hp calculators

HP 10BII Time value of money basics

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The time value of money

Money has a time value. That simple statement is the basis for all of finance. The fact that money has a time value is easily understood by answering the question: "Would you rather have $100 today or $100 in 20 years?"

The answer should be "today." At the very least, the $100 today could be deposited into a savings account and you would have more than $100 in 20 years. It is also probably true that $100 today would buy more pizzas than $100 in 20 years. Therefore, money has a time value.

If you loan money to someone today and they will repay you in 5 years, you would expect to get more money back than you loaned. This incremental amount you would be repaid is called interest. Interest is effectively the cost of money.

Depending on the complexity of the financial arrangement, the appropriate solution may involve simple interest, compound interest, an annuity, or cash flow analysis.

This learning module will describe some basics of using the time value of money on the HP 10BII calculator. Other learning modules will go into these topics in more detail.

The time value of money application

The time value of money application built into the HP 10BII is used to solve compound interest problems and annuities that involve regular, uniform payments. Compound interest problems require the input of 3 of these 4 values: [N] [I/YR] [PV] [FV] . Annuity problems require the input of 4 of these 5 values: [N] [I/YR] [PV] [PMT] [FV] . Once these values have been entered in any order, the unknown value can be computed by pressing the key for the unknown value.

The time value of money application operates on the convention that money invested is considered positive and money withdrawn is considered negative. In a compound interest problem, for example, if a positive value is input for the [PV] , then a computed [FV] will be displayed as a negative number. In an annuity problem, of the three monetary variables, at least one must be of a different sign than the other two. For example, if the [PV] and [PMT] are positive, then the [FV] will be negative. If the [PV] and [FV] are both negative, then the [PMT] must be positive. An analysis of the monetary situation should indicate which values are being invested and which values are being withdrawn. This will determine which are entered as positive values and which are entered as negative values.

Interest rates are always entered as the number is written in front of the percent sign, i.e., 5% is entered as a 5 rather than as 0.05.

Special settings

There are several settings that affect the operation of the time value of money application.

Clearing the time value of money registers. The 5 storage registers that hold the time value of money values, [N] [I/YR] [PV] [PMT] [FV] , are cleared when [shift] [C ALL] is pressed. Note that this will also clear all storage registers. Another way to clear these registers is to store a 0 in the unused register. Both methods are illustrated in problems below.

Begin/End Mode. A special mode setting relates to the solution of problems known as annuities. This mode tells the HP 10BII to solve these problems assuming that payments are made either at the beginning of a period or at the end of a period, which is why this mode is called Begin / End mode.

When the HP 10BII is in Begin mode, the display will show the word BEGIN in the space below numbers. There is no indication in the HP 10BII display when the calculator is in End mode, other than by the absence of the word BEGIN.

This mode is changed using the yellow-shifted BEG/END function, located above the MAR key, or [■] [BEG/END]. This function will change the mode from whatever mode the calculator is presently in to the other mode – it will cycle through the modes if pressed repeatedly.

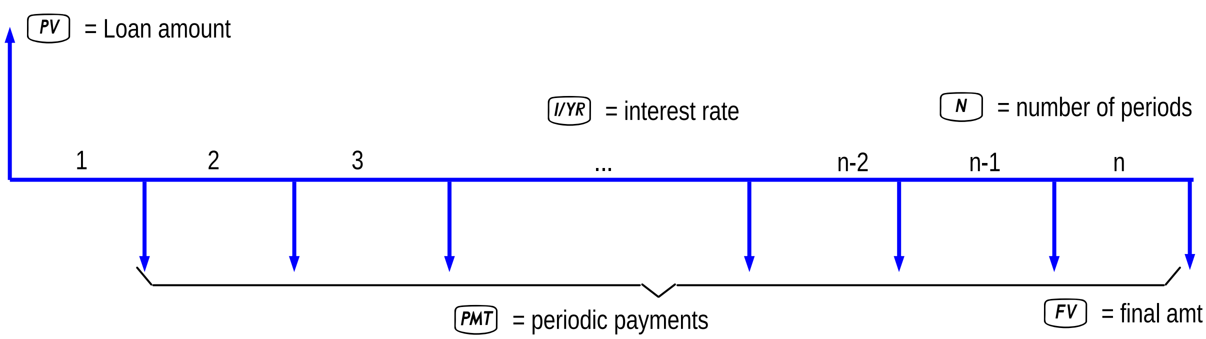
If you receive an unexpected result when solving an annuity problem, make sure that the calculator is in the proper mode and try resolving the problem.

Begin / End mode does not affect compound interest problems or any other type of calculation other than annuities.

Periods per year. The number of periods per year is set using the yellow-shifted [P/YR] function. Problems involving annual compounding or annual payments should be solved with this value set to 1. Problems involving monthly compounding or monthly payments should be solved with this value set to 12. To set this value to 4 for quarterly payments / quarterly compounding, for example, you would press [4] [■] [P/YR].

Cash flow diagrams and sign conventions

The sign conventions for cash flows in the HP 10BII follow this simple rule: money received is positive (arrow pointing up), money paid out is negative (arrow pointing down). The key is keeping the same viewpoint through each complete calculation. The regular use of cash flow diagrams allows a faster approach to solve most TVM-related problems. The cash flow diagram below represents the borrower viewpoint of the most problems and their relationship to the TVM variables.



Practice solving time value of money problems

<u>Example 1:</u> If you deposit $100 today, how much is it worth in 20 years, if interest is compounded at a 4% annual rate? Use the [■] [C ALL] function.

<u>Solution:</u>
[■] [C ALL]
[1] [■] [P/YR]
[2] [0] [N]
[4] [I/YR]
[1] [0] [0] [PV]
[FV]

Answer: $-219.11. Note that the solution is displayed as a negative value. The problem is set up with the $100 as a deposit. The value at the end of the 20-year period would be a withdrawal and is therefore shown as a negative value.

Example 2: If you deposit $100 today, how much is it worth in 20 years, if interest is compounded at a 4% annual rate? Do not use the [■] [C ALL] function.

Solution:
[1] [■] [P/YR]
[2] [0] [N]
[4] [I/YR]
[1] [0] [0] [PV]
[0] [PMT]
[FV]

Answer: $-219.11. Note that the same answer is found by storing a 0 into the unused time value of money register.

Example 3: If you deposit $50 a month starting one month from today, how much do you have in the account in 10 years, if the account begins with $1000 in it and earns 5%, compounded monthly?

Solution:
[■] [C ALL]
[1] [2] [■] [P/YR]
[1] [2] [0] [N]
[5] [I/YR]
[1] [0] [0] [0] [PV]
[5] [0] [PMT]
[FV]

Answer: $-9,411.12.

Example 4: If you need $50,000 in 20 years, how much do you need to deposit each quarter into an account, if the account earns 6%, compounded quarterly?

Solution:
[4] [■] [P/YR]
[8] [0] [N]
[6] [I/YR]
[0] [PV]
[5] [0] [0] [0] [0] [+/−] [FV]
[PMT]

Answer: $327.42. Note that the $50,000 is entered as a negative number since it will be withdrawn from the account in 20 years.