hp calculators

HP 9s Basic Arithmetic

Practice Doing Arithmetic

Practice doing arithmetic

This learning module describes how to carry out simple arithmetic calculations on your HP 9s. Since the HP 9s uses the familiar *algebraic* entry system, you will not need to learn a new method: expressions involving the four basic arithmetic functions are entered in the same left-to-right order that you would write them on paper.

We will work in the main operating mode (i.e. when none of the following annunciators is lit: CPLX, STAT, BIN, OCT, and HEX), also known as DEC mode. DEC is the default operating mode and where common math calculations are done. Basic arithmetic in Base-N mode (i.e. with numbers in HEX, BIN or OCT bases) is possible, as well as in STAT mode but the memory is not available in this mode. In CPLX mode the ⊕ , ⊖ , ⊗ and ⊘ keys expect complex numbers. All these modes are described in greater detail in their respective learning modules and in the HP 9s learning module *Operating Modes and Display Format..*

Simply press ② ⌐ to make sure you're in the proper mode to perform the examples below. In the following examples the default display format (floating point) is assumed. If you have changed this format, press these keys to restore the default mode: press ⊘ ② ᶠ/ₓ ⊙ . Display formats are also discussed in the HP 9s learning module *Operating Modes and Display Format*.

To be sure your calculator displays the same results as shown below, press ⊘ now to clear any previous calculation.

Example 1:   Add 721.07 and 223.89

Solution: Press:

⑦ ② ① ⊙ ⓪ ⑦ ⊕ ② ② ③ ⊙ ⑧ ⑨ ᴱᴺᵀᴱᴿ

The result appears as soon as ᴱᴺᵀᴱᴿ has been pressed.

Answer: 944.96

Once the HP 9s has completed a calculation, the result can be used in another one. This is called a *chain* calculation:

Example 2:   Multiply the previous result by 5

Solution: ⊗ ⑤ ᴱᴺᵀᴱᴿ

Answer: 4724.8

Example 3:   Calculate $750.34 \times 36 - 25$

Solution: This is a new calculation, but you need not press ᴱᴺᵀᴱᴿ first as we are not going to *repeat* any calculation (more on this later). Press:

⑦ ⑤ ⓪ ⊙ ③ ④ ⊗ ③ ⑥ ⊖ ② ⑤ ᴱᴺᵀᴱᴿ

Note that you need not put 750.34×36 in parentheses because ⊗ and ⊘ take priority over ⊕ and ⊖ : when the ⊖ key was pressed, the partial result 750.34×36 was displayed, and the ᴱᴺᵀᴱᴿ key then performed the calculation $(750.34 \times 36) - 25$.

Answer: 26987.24

Example 4:   Calculate –75 × 45 and 4.52 × (–7.1)

Solution: To key in negative numbers the ⊕⁄⊖ key must be pressed *after* or *while* keying in the number, but before pressing the next function key. The first calculation can be done in several ways:

7 +/– 5 ✕ 4 5 ENTER or
7 5 +/– ✕ 4 5 ENTER

But be warned that 7 5 ✕ +/– 4 5 ENTER won't produce the same result (it returns 3375 instead) because the Change Sign function (i.e. +/–) is cancelled by the ✕ key. If you press +/– after a function key, you must press that function key again so that the sign is not lost: 7 5 ✕ +/– ✕ 4 5 ENTER .

Likewise, to do the second calculation you can press either:

4 • 5 2 ✕ 7 +/– • 1 ENTER or
4 • 5 2 ✕ 7 • +/– 1 ENTER or
4 • 5 2 ✕ 7 • 1 +/– ENTER

Answers: –3375 and –32.092

Results greater than 10^{10} or less than 10^{-9} are displayed in scientific notation. To enter numbers in scientific notation, key in the mantissa (there is no need to enter it, if it is 1), press +/– if the mantissa is negative, press the EXP key, key in the exponent and finally press +/– if the exponent is negative. In fact, you can enter the sign of the exponent anytime after pressing the EXP key.

