

D-How to Use a Financial Calculator*

Most personal finance decisions involve calculations of the time value of money. Three methods are used to compute this value: time value of money tables (such as those found in Appendix A), computer software programs, and financial calculators.

Compared with time value of money tables and computer software programs, financial calculators offer some relative advantages. Using calculators provides more accurate answers than time value tables. In addition, a person using a calculator can find the answers more rapidly and with more flexibility than someone using tables for calculating the time value of money. While computer software programs may handle more sophisticated calculations, the calculators are easier to access, carry around, and learn how to use, and they are considerably less expensive. Using financial calculators may be the most practical way to compute the time value of money for personal finance decisions and obtain satisfactory results.

Financial calculators—also called business calculators—can not only calculate the time value of money, but also perform statistical, business, and basic arithmetic calculations. In this appendix, we focus on the calculation of the time value of money for personal finance decisions.

A variety of brands of financial calculators are available. The most commonly used and least expensive ones (less than \$35) are Sharp's EL-733A, Hewlett-Packard's HP-10B, and Texas Instruments' BA-II PLUS. This appendix will illustrate how to perform financial calculations with these three brands of calculators.

This appendix is divided into four sections. The first section discusses the preparations necessary before financial calculations can be made. Because all financial calculations will fall into one of two categories [the time value of a single amount (lump sum) or a series of equal amounts (annuity)], the second and third sections, respectively, illustrate how to perform these calculations. The last section demonstrates how to deal with more complicated calculations that require multistep procedures. For more comprehensive information on other functions of financial calculators, refer to the user's manuals provided by the financial calculator manufacturers.

Preparations for Personal Finance Calculations

The preparations required before performing personal finance calculations include clearing the register and setting the decimal places, compounding methods, and financial calculation mode. Other related issues include changing signs and clearing error messages.

Clearing the Register

Make sure to clear all memory registers before making a calculation. Otherwise, the results could be wrong. To clear the memory registers, use the following key strokes:

Purpose	EL-773A	HP-10B	BA-II PLUS
Clear memory registers	0	n	

Clear TVM registers n

Note: The n key for HP-10B refers to the square orange key on the calculator.

Setting Decimal Places

A fixed or floating decimal place may be set before performing a calculation. The following two examples demonstrate how to accomplish this action.

Purpose	EL-773A	HP-10B	BA-II PLUS
Set 4 decimal places	4 n 4	4	
Set a floating decimal point	. n .	9	

Setting Compounding Methods

HP-10B and BA-II PLUS require you to preset the compounding methods before personal finance calculations, unlike EL-773A. The following examples illustrate how to preset compounding methods annually or monthly (daily and other compounding periods are also possible). Failure to preset the correct compounding method will result in erroneous answers.

Purpose	EL-773A	HP-10B	BA-II PLUS
Compounding not required annually		1 n 1	
Compounding not required monthly		12 n 12	

Setting Financial Calculation Mode

HP-10B and BA-II PLUS can access financial calculations any time. To access financial calculations for EL-773A, use the key sequence:

Changing Signs

Conventionally, all cash outflows or payments carry a negative sign, and all cash inflows or receipts carry a positive sign. To input a negative number, hit the \pm key after entering the number. Entering a number with a wrong sign will result in an incorrect answer or error message.

Clearing Error Messages

The following messages indicate that an error has occurred and explain how to clear the error messages:

	EL-773A	HP-10B	BA-II PLUS
Error message on screen		E	no Solution
Clear error message			Error 5

The Time Value of a Single Amount

Calculating the time value of a single amount always involves four factors: present value, future value, interest rate, and time periods. The personal finance question usually asks for one factor, given the other three factors. On HP-10B and BA-II PLUS, make sure to use the correct compounding method (annually, monthly, or other). For EL-773A, remember to convert the annual interest rate into a monthly (or other) rate when monthly (or other) compounding frequencies methods are used.

Example 1: Future Value of an Investment

If you invest \$500 at an annual interest rate of 15 percent, how much will you have at the end of a 12-year period?

Input/Result	EL-773A	HP-10B	BA-II PLUS
Present value	500	500	500
Time period: year	12	12	12
Interest rate	15	15	15
Result: future value	2675.13	2675.13	2675.13

Thus, at the end of a 12-year period, you will receive \$2675.13.

