



## hp calculators

### HP 17bII+ The Solver

The HP Solver

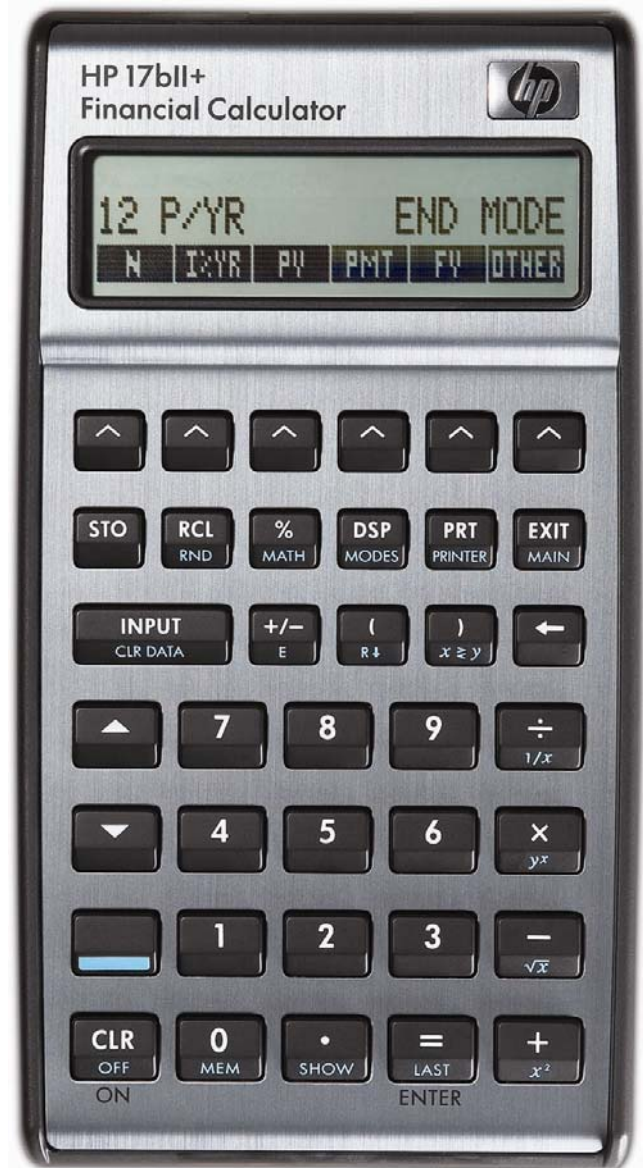
Accessing the solver

Entering an equation

Editing an equation

Solving an equation

Practice using the solver



## The HP Solver

One of the most powerful tools contained in the HP 17bII+ calculator is the HP Solver. This tool allows you to key in an equation in algebraic format, enter values for the variables you know, and then automatically solve for the unknown variable. For example, you could key in the equation  $A = B + C$ , and if you know the value of A and C, automatically solve for the unknown variable B – without any programming. Very complicated equations can be entered and solved in this manner.

The HP solver allows the user to customize the HP 17bII+ calculator to suit their own personal needs and circumstances. It is unique to HP and demonstrates HP’s continuing commitment to give users flexibility to find their own solutions.

## Accessing the solver

The HP Solver is accessed from the main menu, as shown below.

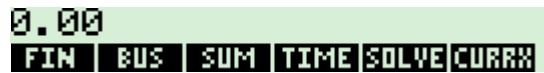


Figure 1

Pressing  will do one of two things. If there are no existing equations in the HP 17bII+ calculator, then the screen in figure 2 is displayed. This indicates that you must press  to enter an equation.



Figure 2

If the HP 17bII+ already has some equations in the equation catalog, a screen similar to the one shown in figure 3 would be displayed. The equation is shown on the top line of the screen.



Figure 3






You can use the  and  keys to scroll up and down through the list of equations in the calculator. When you get to the top of the list, the screen in figure 4 is displayed. When you get to the bottom of the list, the screen in figure 5 is displayed.



Figure 4



Figure 5

The  key allows you to edit the currently displayed equation. The  key allows you to remove the currently displayed equation from the catalog. The  key will enter the equation calculation environment for the currently displayed equation where you can solve for variables within the equation.

## Entering an equation



When you are in the equation catalog and the  menu key is displayed, pressing it allows you to enter a new equation into the catalog. Pressing  displays the screen as shown in figure 6.



Figure 6

The prompt is displayed indicating that you should use the displayed alpha menu keys to enter the equation and press when you are finished. Each of the displayed alpha menu keys will access a second screen that allows the entry of the individual letters shown. For example, the key allows you to enter , , , or . If you press the second screen is shown as below. To exit this screen, press one of the letter menu keys or .



