register that can contain *expressions,* which are described in the HP 30S learning module *Working with Expressions*.

Note that changing the operating mode does not clear the contents of these variables, but EQN is *not* available in STAT mode.

The running memory and the constant expression

The running memory is similar to the one found on many calculators. It is controlled by the following three keys: MRC , M+ and 2nd M− . This memory is most useful in adding or subtracting a series of results (e.g. when balancing your checkbook). M+ and 2nd M− work much like the ENTER key – the calculation in the entry line is performed and the result is displayed in the result line and stored in the ANS memory. But it is also added (M+) or subtracted (2nd M−) to the running memory. Of course, adding a negative amount using M+ is the same as subtracting that amount with a positive sign using 2nd M− . Pressing MRC recalls the contents of the running memory. When this register memory contains a non-zero value, a small M appears in the display.

The constant expression (K) is any combination of operators, functions, variables and numbers that is automatically appended to the entry line when ENTER is pressed. This is most useful in applying the same operation many times to different inputs. To define the constant expression, press 2nd K , enter the desired expression, say + 56, (you can press CL to clear the previous constant expression, if any) and press ENTER . The K annunciator is lit, which means that whenever ENTER is pressed, + 56 is attached to your input, and the result is displayed. To disable the constant expression feature, simply press 2nd K again.

The HP 30S learning module *Clearing, Editing and Correcting* explains how to clear variables and other data. In brief, to clear all memory variables except EQN, press 2nd CL-VAR ; EQN is cleared by pressing 2nd CL-EQN , and pressing MRC twice in a row (MRC MRC) clears the contents of the running memory.

Practice using memories to solve problems

Example 1: Calculate $1.46+12-7.5+67+987+6-89$ using the M+ key.

Solution: First of all, clear the running memory: MRC MRC . We can add all these numbers as follows:

CL 1 . 4 6 M+ 1 2 M+ 7 . 5 2nd M− 6 7 M+ 9 8 7 M+ 6 M+ 8 9 2nd M−

Press MRC to display the answer.

Answer: 976.96

You may find it more convenient to use the usual way, that is: 1 . 4 6 + 1 2 − … − 8 9 ENTER which is actually shorter, but consider this:

Example 2: Calculate the following operations, and find the sum of the first, second and fourth results:

$35\times\ln 5,\ -2\times 8^{5},\ \sqrt[3]{34}$ and $\dfrac{31}{13^{-3.5}}$.

Solution: The M+ key allows us to select the numbers to be added. Clear the running memory (MRC MRC CL) and press:

3 5 ln 5 ENTER M+
+/− 2 × 8 2nd y^x 5 ENTER M+
3 2nd $\sqrt[3]{}$ 3 4 ENTER
3 1 ÷ 1 3 2nd y^x +/− 3 . 5 ENTER M+

Press MRC to display the sum.

Answers: Rounded to two decimal places, the results are 56.33, –65536, 3.24 and 245563.28, respectively. The sum requested is 180083.61

Example 3: An engineer is working with a type of concrete that has a density of 149.8 lb/ft³ . Store the density of this concrete in a variable and use it to calculate the mass of a concrete beam 2 ft by 1.5 ft by 20ft.

Solution: In many cases it is helpful to use variable names as mnemonics, for example D for density or A for area, but when registers are used to store a table, for instance, then names are meaningless and the numeral for each register is what counts. In this example, storing the density in the variable D makes good sense, to do it press:

CL 1 4 9 . 8 STO ▶ ▶ ▶ ENTER

To calculate the mass, multiply the length by the width by the height. Then recall the number from D and multiply by that. Press the keys:

2 × / . 5 × 2 0 VRCL ▶ ▶ ▶ ENTER

The multiplication symbol is not needed if one of the parts (or both) is a variable name. In this example, notice the implicit multiplication between 20 and D.

Answer: The beam has a mass of 8988 pounds. This value of the variable D can be used for further calculations. If a different type of concrete is selected, the density of this new type can be stored in D and the calculations can be repeated. The value in D is not lost when the calculator is turned off.