Example 1 can be rephrased in three other ways: (1) If you invest \$500 at an annual interest rate of 15 percent, in how many years will you receive \$2675.13?; (2) If you invest \$500, what should be the interest rate if you receive \$2675.13 at the end of a 12-year period?; and (3) If you want to receive \$2675.13 given an annual interest rate of 15 percent at the end of a 12-year period, how much should you invest now?

Based on Example 1, can you figure out answers for the three questions with the calculator? Finding the answers may give you a better understanding of how to use a financial calculator.

Following are more examples dealing with the time value of a single amount.

Example 2: Present Value of an Investment Goal

If you want \$30,000 for a newborn child's college education 18 years from now, and if a current investment opportunity yields 7 percent, how much should you invest now?

Input/Result	EL-773A	HP-10B	BA-II PLUS
Future value	30000	30000	30000
Time period: year	18	18	18
Interest rate	7	7	7
Result: present value	-8875.92	-8875.92	-8875.92

To achieve the investment goal, the initial amount to be invested should be \$8876.

Example 3: Retirement Needs

If you need \$250,000 for retirement purposes, and you would like to invest \$36,000 now and let it grow for 25 years, what is the required annual interest rate?

Input/Result	EL-773A	HP-10B	BA-II PLUS
Present value	36000	36000	36000
Future value	250000	250000	250000
Time period: year	25	25	25
Result: interest rate	8.06	8.06	8.06

To meet the retirement needs, the interest rate should be at least 8.06%.

Example 4: Impact of Inflation on the Value of an Asset

If a car is now priced at \$20,000, how many years will it take for its price to reach \$24,000 at a 5 percent annual inflation rate?

Input/Result	EL-773A	HP-10B	BA-II PLUS
Present value	20000	20000	20000
Future value	24000	24000	24000
Interest rate	5	5	5
Result: time period	3.74	3.74	3.74

The car price will reach \$24,000 in 3.74 years.

The Time Value of an Annuity (a Series of Equal Amounts)

Two general types of personal finance questions involve annuities. The first type of question focuses on an outflow of money in equal payments, such as an auto loan, home mortgage payment, or contributions to a retirement plan. The second type of question concerns an inflow of money in equal amounts, such as receiving monthly benefit checks from a retirement plan or government agency.

Calculating the time value of an annuity involves four factors: a series of equal payments (annuity), present value or future value of total amount, interest rate, and time periods.

Many personal finance questions will ask for one factor given the other three factors.

Thus, if you can identify the factors presented in a problem, understand the given factors, and know what factor you are calculating, you will comprehend the problem and solve it accurately.

But beware! Before calculating personal finance problems, be sure to clear the memory registers and to use the correct compounding methods.

Example 5: Future Value of Retirement Savings

If you are 49 years old and put \$7000 per year from current income in a savings program yielding 8 percent, how much will you accumulate when you retire 16 years later? In this problem, you are given the annuity (a series of equal payments), interest rate, and time periods. You are asked to calculate the future value of the total retirement contributions and interest income.

Input/Result	EL-773A	HP-10B	BA-II PLUS
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Each payment	7000	7000	7000	
Time period: year	16	16	16	
Interest rate	8	8	8	
Result: FV of total amount	212269.98	212269.98	212269.98	212269.98

You will accumulate about \$212,270 after 16 years.

Example 6: Present Value of Loan Payments

If you acquire a car loan of \$20,000 at an interest rate of 8 percent for four years, what is the amount of your monthly payment?

Input/Result	EL-773A	HP-10B	BA-II PLUS
PV of loan amount	20000	20000	20000
Time period: month	48	48	48
Interest rate	8 12	8	8
Result: each payment	-488.26	-488.26	-488.26

The monthly payment would be \$488.26.

Example 7: The Annual Percentage Rate of a Loan

If you have a car loan of \$20,000 with a monthly payment of \$400 for five years, what is the annual percentage rate (APR)?

Input/Result	EL-773A	HP-10B	BA-II PLUS
PV of loan amount	20000	20000	20000
Time period: month	60	60	60
Each payment	400	400	400
Result: interest rate	.618	7.42	7.42

The APR would be 7.42 percent. The EL-773A shows the monthly rate of 0.618 percent, which must be multiplied by 12 (months) to obtain the annual rate of 7.42 percent.