Figure 7

If you press you can enter one of many special characters if you wish. These are shown in the HP 17bII+ User Manual in the solver chapter.

Suppose you wish to enter  $A = B + C$  into the solver. If the screen from figure 6 is still displayed, you would press the following keys: , , , , , . If you pressed the keys correctly, the screen should look like figure 8 below. If your equation is too long to fit in the display, it may look like the screen in figure 9 below with an ellipsis at the end of the equation indicating that the text continues off the display. The example in figure 9 also shows that you can use long variable names if you wish.



Figure 8



Figure 9

If you now wished to enter another equation, simply press again and enter the next equation.

### Editing an equation

If you need to edit the equation, press and the screen shown in figure 9 is displayed. The blinking cursor is positioned at the first character of the equation. From this position, will delete the character at the position of the cursor. The next four menu keys displayed allow you to "move through" an equation to edit other positions within the list. and will move the cursor one position left or right. and will move the cursor to the beginning or end of the equation. displays the alpha menu key environment to allow you to add letters to the equation.



Figure 10

After pressing two times, the display looks like this:



Figure 11

Pressing deletes the B. Now press and then to change the equation to the one shown



Figure 12

**Solving an equation**

When an equation is displayed in the equation catalog, pressing the **ENTER** key will enter the equation calculation environment you can solve for variables within the equation. What the HP 17bII+ does at this point is scan through the equation to verify that it is valid. For example, if you press **ENTER** with the equation displayed in figure 13 below, the calculator will briefly display “invalid equation” and prompt you in edit mode to fix the equation.



Figure 13

If the equation is valid, the HP 17bII+ will scan through the equation for variable names and create a custom menu key screen for the variables in the equation. If the equation  $A = D + C$  were the one chosen, then the solver screen would appear as shown in figure 14 below after **ENTER** was pressed. Note: although you can use long variable names in equations, names longer than 4 or 5 characters long may not be displayable in a menu key location in the display.



Figure 14

At this point, you can enter values for any two variables that you know and solve for the unknown variable. If  $A = 6$ , you press **6** **ENTER**. The display appears as shown in figure 15.



Figure 15

If  $D = 2$ , press **2** **ENTER**. The display appears as shown in figure 16.



Figure 16

To solve for C, just press **ENTER**. Figure 17 shows the result.



Figure 17

What could be simpler?

**Practice using the solver**

Example 1: Enter the breakeven formula  $BE = FC \div CM$ , where BE is the breakeven point in units, FC are the fixed costs in dollars, and CM is the contribution margin per unit.

Solution:



Figure 18

Answer: The formula should appear as shown above in figure 18.

Example 2: Using the formula entered in example 1, determine how many units would need to be sold to breakeven if your fixed costs are \$5.5 million per year and your contribution margin per unit is \$12.50. Assume this example is being worked immediately after example 1 and that the HP 17bII+ is still showing the display from figure 18.

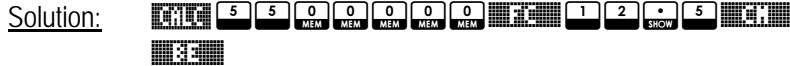


Figure 19

Answer: Breakeven is 440,000 units per year.

Example 3: Enter a new equation to solve for the number of permutations of n items taken r at a time as shown in the formula below. The ! symbol represents the factorial function found in the MATH menu of the HP 17bII+.

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

Figure 20

(Permutations determine the number of ways you can select a subgroup of a specified number of items from a larger group, where the order of each of the items in the subgroup is important.)



Figure 21

At this point, the factorial function needs to be entered. Note how the N! factorial function is spelled out as FACT. An open parenthesis is provided since the factorial function requires an argument.

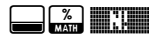


Figure 22



Figure 23

Answer: The formula should appear as shown in figure 23 above.

Example 4: Using the permutation formula from example 3, compute the number of permutations of 15 items taken 3 at a time. This example might also be worded like this: "How many ways can you draw a set of 3 items from 15 total items, where the order of the first, second and third item drawn is important?" In this terminology, 15 would be N and 3 would be R. Assume that the example 3 equation is still displayed and that this example is being worked immediately after example 3.


Solution: 



Figure 24

Note that although N occurs twice in the equation, only one menu key label is used in the solve environment, since N will have the same value in both locations within the formula.

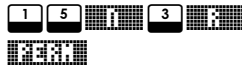


Figure 25

Answer: There are 2730 ways you can draw sets of 3 items out of 15 total items, assuming the order in which the items are drawn is important.