Sharp EL-733A Tutorial

To begin, look at the face of the calculator. Almost every key on the EL-733A has two functions: each key's primary function is noted on the key itself, while each key's secondary function is noted in reddish-brown above the key. To use the function on the key, simply press the key. To access the function above each key, first press the yellow key with "2ndF" printed on it, which we will call the "2nd function" key, and then press the desired function key. (Note that the 2nd function key is located at the upper left corner of the calculator keyboard.)

Turning the Calculator On and Off

To turn on the calculator, press [C-CE]. To turn off the calculator, press [OFF].

Note that the ON and OFF keys are in the upper right corner of the keyboard. 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.

Also, note that pressing the 2nd function key places a little "2ndF" symbol in the upper left corner of the display. Press the 2nd function key again and the symbol goes away. The [2ndF] key is a toggle key that switches back and forth between the "regular" and the "2nd" functions. [2ndF] is like the typewriter shift key. After you press [2ndF], look only at the reddish-brown writing above the keys.

Note that the calculator has a continuous memory, so turning it off does not affect any data stored in the calculator, but will erase any number showing on the screen.

Clearing the Calculator

Three of the most commonly used methods of clearing data are presented below:

[2ndF] [CA]	Clears all the memory registers associated with a particular mode (normal, FIN, or STAT).
[C-CE]	Clears the entire display, but not the memory.
[o]	Clears numbers on the display one at a time if you made a mistake entering data.

Review your owner's manual for other methods of clearing information.

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.

Changing the Display

To change decimals from 2 to 4, press [2ndF] [TAB] [4]. 0.0000 is displayed.

To change from 4 places to 2, press [2ndF] [TAB] [2]. 0.00 is displayed.

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.

Changing the Mode

The calculator has three calculation modes: NORMAL, FIN (financial), and STAT (statistics). The mode of the calculator dictates the type of calculations that can be performed. When working financial problems, you will typically use the FIN mode, while statistical problems normally will be handled in STAT mode. Modes are indicated in the display as follows: a box showing "FIN" indicates finance mode, a box showing "STAT" indicates statistics mode, and no box appears when in the normal mode. To change modes, simply press, [2ndF] [MODE]. The calculator rotates through the modes from normal to finance to statistics to normal.

Time Value of Money (TVM)

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

[n] [i] [PV] [FV] [PMT]

To enter the time value of money mode do the following:

Press [2ndF] [MODE] repeatedly until the [FIN] indicator appears in the display.

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 [2ndF] [CA].

Next, enter the data.

3 [n]
26 [i]
100 [PV]
0 [PMT] (Optional if registers are cleared.)

To determine the FV simply press [COMP] [FV] and the FV of -$200.04 is displayed. (COMP is the key framed in black near the upper left corner.)

The EL-733A is programmed so that if the PV is + then the FV is displayed as - and vice versa, because the EL-733A 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]
0 [PMT] (Optional if registers are cleared.)
500 [FV]

Pressing the [COMP] [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 COMP i key and the HP calculates the rate of return to be 12.18%.

Remember that the EL-733A is programmed so that if the PV is + then the FV is displayed as - and vice versa, because the EL-733A assumes that one is an inflow and other is an outflow. Also, note that the negative sign is placed on the 200 PV entry by pressing the key marked "+/-".

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

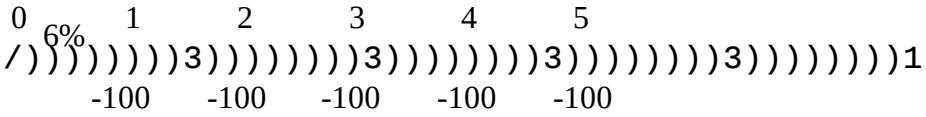
Override the -200 by entering 300 +/- PV, then press COMP i to get 8.98 percent. If you pay more for the bond, you earn less on it. The important thing, though, is that you can do "what if" analyses with the calculator.

Now do nothing except press OFF to turn off the calculator. Then turn on the calculator C-CE. The display shows 0.00. Is the memory erased? Not completely. What was on the screen is gone, but press 2ndF RCL n to see that the N = 14 entry is still in the calculator's memory.

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]

0 [PV]

100 [+/-] [PMT]

Now press the [COMP] [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 [COMP] [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 [BGN]. The symbol "BGN" appears in the upper right corner of the display. Now the EL-733A analyzes the cash flows based on beginning of period payments. Change back to end mode by pressing [BGN] again.