Example 5:   Calculate 1 000 000 ÷ 2.75

Solution: EXP 6 ÷ 2 • 7 5 ENTER

             Since the mantissa is 1, it can be omitted. Using the EXP key is simpler to work with than 1000000 and shorter than 6 2ndF 10ˣ F ÷ 2 • 7 5 ENTER .

Answer: 363636.3636

Parentheses are important in specifying the order of operation. Without parentheses, the HP 9s calculates according to the order of algebraic precedence, that is: multiplications and divisions take priority over addition and subtraction. On the HP 9s parentheses are not needed to enclose the argument of one-argument functions, such as SIN(45), because they take their argument from the number currently being displayed: they are indeed postfix functions. Trailing parentheses that would be entered just before pressing ENTER can be omitted. Parentheses are entered by pressing the ⛁ and ⛁ keys. Up to 13 nested parentheses can be entered in a single calculation, even though the number of pending operations is limited to six. If the "( ) " annunciator is not lit when pressing the ⛁ key, it may be because the last key pressed was not one of the following: ON/C , CE , ENTER or a two-argument function.

Example 6:   Calculate $(73 - 89) \times (523 + 34)$

Solution: ⒤ ⑦ ③ ⊖ ⑧ ⑨ ⑴ ⓧ ⒤ ⑤ ② ③ ⊕ ③ ④ ⑴ (ENTER)

Note that the partial results $(73 - 89)$ and $(523 + 34)$ are displayed as soon as the parentheses are closed by pressing the ⑴ key. Note also that there's no implicit multiplication on the HP 9s, i.e. pressing the ⓧ key is mandatory. The first parenthesis is not necessary if the (ENTER) key is pressed before ⓧ :

⑦ ③ ⊖ ⑧ ⑨ (ENTER) ⓧ ⒤ ⑤ ② ③ ⊕ ③ ④ ⑴ (ENTER)

Also, the last closing parenthesis is not necessary either:

⑦ ③ ⊖ ⑧ ⑨ (ENTER) ⓧ ⒤ ⑤ ② ③ ⊕ ③ ④ (ENTER)

The (ENTER) key always performs all pending operations.

Answer: −8912

Parentheses are also used for specifying the order in which operations with the same priority must be performed. Compare the following two examples.

Example 7:   Calculate $\dfrac{8/3}{5}$

Solution: ⑧ ⊘ ③ ⊘ ⑤ (ENTER)

Parentheses are not necessary in this case because as soon as the second ⊘ key is pressed, the pending operation 8/3 is done, as intended.

Answer: 0.533333333

Example 8:   Calculate $\dfrac{8}{3/5}$

Solution: ⑧ ⊘ ⒤ ③ ⊘ ⑤ (ENTER)

Answer: 13.33333333

One of the handy features of the HP 9s is that calculations can be repeated easily.

Example 9:   Find the first five multiples of e

Solution: Finding the first n multiples of a number is very easy on the HP 9s. The number e is the base of the natural logarithms. You need not enter it, because it can be easily calculated as follows:

1 ②ₙₐF e^x E

This is actually the first multiple ($e \times 1$). To find the second, simply press:

+ ENTER

The second multiple is returned. Note that no number was keyed in between the + and the ENTER keys. When + , − , × or ÷ is followed by the ENTER key, the first argument (i.e. the number displayed when the function key was pressed) is used as the second argument too. That is to say:

$$(\text{ON/C}) \; a \left\{ \begin{matrix} \div \\ \times \\ - \\ + \end{matrix} \right\} \; \text{ENTER} \quad \text{is the same as} \quad (\text{ON/C}) \; a \left\{ \begin{matrix} \div \\ \times \\ - \\ + \end{matrix} \right\} \; a \; \text{ENTER}$$

From now on, each press of ENTER gives a multiple of e. So, press the ENTER key three times to find the other three multiples.

