hp calculators

HP 17bII+ The Solver – Using functions

The HP Solver

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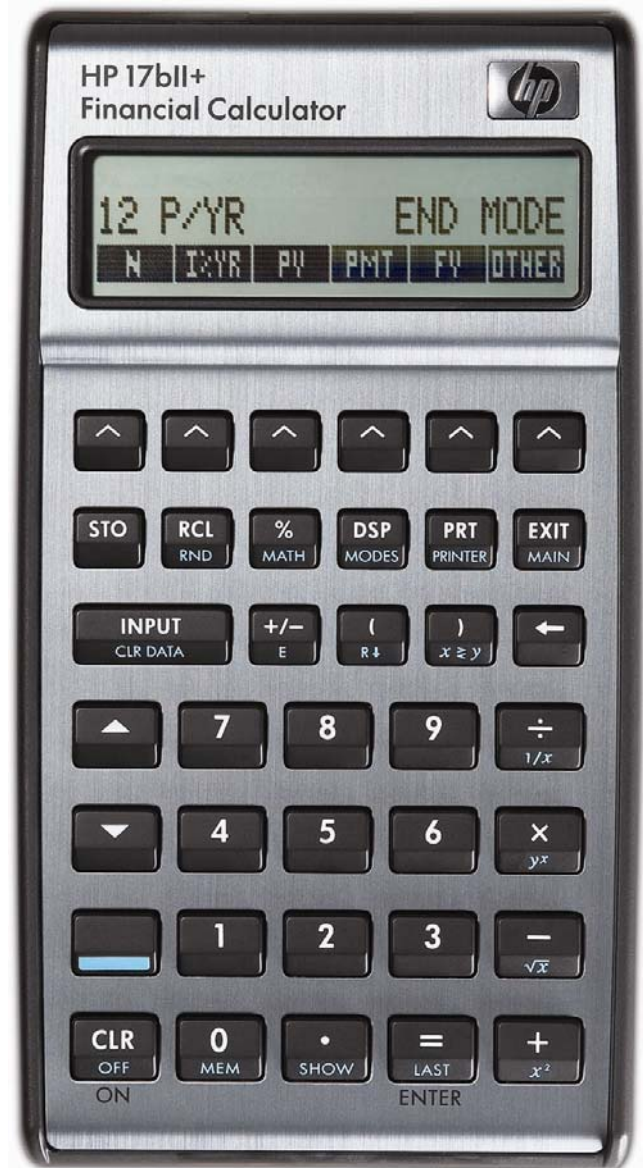
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The HP Solver

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.

More information is found in the learning module that introduces the solver.

Accessing the solver

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

```
0.00
 FIN | BUS | SUM | TIME|SOLVE|CURRX
```
Figure 1

Pressing **SOLVE** 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 **NEW** to enter an equation.

```
(NEW) FOR NEW EQUATION
 CALC | EDIT |DELET| NEW
```
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.

```
A=B+C
 CALC | EDIT |DELET| NEW
```
Figure 3

The **EDIT** key allows you to edit the currently displayed equation. The **DELET** key allows you to remove the currently displayed equation from the catalog. The **CALC** 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 **NEW** menu key is displayed, pressing it allows you to enter a new equation into the catalog. Pressing **NEW** displays the screen as shown in figure 4.

```
TYPE EQUATION; [INPUT]
 ABCDE|FGHI |JKLM |NOPQ |RSTUV|WXYZ
```
Figure 4

The prompt is displayed indicating that you should use the displayed alpha menu keys to enter the equation and press **INPUT CLR DATA** 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 **ABCDE** key allows you to enter **A**, **B**, **C**, **D**, or **E**. If you press the second screen is shown as below. To exit this screen, press one of the letter menu keys or **EXIT MAIN**.