Example 8: Monthly Payment of a Fixed-Rate Mortgage Loan

If you take out a mortgage loan of \$120,000 at a fixed rate of 8 percent for 30 years, what is the monthly payment?

Input/Result	EL-773A	HP-10B	BA-II PLUS
PV of loan amount	120000	120000	120000
Time period: month	360	360	360
Interest rate	8 12	8	8
Result: each payment	-880.52	-880.52	-880.52

The monthly payment would be \$880.52.

You may want to obtain more information about the mortgage loan payment before clearing the data from your financial calculator. For example, to find out the loan amortization amount at the fiftieth payment, hit the following keys:

Input/Result	EL-773A	HP-10B	BA-II PLUS
50th payment	50	50 n	50
	50		
Results:	(Principal)	(Interest)	(Balance)
	-111.50	-769.01	115240.58
	(Interest)	(Principal)	(Principal)
	-769.01	-111.50	-111.50
	(Balance)	(Balance)	(Interest)
	115240.58	115240.58	-769.01

The principal and interest would be \$111.50 and \$769.01, respectively, and the unpaid balance would be \$115,240.58 when payment 50 is made.

To review the fraction of your first 50 payments that went for interest and the portion used for the repayment of principal, you may use the following key sequences:

Input/Result	EL-773A	HP-10B	BA-II PLUS
Payment	1 50	1 50 n	1
1-50	50		
Results:	(Principal)	(Interest)	(Balance)
	-4759.42	-39266.45	115240.58
	(Interest)	(Principal)	(Principal)
	-39266.45	-4759.42	-4759.42
	(Balance)	(Balance)	(Interest)
	Not available	115240.58	-39266.45

The first 50 payments for principal and interest would be \$4759.42 and \$39,266.45, respectively, and the unpaid balance would be \$115,240.58.

Example 9: Yield to Maturity for Bonds

Calculating the yield to maturity (YTM) for bonds is similar to the calculation of annual percentage rates (APRs) for annuities. If you paid \$740 for a 20-year bond with a face value of \$1000 and a promised interest payment of 7 percent (\$70 annually), the YTM can be calculated as follows:

Input/Result	EL-773A	HP-10B	BA-II PLUS
PV of market price	740	740	740
Time period:			
years to maturity	20	20	20
Interest payment	70	70	70
FV of face value	1000	1000	1000
Result: yield to maturity		10.07	10.07

The yield to maturity would be 10.07 percent.

More Complicated Calculations

The following examples demonstrate how to use multiple-step procedures to solve more complicated problems.

Example 10: Home Equity Loan with Variable Interest Rates

Assume you take a home equity loan of \$12,000 for four years with a variable interest rate. If the interest rate is 11 percent for the first two years and 12 percent for the last two years, what is the monthly payment? To solve this problem: calculate the monthly payment in the first two years, calculate the unpaid balance at the twenty-fourth payment, and figure the monthly payment during the last two years.

1. Monthly payment in the first two years.

Input/Result	EL-773A	HP-10B	BA-II PLUS
PV of loan amount	12000	12000	12000
Time period: month	48	48	48
Interest rate	11 12	11	11
Result: each payment	-310.15	-310.15	-310.15

The monthly payment for the first two years would be \$310.15. Do not clear the data; hit the following keys:

2. The unpaid balance at payment 24.

Input/Result	EL-773A	HP-10B	BA-II PLUS
24th payment	24	24 n	24
		24	
Results:	(Principal)	(Interest)	(Balance)
	-246.89	-63.26	6654.38
	(Interest)	(Principal)	(Principal)
	-63.26	-246.89	-246.89
	(Balance)	(Balance)	(Interest)
	6654.38	6654.38	-63.26

After payment 24 (at the end of the first two years), the unpaid balance would be \$6654.38. Clear the memory register, then perform the following calculation:

3. Monthly payment in the last two years.

Input/Result	EL-773A	HP-10B	BA-II PLUS
PV of loan amount	6654.38	6654.38	6654.38
Time period: month	24	24	24
Interest rate	12 12	12	12
Result: each payment	-313.24	-313.24	-313.24

The monthly payment for the last two years would be \$313.24.