Hewlett-Packard 10B Tutorial

To begin, look at the face of the calculator. Every key (except one, the gold shift key) on the 10B has two functions: each key's primary function is noted in white on the key itself, while each key's secondary function is noted in gold above the key. To use the function on the key, simply press the key. To access the gold function above each key, first press the key with the solid gold face, which we will call the "gold shift" key, and then press the desired function key. (Note that the gold shift key is near the lower left corner of the calculator keyboard.)

Turning the Calculator On and Off

To turn on the calculator, press [C].

Note that the ON key is on the lower left corner of the keyboard—the face of the key has a white "C," while the word "ON" appears below the key. Also, we will designate keys throughout this tutorial by the use of small boxes, as above. To conserve the battery, the calculator turns itself off about 10 minutes after your last keystroke.

To turn the calculator off, press ■ [OFF].

Here we are using the solid black square to represent the gold shift key. Thus, the keystrokes to turn the calculator off are (1) press the gold shift key, and (2) then press the C key. Note that the word "OFF" appears above the C key in gold. Thus, by pressing the gold shift key first, we are activating the gold function above the C key, which is the off function. Also, note that pressing the gold shift key places a little "up arrow" symbol in the lower left corner of the display. Press the gold shift key again and the symbol goes away. The ■ key is a toggle key that switches back and forth between the “regular” and the “gold” functions. ■ is like the typewriter shift key. After you press ■, look only at gold writing. In this tutorial, whenever you see ■, the label on the next key is the gold label above the key, not the label on the key itself.

Note that the calculator has a continuous memory, so turning it off does not affect any data stored in the calculator.

Clearing the Calculator

To clear the calculator’s memory, press ■ [CLEAR ALL].

If we did not press ■, we would input the data shown on the screen to memory. Clearing the calculator is very important, since unwanted data in memory can result in improper calculations, and hence wrong answers. It is best to get into the habit of automatically clearing memory before starting a calculation. Occasionally, you may purposely want to save data, but, in general, you will be entering all new data, so starting with a clear memory is the safest approach.

There are three different levels of clearing data:

■ CLEAR ALL clears all memory and the display.

C clears the entire display, but not the memory.

» clears numbers on the display one at a time if you made a mistake entering data.

Changing the Display

Enter 5555.5555.

To change the number of decimal places from 2 to 4, press ■ DISP 4. 5,555.5555 is displayed.

To change from 4 places to 2, press ■ DISP 2. 5,555.56 is displayed. (Rounding is automatic.)

We usually set the display to 2 places, which is especially convenient when working with dollars and percentages. However, we often use 4 places when dealing with interest rates and rates of return that are entered as decimals.

If periods and commas are reversed, press ■ ./,. (Many European countries use a ./, convention that is just the opposite of ours.

Note that "PEND" means something is pending. For example, press 4 ÷. The calculator is waiting for the denominator, so "PEND" appears in the display.

Enter 6 and = to get 0.67.

Press ■ DISP 4 to see 0.6667.

Press ■ DISP 2 to shift back to 2 decimal places.

To control the brightness of the display, hold down C and press + or -.

Periods per Year Setting

One important setting that can cause problems is the periods per year setting. To check the current setting, press ■ and then press and hold down CLEAR ALL. The display shows the setting for periods/year. The calculator comes pre-set at 12 periods per year, that is, it assumes calculations will be done on a monthly basis. However, finance textbook problems generally use 1 period/year. To change to 1/year:

Press 1 ■ P/YR.

Now the calculator is set to assume 1 period/year. To confirm this setting, press and hold ■ CLEAR ALL. Unless needed for other work, we generally leave the calculator setting at 1 period per year.

Time Value of Money (TVM)

The TVM keys are located on the top row of the keyboard.

N | I/YR | PV | PMT | FV

In general, TVM problems involve four variables—three are known and the fourth is unknown.