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.

Before beginning this procedure it is important to note that another name for the nominal rate is the annual percentage rate (APR). In fact, the EL-733A uses the term APR for the nominal interest rate. Thus, the keystrokes required to calculate the above effective rate for 12 compounding periods would be as follows:

12 [2ndF] [° EFF] 10 [=]

The effective rate of 10.47% is displayed on the screen.

If you were given the effective rate and wished to convert it to an APR (nominal rate), the key strokes for 12 compounding periods would be as follows:

12 [2ndF] [° APR] 10.4713 [=]

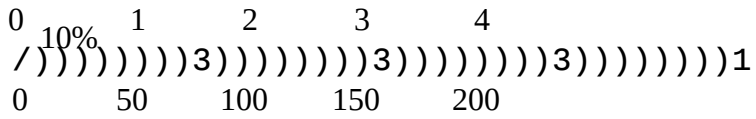
The nominal rate of 10.00 percent is displayed on the screen.

Cash Flow Operations

We can also find the PV, FV, and IRR (internal rate of return) of a series of unequal cash flows.

Example 1: Uneven Cash Flows

Assume the following cash flows:



What is the PV of these CFs?

First clear any previous cash flow or TVM analyses by pressing [2ndF] [CA]. Next, enter the cash flows:

0	[CF*i*]	Sets CF_0 equal to 0 and moves to CF_1.
50	[CF*i*]	Sets CF_1 equal to 50 and so on.
100	[CF*i*]	
150	[CF*i*]	
200	[CF*i*]	

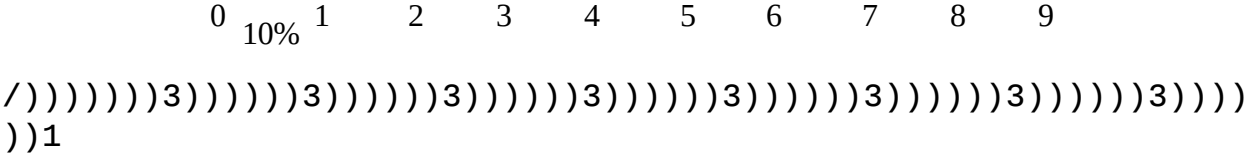
The CFs from the time line are entered. Now enter the interest rate.

10 [i]

At this point the EL-733A knows the cash flows, the number of periods, and the interest rate. To find the PV, press [COMP] [NPV] to get PV = NPV = $377.40.

Example 2: Embedded Annuities

We have these cash flows, which contain embedded annuities:



0 100 100 100 200 200 300 300 300 300

What's the PV?

First clear any previous cash flow analyses, [2ndF] [CA]. Next, enter the cash flows:

0	[CF*i*]	Sets CF_0 equal to 0 and moves to CF_1.
3	[2ndF] [N*i*]	Tells the calculator that the *following* CF will occur three consecutive times.
100	[CF*i*]	Sets the first three CFs equal to 100.
2	[2ndF] [N*i*]	
200	[CF*i*]	
4	[2ndF] [N*i*]	
300	[CF*i*]	

Now the EL-733A knows the cash flows. Thus, enter the interest rate:

10 [i]

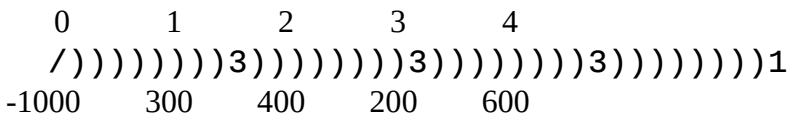
At this point the EL-733A knows the cash flows, the number of periods, and the interest rate. To find the PV, press [COMP] [NPV] to get PV = NPV = $1,099.94.

To check your entries:

Press [2ndF] [RCL] [1] to see that the amount of the first group of CFs is $100.00 each. You can now check the frequency of this CF group by pressing [2ndF] [RCL] [2ndF] [N*i*]. This $100.00 cash flow occurs 3 consecutive times.

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?

First clear any previous cash flow analyses, [2ndF] [CA]. Next, enter the cash flows:

1000	[+/-] [CF*i*]	Sets CF_0 equal to -1000 and moves to CF_1.
300	[CF*i*]	Sets CF_1 equal to 300 and moves to CF_2.
400	[CF*i*]	
200	[CF*i*]	
600	[CF*i*]	

Now the EL-733A knows the cash flows. Thus, simply press [COMP] [IRR] and the IRR of 16.71 percent is displayed.