Example 4: The formula below uses the expression (0.2 + sin(35°)) three times. Store this expression in a variable and then solve the formula.

$$\frac{5 \cdot \arcsin(0.2 + \sin(35))}{\arccos(0.2 + \sin(35))} \cdot \sqrt{3 \cdot (0.2 + \sin(35))}$$

Solution: The expression uses degrees, so select DEG mode if it is not already set. (To do this press DRG , select DEG and press ENTER). First, calculate the expression that is used several times and store its value in the variable A: (0.2 + sin(35°))→A. Press:

. 2 + sin 3 5 ▶ STO ENTER

Variable A now contains the partial result 0.773576436. And the formula is now reduce to this:

$$\frac{5 \cdot \arcsin(A)}{\arccos(A)} \cdot \sqrt{3 \cdot A}$$

Press: 5 2nd sin⁻¹ VRCL ENTER ▶ √ 3 VRCL ENTER ▶ ÷ 2nd cos⁻¹ VRCL ENTER ENTER

Even though you can always use the ANS register to do this kind of calculations, memory variables are less volatile and can be reused in further calculations.

Answer: 9.815891138

Example 5: A student needs to use the law of cosines to find the side c of three triangles with sides a, b, and c and C being the angle opposite side c. The known values are: a=24, b=28, C=34º for the first triangle, a=18, b=28, C=45º in the second exercise, and a=23, b=17, C=45º in the third case. What can her HP 30S do for her?

Solution: The three exercises consist in applying the same formula, namely:

$$c = \sqrt{a^2 + b^2 - 2ab\cos C}$$

The HP 30S has a powerful feature to evaluate a formula for various values: an entire expression can be *stored in a variable* and when executed, the calculator automatically prompts the user for the values that

will be used for all the variables present in the expression. (This topic is discussed in greater detail in the HP 30S learning module *Working with Expressions*.) First of all, we have to store the above square root: $\sqrt{a^2 + b^2 - 2ab\cos C} \rightarrow EQN$. To do so press:

2nd CL-VAR √ VRCL x^2 + VRCL ▶ x^2 − 2 VRCL ENTER VRCL ▶ cos VRCL ▶ ▶ ENTER ▶ ▶ STO ◀ ENTER

Now, let's invoke the expression by pressing VRCL ◀ ENTER . The above expression appears in the entry line. Even though it is identical to the expression initially entered, there is one important difference: this one, when executed, will prompt for the values of A, B and C ,whereas this same expression would have returned a result using the *current* values of A, B and C had it not been stored in EQN. Press ENTER . The HP 30S displays A = 0 in the entry line and the cursor is placed just after the equal sign. To enter the new value for A, simply press CL 2 4 ENTER . And the same goes for B and C:

2 8 ENTER
3 4 ENTER

The result, 15.68, is displayed in the result line. Let's now solve the second triangle by evaluating the expression again: VRCL ◀ ENTER ENTER A is now 18 so press 1 8 ENTER . Since B is still 28, just press ENTER . C has changed, though, press 4 5 ENTER and the side c of this triangle appears in the result line. Finally, these are the keys needed to solve the third exercise:

VRCL ◀ ENTER ENTER 2 3 ENTER 1 7 ENTER ENTER

Answer: Rounding to two decimal places, the side c of the three triangles are 15.68, 19.88 and 16.28 respectively.

Example 6: Verify that $1.3407 + \dfrac{1}{1.3407 + \dfrac{1}{1.3407 + ...}} = \dfrac{1.3407 + \sqrt{1.3407^2 + 4}}{2}$

Solution: Continued fractions can be easily evaluated on the HP 30S using the ANS function. Since we are working with four decimal digits, let's set FIX 4: 2nd FIX 4 , and then store 1.3407 in the running memory and in the last answer register:

MRC MRC CL 1 . 3 4 0 7 M+ ENTER

Now enter the following operations into the entry line: $Ans^{-1} + 1.3407$:

2nd x^{-1} + MRC ENTER

which must be repeated until the result does not change. Simply press ENTER as many times as needed. Results are 2.0866, 1.8200, 1.8902, 1.8698, 1.8755, 1.8739, 1.8744, 1.8742, 1.8743, 1.8742, 1.8742. Therefore, the fraction seems to converge to the number 1.8742.

Let's now evaluate the right-hand side:

(MRC + √ MRC x^2 + 4 ▶) ÷ 2 ENTER

Answer: Both sides of the equation evaluate to 1.8742. (Remember to press 2nd FIX . to restore the default display format).