Lump Sums

To begin, we consider TVM calculations with single (lump) sums. In this situation, we do not use the PMT key, so be sure to either clear all, which sets the payment (PMT) equal to 0, or enter 0 as the PMT when entering the input data. If you know any three variables, you can find the value of the fourth.

Example 1:

What is the FV of $100 after 3 years if the interest rate is 26 percent? First, clear with ■ CLEAR ALL.

Next, enter the data.

3 [N]
26 [I/YR]
100 [PV]
0 [PMT] (Optional if registers are cleared.)

To determine the FV simply press [FV] and the FV of -$200.04 is displayed.

The HP is programmed so that if the PV is + then the FV is displayed as - and vice versa, because the HP assumes that one is an inflow and the other is an outflow. When entering both PV and FV, one must be entered as negative and the other as positive.

Example 2:

What is the PV of $500 due in 5 years if the interest rate is 10 percent? Clear first and then enter the following data.

5 [N]
10 [I/YR]
0 [PMT] (Optional if registers are cleared.)
500 [FV]

Pressing the [PV] key reveals that $310.46 will grow to $500 in 5 years at a 10 percent rate.

Example 3:

Assume a bond can be purchased today for $200. It will return $1,000 after 14 years. The bond pays no interest during its life. What rate of return would you earn if you bought the bond?

14 [N]
200 [+/-] [PV] (The [+/-] key changes the sign.)
0 [PMT]
1000 [FV]

Simply press the [I/YR] key and the HP calculates the rate of return to be 12.18 percent.

Remember that the HP is programmed so that if the PV is + then the FV is displayed as - and vice versa because the HP assumes that one is an inflow and other is an outflow. When entering both PV and FV values, one must be negative and one positive.

Now suppose you learn that the bond will actually cost $300. What rate of return will you earn?

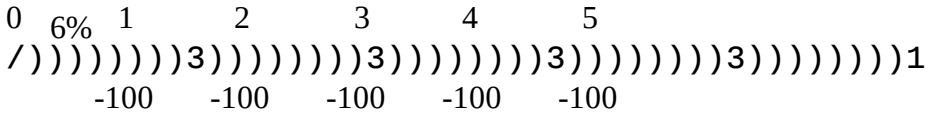
Override the -200 by entering 300 [+/-] [PV], then press [I/YR] to get 8.98 percent. If you pay more for the bond, you earn less on it. The important thing, though, is that you can do "what if" analyses with the calculator.

Now do nothing except [■] [OFF] to turn off the calculator. Then turn on the calculator [C]. The display shows 0.00. Is the memory erased? Not completely. What was on the screen is gone, but press [RCL] [N] to get N = 14. The other memory registers also retain information unless you press [■] [CLEAR ALL].

Ordinary Annuities

Example 1:

What is the FV of an annuity of $100 paid at the end of each year for 5 years if the interest rate equals 6 percent?



5 [N]

6 [I/YR]

0 [PV]

100 [+/-] [PMT]

Now press the [FV] key, and an FV of $563.71 is displayed.

Example 2:

What is the PV of the same annuity?

Leave data in calculator, but enter 0 as the FV to override, then press [PV] to get $421.24.

Annuities Due

Each payment of an annuity due occurs at the beginning of the period instead of at the end as with a regular annuity. In essence, each payment is shifted back one period. To analyze annuities due press [■] [BEG/END]. The word "begin" appears on the screen. Now the HP analyzes the cash flows based on beginning of period payments. Change back to end mode by pressing [■] [BEG/END].

Interest Conversion

The following equation is used to convert a nominal rate to an effective rate.

$$EAR = \left[1 + \frac{k_{Nom}}{m}\right]^{m} - 1.$$

Given: k_{Nom} = 10% and m = 12 payments/year,

$$EAR = \left[1 + \frac{0.10}{12}\right]^{m} - 1 = (1.0083)^{12} - 1 = 1.1047 - 1 = 0.1047 = 10.47\%.$$

However, it's much easier to convert the nominal rate using the calculator:

10 [■] [NOM %]

12 [■] [P/YR]

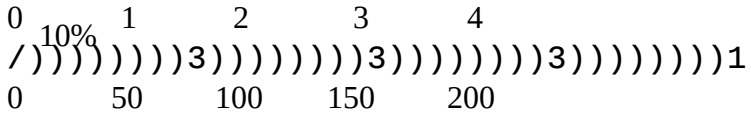
[■] [EFF %] = 10.47% shows on the screen.