Answer: 2.718281828, 5.436563657, 8.154845485, 10.87312731, 13.59140914.

Example 10: We can always add 1 by pressing two keys, but is there a way of counting by pressing a single button?

Solution: Here's a simple yet useful counting technique. Press 1 and ENTER . As simple as that. Now each time ENTER is pressed, the displayed number is incremented by one. Of course, several refinements are possible: we can initialize the counter to any desired number and count by a number other than one:

Example 11: Set the previous counter so that it displays odd numbers.

Solution: Simply press 1 + 2 ENTER , which, of course, returns 3. Now, successive presses of ENTER will return 5, 7, 9, etc. because ENTER repeats the keys + 2 , using the displayed number as the first operand, which can also be entered by the user:

Example 12: Calculate 1130 + 135, 1095 + 135 and 724 + 135.

Solution: Note that the operation "+ 135" is present in all these calculations. We need not enter "+ 135" each time:

1 1 3 0 + 1 3 5 ENTER (The operation "+ 135" is now in memory)
1 0 9 5 ENTER (returns 1095 + 135)
7 2 4 ENTER (returns 724 + 135)

Answers: 1265, 1230 and 859

This feature also works for the − and ÷ keys. For example, 3 4 5 ÷ 2 5 ENTER stores the operation / 25. Pressing 1 0 0 ENTER returns 4 (i.e. 100 / 25). But , for × the operand stored is the first one (often known as the multiplicand) and not the multiplier:

Example 13: Calculate 23 × 13, 15 × 13 and 74 × 13.

Solution: Now, the reoccurring operation is × 13, but we have to enter it *first*:

[1] [3] [×] [2] [3] [ENTER] (The operation "13 ×" is now in memory)
[1] [5] [ENTER] (returns 13 × 15)
[7] [4] [ENTER] (returns 13 × 74)

When in doubt whether the intended factor is being used, use the X↔Y function ([2ndF] [X–Y]). In this example, pressing [2ndF] [X–Y] returns 13. Remember to press [2ndF] [X–Y] again if you want to multiply any other number by 13, otherwise you'll be multiplying by the last result, 962.

Answers: 299, 195, and 962.

The following way of calculating square roots, named after Jimmy Lewis of New York University, was described in the 1973 book "*How to get the most out of your pocket calculator.*" [1] It was aimed at users of calculators not having the [√] key but having the constant divisor feature, which is also present on your HP 9s…

Example 14: In essence, the Lewis method for finding the square root of *a,* where a ≥ 0, is as follows:

♦ Store $a - 1$ in M, (i.e. a [–] [1] [ENTER] [X–M])
♦ Press [ON/C]
♦ Press [2] [ENTER] [÷] [ENTER] [MR] [ENTER] [+] [2]
♦ Repeat the previous step until the resulting number does not change.
♦ The displayed number is $\sqrt{M+1} - 1 = \sqrt{a} - 1$, so simply press [1] [ENTER] to find $\sqrt{a}$.

Find $\sqrt{2}$ using the Lewis method.

Solution: [ON/C]
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.5)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.4)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.416666666)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.413793103)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.414285714)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.414201183)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.414215686)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.414213198)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.414213624)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.414213551)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.414213564)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.414213562)
[2] [ENTER] [÷] [ENTER] [1] [ENTER] [+] (returns 0.414213562) [1] [ENTER]

Answer: $\sqrt{2}$ = 1.414213562 to ten significant digits.

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[1] This method is based on the formula $2 + \cfrac{a}{2 + \cfrac{a}{2 + ...}} = 1 + \sqrt{a+1}$, where $a \geq 0$.

[2] Note that this sequence is one keystroke shorter than the equivalent [2] [ENTER] [÷] [MR] [ENTER] [2ndF] [x⁻¹] [+] and as long as ([2]) [2ndF] [x⁻¹] [×] [MR] [+] [2] [ENTER] (in which case 1 must be *subtracted* at the end: [–] [1] [ENTER]).