hp calculators


HP 30b Basic Arithmetic

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## Basic Arithmetic

Any basic arithmetic problem can be easily solved with the HP 30b's built-in arithmetic functions. Using the efficiency of its Reverse Polish Notation (RPN) logic system or its algebraic and chain operating modes, daily arithmetic problems can be handled and solved quickly. Note that there is an entire learning module devoted to RPN mode and how to use it efficiently as well as an entire module devoted to using algebraic and chain mode efficiently. This module is only an introduction.

### RPN and the order of operations

When using RPN mode, functions in the HP 30b are performed as their keys are pressed. Some functions apply to one number only, others return values from two numbers. On the HP 30b, [+], [−], [×], [÷] and [$y^x$] (and [nPr] and [nCr]) apply to two already entered numbers. As a general rule, both numbers are entered in a sequence and are separated by pressing [INPUT] before pressing the two-number function. (Actually the [=] key also works just like the [INPUT] key in RPN mode if you prefer). If one of the numbers is already in the display as a result from any previous operation, simply key the second number and execute the function.

In RPN mode, there is no order of operations to remember. Operations are performed when you press the key. In other words, you determine the order in which operations are evaluated. RPN mode is entirely consistent in this respect.

### Chain mode and the order of operations

On the HP 30b in chain mode, functions are performed once they have enough arguments. Some functions apply to one number only, others return values from two numbers. One number functions in chain or algebraic mode work like RPN mode functions – they execute as soon as you press the function key. One number functions include [LN] [$e^x$] [$x^2$] [√] [1/x] [!] [SIN] [COS] [TAN] and others included in the MATH menu. Functions that operate on one number perform their function on a number just entered or a value already showing in the display.

On the HP 30b, [+], [−], [×], [÷] and [$y^x$] (and [nPr] and [nCr]) work with two numbers. Enter the first number, press the proper function key, enter the second number and then press the [=] key. For example, the expression 1 + 2 x 3 = will be evaluated by the HP 30b as follows: (1) Entering [1] [+] [2] [×] will cause the HP 30b to solve 1 + 2 (yielding a value of 3) and be ready to multiply this intermediate result by the next number entered. (2) When the [3] [=] keys are pressed, the HP 30b will multiply the previous intermediate result by 3 to provide the answer of 9. If you wish to alter the order of operations, you can use parentheses to force evaluation using whatever order is needed.

### Algebraic mode and the order of operations

In algebraic mode, functions are evaluated according to a hierarchy or standard order. One number functions as described in the previous section are evaluated immediately when the key is pressed. For example, multiplication and division are performed before addition and subtraction, but after the power function [$y^x$]. The entire list of the order of operations is included in the 30b User Guide.

For the expression 1 + 2 x 3 =, the HP 30b would evaluate it as follows in algebraic mode: (1) Entering [1] [+] [2] [×] will cause the HP 30b to store the 1 and the addition as a pending operation until the multiplication is completed. (2) When the [3] [=] keys are pressed, the HP 30b will multiply the 2 by 3 to provide the intermediate answer of 6. (3) The HP 30b will then use this pending result of 6 as the second number for the addition operation by adding 1 to it for a final result of 7. If you wish to alter the order of operations, you can use parentheses to force evaluation using whatever order is needed.

Note: The HP 30b can handle up to 12 pending operations or open parentheses in algebraic or chain mode.

## Practice solving basic arithmetic problems

Example 1: Evaluate $1/x$ given $x = 7.2$

Solution: The reciprocal ($1/x$) is categorized as a one-number function, so all that is required is to enter the number and press the function key regardless of the mode. Note that the $1/x$ function is the shift of the [−] key.

[7] [.] [2] [▬] [1/x]


Figure 1

Answer: The reciprocal of 7.2 is 0.14.

Example 2: Evaluate both 10 + 3.5 x 4 and (10 + 3.5 ) x 4 as written and compare the results.

Solution: The first expression can be evaluated with the following keystroke sequences:

In RPN mode: [3] [.] [5] [INPUT] [4] [×] [1] [0] [+]

In algebraic mode: [1] [0] [+] [3] [.] [5] [×] [4] [=]


Figure 2

In chain mode: [1] [0] [+] [3] [.] [5] [×] [4] [=]


Figure 3

The second expression can be evaluated with the following keystroke sequences:

In RPN mode: [3] [.] [5] [INPUT] [4] [×] [1] [0] [+]

In algebraic or chain mode: [(] [1] [0] [+] [(] [3] [.] [5] [×] [4] [)] [=]

In chain mode: [1] [0] [+] [3] [.] [5] [×] [4] [=]


Figure 4

Answer: The first expression evaluates to 24 in RPN and algebraic mode, but to 54 in chain mode. The second expression evaluates to -5 in all three modes. The difference results from the way chain mode and algebraic mode work when presented with numbers and operations. Also note that the parentheses could be typed in chain mode – the result will be the same as algebraic. However, if you do not use the parentheses in algebraic mode, you will get a different (and incorrect) answer. You should become familiar with the way the mode you choose to use operates and practice to ensure you use it properly.

Example 3: Evaluate: $\frac{(30-3.5\times 5)}{2}$ =

Solution: As written, the top of the expression should be evaluated before the division.

In RPN mode: 3 0 INPUT 3 . 5 INPUT 5 × − 2 ÷

In algebraic mode: ( 3 0 − 3 . 5 × 5 ) ÷ 2 =

In chain mode: ( 3 0 − ( 3 . 5 × 5 ) ) ÷ 2 =


Figure 5

Answer: The expression evaluates to 6.25. Note that even though the expression is not written with a set of parentheses around the 3.5x5 portion, it is necessary to insert these in chain mode to make sure the result follows implied standard order of operations.

Example 4: Evaluate $\frac{\left((10-3.5)\times 5-7.2\right)\times 4}{(2+4.7\div 3)}$ =

Solution: The following keystroke sequence is used to find the numerator:

In RPN mode: 1 0 INPUT 3 . 5 − 5 × 7 . 2 −
4 × 2 INPUT 4 . 7 INPUT 3 ÷ + ÷

In algebraic mode: ( ( 1 0 − 3 . 5 ) × 5 −
7 . 2 ) × 4 ÷ ( 2 + 4 . 7 ÷ 3 ) =

In chain mode: ( ( 1 0 − 3 . 5 ) × 5 −
7 . 2 ) × 4 ÷ ( 2 + ( 4 . 7 ÷ 3 ) ) =


Figure 6

Answer: The expression evaluates to 28.37. Note the extra set of parentheses required in the denominator's calculation in chain mode. Also note how the approach in RPN mode is consistent regardless of the problem.