Suppose you wish to enter A = B + C into the solver. If the screen from figure 4 is still displayed, you would press the following keys: ▓▓▓▓ ▓▓▓ ▓▓ ▓▓▓▓ ▓▓▓ ▓▓ ▓▓▓▓ ▓▓▓ ▓▓▓▓ . If you pressed the keys correctly, the screen should look like figure 5 below. If your equation is too long to fit in the display, it may look like the screen in figure 6 below with an ellipsis at the end of the equation indicating that the text continues off the display. The example in figure 6 also shows that you can use long variable names if you wish.

```
A=B+C
CALC EDIT DELET NEW
```
Figure 5

```
COST=WEIGHT×POUNDS+FE...
CALC EDIT DELET NEW
```
Figure 6

Solving an equation

When an equation is displayed in the equation catalog, pressing the ▓▓▓▓ 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. 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 7 below after ▓▓▓▓ 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.

```
0.00
  A    D    C
```
Figure 7

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 ▓ ▓▓▓ . The display appears as shown in figure 8.

```
A=6.00
  A    D    C
```
Figure 8

If D = 2, press ▓ ▓▓▓. The display appears as shown in figure 9.

```
D=2.00
  A    D    C
```
Figure 9

To solve for C, just press ▓▓▓. Figure 10 shows the result.

```
C=4.00
  A    D    C
```
Figure 10

Using functions

In the solver basics learning module a solver equation is presented that uses the factorial function to compute solve for the number of permutations of n items taken r at a time. In fact, the HP 17bII+ solver has a multitude of functions available for use within solver equations. These functions range from (of course) the basic math functions found on the keyboard to other functions that are available only within the solver. These functions are listed in table 12-2 of the HP 17bII+ Users Guide. Several functions are shown as examples of what can be done below.

Sample solver functions

DDAYS(d1:d2:cal)   Determines the number of dates between the dates d1 and d2. The cal argument has values of 1 for an actual calendar recognizing leap years, 2 for an actual calendar that ignores leap years and 3 for a 360 day calendar of 12 months, each with 30 days.

IF(cond:exp1:exp2)   Evaluates the conditional expression cond. If cond is true, exp1 is evaluated. If cond is false, exp2 is evaluated. This function is covered in another learning module.

MAX(x:y)   Returns the maximum (largest) of x and y. Either argument can be a variable within the equation or a constant.

MIN(x:y)   Returns the minimum (smallest) of x and y. Either argument can be a variable within the equation or a constant.

∑(ctr:c1:c2:s:expr)   Sums the algebraic expression expr for values of the counter variable ctr stepping from the value of c1 to the value of c2, incrementing by the step value s. This function is covered in another learning module.

SPFV(i%:n)   Computes the future value of a single $1 payment at the i% interest rate, n periods into the future. The i% argument is the interest rate per period and n represents the total number of periods. This is a compound interest future value function.

SPPV(i%:n)   Computes the present value of a single $1 payment n periods in the future at the i% interest rate. The i% argument is the interest rate per period and n represents the total number of periods. This is a compound interest present value function.

USFV(i%:n)   Computes the future value of a uniform series of $1 payments at the i% interest rate. The i% argument is the interest rate per period and n represents the total number of periods. This is an ordinary annuity future value function.

USPV(i%:n)   Computes the present value of a uniform series of $1 payments at the i% interest rate. The i% argument is the interest rate per period and n represents the total number of periods. This is an ordinary annuity present value function.

Note that the arguments to these functions are separated with a colon. This character is entered when the alpha mode is active within the solver by pressing one of the letter selection keys, such as ▨▨▨▨, and then pressing ▨▨▨▨. The colon character is the first character on the menu page displayed, as shown in figure 12 below.

Figure 11

Figure 12

Remember that this is only a <u>small</u> sample of the functions available within the solver. Other functions include a multitude of math functions, integer division and mod functions, as well as functions that give access to specific cash flows within cash flow and sum lists.

Some of these functions will be used within the examples below. They are shown to illustrate possible uses that may prove of value to you as you use the HP 17bII+ calculator.