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] [COMP] [NPV]

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

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[1]If a negative CF occurs at the end of a project's life, or if a sequence of cash flows has two or more sign changes, there may be multiple IRR solutions. The calculator displays the IRR closest to zero. However, the displayed solution has no financial meaning. Thus, you should use caution in making investment decisions based on an IRR computed for a cash flow stream with more than one sign change. When you are solving very complex cash flow problems, the calculator may not be able to find IRR, even if a solution exists. When this is the case, the calculator displays *E*. An error can be cleared by pressing the [C-CE] key.

Statistical Calculations

The EL-733A can also be used for several types of statistical calculations.

Mean and Standard Deviation (F)

Year	Sales
1994	$150
1995	95
1996	260

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

First, put the calculator into the Statistics mode by pressing [2ndF] [MODE] until the [STAT] indicator shows on the display. Then clear any previous data entries, [2ndF] [CA]. Next, enter the data:

150	[M+]	This enters 150 as the data entry and tells the calculator it occurs one time. Note that [DATA] is the meaning of the [M+] key when the calculator is in the statistics (STAT) mode.
95	[M+]	This enters 95 as the second data entry and tells the calculator it occurs one time.
260	[M+]	This enters 260 as the third data entry and tells the calculator it occurs one time.

Determine the mean by simply pressing the following:

[2ndF] [$\bar{x}$]	The mean equals $168.33.

Determine the standard deviation by pressing the following:

[2ndF] [S_x]	The standard deviation is $84.01. S_x and S_y are sample standard deviations. F_x and F_y refer to population statistics.

Linear Regression

Beta coefficients can be calculated by using the EL-733A'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

First, put the calculator into the Statistics mode by pressing [2ndF] [MODE] until the [STAT] indicator shows on the display. The clear any previous data entries, [2ndF] [CA]. Next, enter the data as follows:

23.8	[RM]	This enters 23.8 as the first X variable. (The [RM] key in the STAT mode is the [(x, y)] key.)
38.6	[M+]	This enters 38.6 as the first Y variable.
7.2	[+/-] [RM]	This enters -7.2 as the second X variable.
24.7	[+/-] [M+]	This enters -24.7 as the second Y variable.
6.6	[RM]	This enters 6.6 as the third X variable.
12.3	[M+]	This enters 12.3 as the third Y variable.
20.5	[RM]	This enters 20.5 as the fourth X variable.
8.2	[M+]	This enters 8.2 as the fourth Y variable.
30.6	[RM]	This enters 30.6 as the fifth X variable.
40.1	[M+]	This enters 4.1 as the fifth Y variable.

Determine the intercept by pressing [2ndF] [a]. The display shows that "a," which is the *vertical axis intercept*, is equal to -8.92. To find the slope simply press [2ndF] [b]. The display shows that "b" is equal to 1.60, which is the slope coefficient and the *beta coefficient*.

Amortization

The EL-733A 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.

Press [2ndF] [MODE] repeatedly until the [FIN] indicator comes on the display screen. Then clear any previous data entries, [2ndF] [CA].

Now perform the following steps:

3	[n]	
10	[i]	
1000	[PV]	
	[COMP] [PMT]	A payment of -$402.11 is displayed.

Now, since all the information about the loan is stored in the TVM register, we can use the amortization functions to generate an amortization schedule for the loan.

Determine the principal and interest paid in each payment, and the balance remaining after each payment by doing the following steps:

1	AMRT	Entering 1 tells the calculator we want to examine the first year. The display shows that PRN = -302.11. Thus, out of the first $402.11 payment, $302.11 went toward paying off the principal portion of the loan.
	AMRT	The display shows that INT = -100.00. Thus, out of the first $402.11 payment, $100.00 was payment of interest.
	AMRT	The display shows that BAL = 697.89. Thus, after making the first $402.11 payment, the principal balance you to be paid is $697.89.
2	AMRT	The 2 moves to the second year. The display shows that the principal repayment is Year 2 is PRN = -332.33.
	AMRT	The interest payment is INT = -69.79.
	AMRT	The remaining balance is BAL = 365.56.
3	AMRT	For Year 3, the principal repayment is PRN = -365.56.
	AMRT	The interest payment is INT = -36.56.
	AMRT	The remaining balance is BAL = 0.

Here is the complete amortization table:

	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	332.33	365.56
3	365.56	402.11	36.56	365.56	0.00