Now switch back to 1 payment/year: 1 [■] [P/YR].

Cash Flow Operations

Example 1: Uneven Cash Flows

Assume the following cash flows:



What is the PV of these CFs?

First clear the HP and make sure that periods/year is set equal to 1.

0 [CF$_j$] Sets CF_0 equal to 0.

50 [CF$_j$] Sets CF_1 equal to 50. On next entry, hold down CF_j key to see what it says. By holding down CF_j key, you see that you just entered CF_2.

100 [CF$_j$]

150 [CF$_j$]

200 [CF$_j$]

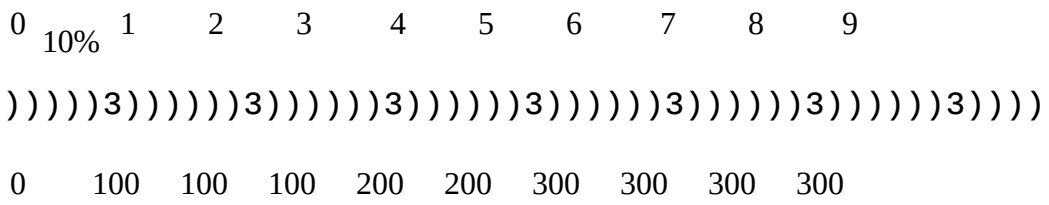
The CFs from the time line are entered. Now enter the interest rate.

10 [I/YR]

At this point the HP knows the cash flows, the number of periods, and the interest rate. To find the PV, press [■] [NPV] to get PV = NPV = $377.40.

Example 2: Embedded Annuities

We have these cash flows, which contain embedded annuities:



What's the PV?

Clear, set P/YR = 1 if changed.

0 [CF_j]
100 [CF_j]
3 [■] [N_j]
200 [CF_j]
2 [■] [N_j]
300 [CF_j]
4 [■] [N_j]

Now the HP knows the cash flows. Thus, enter the interest rate:

10 [I/YR]

Now press [■] [NPV] to get PV = NPV = $1,099.94.

To check your entries:

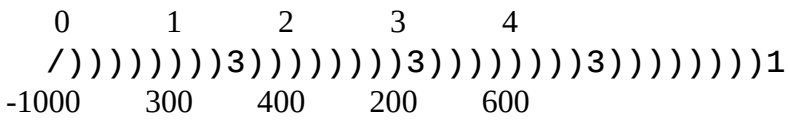
[RCL] 0 to see CF_0.

[RCL] [CF_j] to see first CF entry.

[RCL] [■] [N_j] to see how many times CF_1 is repeated, etc.

Example 3: The Rate of Return Offered by an Investment (IRR)[1]

Assume that we invest $1,000 now (t = 0) and then expect to receive an uneven set of cash flows. Here is the CF time line:



What rate of return will we earn? Enter the following:

	[■] [CLEAR ALL]
1000	[+/-] [CF_j]
300	[CF_j]
400	[CF_j] (Hold down CF_j key to be sure you entered CF_2.)
200	[CF_j]
600	[CF_j]
	[■] [IRR/YR] = 16.71%

You can also determine the NPV of the investment. Leave data entered and then enter the opportunity cost interest rate, say 8 percent. To find NPV press

8	[I/YR]
	[■] [NPV]

The NPV of $220.50 is displayed. Thus, the PV of the cash inflows exceeds the cost of the investment by $220.50.

[1]If a negative CF occurs at the end of a project's life, then the HP may give an error message, indicating that there are two IRRs. Enter data, then enter 10 [■] [STO] [■] [IRR/YR] to get the first IRR. Then enter a large percentage, such as 100 [■] [STO] [■] [IRR/YR] to find other IRR. You might have to experiment with "guesses" to locate the two IRRs.