Practice using solver functions - DDAYS

Example 1: Use the DDAYS function in a solver equation to compute simple interest due between two dates. Use the formula INT = RATE x BAL x DDAYS(D1:D2:1) ÷ 365. The DDAYS function will compute the number of dates between the dates D1 and D2. The third DDAYS argument will take into account leap years and use an actual calendar. The dates should be entered according to the current date mode. This example assumes the HP 17bII+ is in the MM.DDYYYY mode.

Solution:

INT=RATE×BAL×DDAYS(D1…

| CALC | EDIT | DELET | NEW |

Figure 13

Answer: The formula should appear as shown above in figure 13.

Example 2: Use the INT solver formula from example 1 to compute the simple interest due on a $6500 balance at a 5% simple interest rate between the dates of December 5, 2008 and March 10 2009.
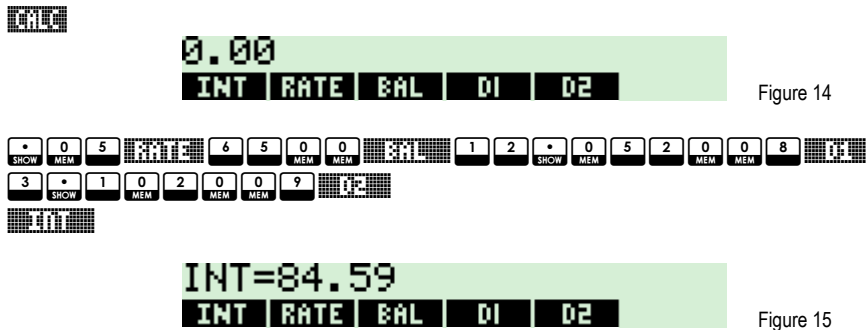
Solution:

0.00

| INT | RATE | BAL | DI | D2 |

Figure 14

INT=84.59

| INT | RATE | BAL | DI | D2 |

Figure 15

Answer: The simple interest due would be $84.59. Note that RATE is entered as 0.05 for 5%. The formula could be modified to allow entry of RATE as 5 for 5% by adding ÷ 1 0 0 after RATE in the formula.

Practice using solver functions – MIN and MAX

Example 3: Use the MIN and MAX functions to multiply the smaller of X and Y by the larger of P and Q. Use the formula: PROD=MIN(X:Y)xMAX(P:Q)

Solution:
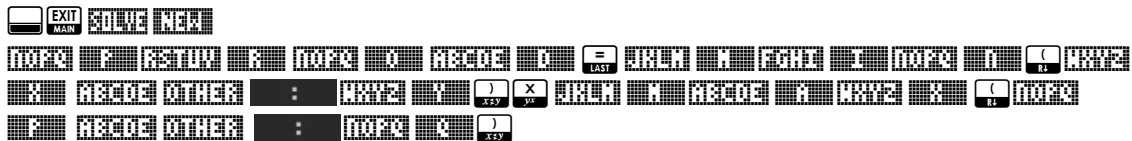
PROD=MIN(X:Y)×MAX(P:Q)
CALC EDIT DELET NEW

Figure 16

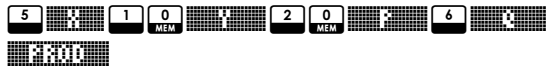Answer: The formula should appear as shown above in figure 16.

Example 4: Use the PROD solver formula from example 3 to compute the product of the minimum of X and Y and the maximum of P and Q. Use 5 and 10 for X and Y and use 20 and 6 for P and Q.

Solution: CALC

0.00
PROD | X | Y | P | Q

Figure 17

5 X 1 0 Y 2 0 P 6 Q
PROD

PROD=100.00
PROD | X | Y | P | Q

Figure 18

Answer: The solver computes the product of 5 x 20. While this is an obviously fairly simple example, the usefulness of something like MIN and MAX should be apparent when you consider using it against computed values that you do not know in advance.