Statistical Calculations

The HP can also be used for several types of statistical calculations.

Mean and Standard Deviation (Σ)

Year	Sales
1994	$150
1995	95
1996	260

What's the mean (average) and standard deviation (Σ) of sales over the 3 years?

Use the Σ+ key to enter data:

■ CLEAR ALL

150 Σ+ A number 1 is displayed.

95 Σ+ A number 2 is displayed.

260 Σ+ A number 3 is displayed.

Determine the mean and standard deviation by simply pressing

■ $\bar{x}, \bar{y}$ The mean equals $168.33.

■ S_x, S_y The standard deviation is $84.01. S_x and S_y are sample standard deviations. σ_x and σ_y refer to population statistics.

Linear Regression

Beta coefficients can be calculated by using the HP's linear regression capabilities. The X (independent variable) and Y (dependent variable) values must be entered in the proper sequence, where the X data is on the horizontal axis (**market**) and Y data is on the vertical axis (**stock**).

Year	Market (k_M)	Stock (k_j)
1	23.8%	38.6%
2	-7.2	-24.7
3	6.6	12.3
4	20.5	8.2

5	30.6	40.1

Enter the data as follows:

	[■] [CLEAR ALL]		
23.8	[INPUT]	38.6	[E+]
7.2	[+/-] [INPUT]	24.7	[+/-] [E+]
6.6	[INPUT]	12.3	[E+]
20.5	[INPUT]	8.2	[E+]
30.6	[INPUT]	40.1	[E+]
0	[■] [y^, m]	The value -8.92 is y when x = 0, or k_j when k_M = 0, which is the vertical axis intercept.	
	[■] [SWAP]	The value displayed, 1.60, is the slope coefficient, or the *beta coefficient*.	

Amortization

The HP can also be used to calculate amortization schedules.

Example:

Determine the interest and principal paid each year and the balance at the end of each year on a three-year $1,000 amortizing loan which carries an interest rate of 10 percent. The payments are due annually.

First, check payments/year and be sure it's 1. Now perform the following steps:

	[■] [CLEAR ALL]
3	[N]
10	[I/YR]
1000	[PV]
	[PMT] A payment of -402.11 is displayed.

This is the amortization schedule corresponding to the loan.

	Beg. Bal.	Payment	Interest	Princ. Repmt.	Ending Bal.
1	1,000.00	402.11	100.00	302.11	697.89
2	697.89	402.11	69.79	332.32	365.57
3	365.57	402.11	36.56	365.55	.02

With the data still entered in the TVM menu, do the following:

1 INPUT

■ AMORT "PEr 1-1" is displayed.

= Hold down to see Int, then release and -100.00 is displayed, which is the interest payment during the first year. Write it into a table as 100.00

= Hold down to see Prin; release to see -302.11. This is the repayment of principal in the first year. Write it in the table.

= Hold down to see Bal; release to see 697.89, the ending balance at the end of the first year. Write it down.

■ AMORT "PEr 2-2" is displayed.

= -69.79 is the interest paid in Year 2.

= -332.32 is the principal paid in Year 2.

= 365.57 is the ending balance at end of Year 2.

■ AMORT "PEr 3-3" is displayed.

= -36.56 is the interest paid in Year 3.

= -365.55 is the principal repayment in Year 3.

= 0.02 is the balance at end of Year 3.

See the manual for an explanation of how to do monthly amortization.

Next, with the data still in the calculator, do the following:

1 INPUT 3 ■ AMORT "PEr 1-3" is displayed.

= Hold down to see Int, then release and -206.35 displayed. This is the total interest paid over Years 1 to 3.

= Hold down to see Prin, then release and -999.98 is displayed. This is the total repayment of principal over Years 1 to 3.

= Hold down to see Bal, then release and 0.02 is displayed. This is the remaining balance.