hp calculators

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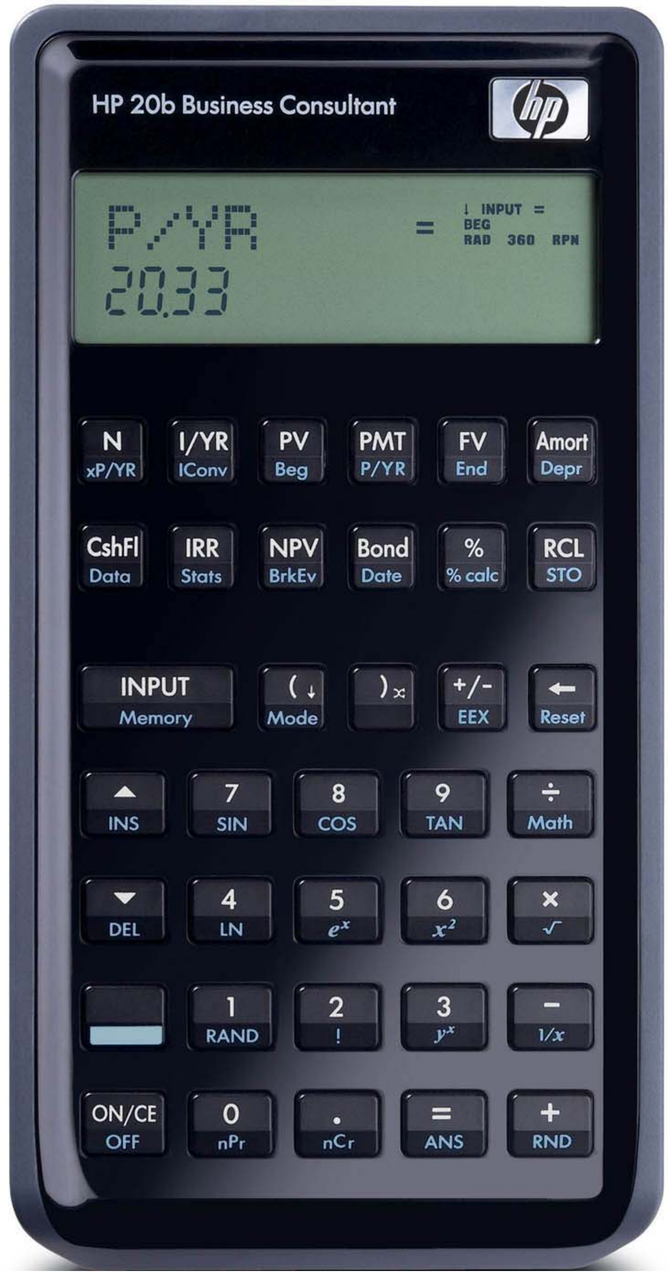


The time value of money application

The time value of money application built into the HP 20b 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The time value of money application operates on the convention that money invested is considered positive and money withdrawn is considered negative.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 [PMT] and [FV] are both negative, then the [PV] must be positive, etc. An analysis of the monetary situation should indicate which values are being invested and which values are being withdrawn.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. The stated annual nominal interest rate is always entered into [I/YR], as shown in the examples.

Additional information can be found in the learning module covering time value of money basics.

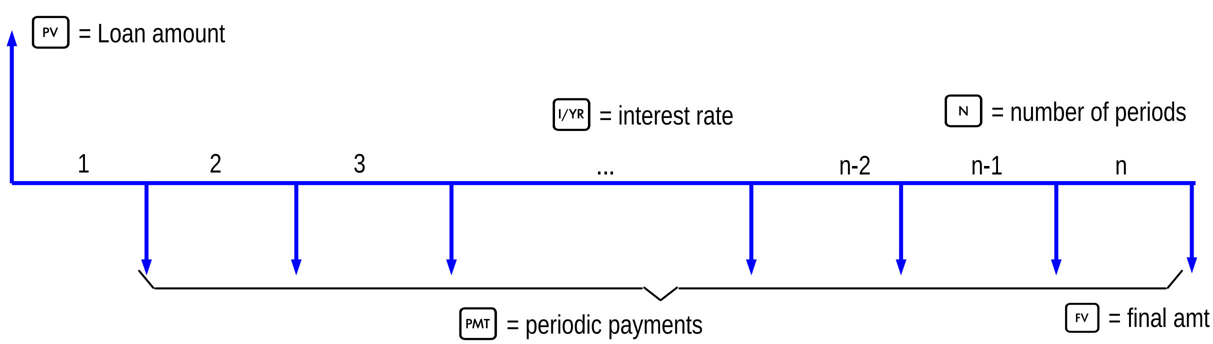
Saving for retirement

Nearly everyone is interested in saving for retirement (or some other similar future goal). This almost always involves making regular deposits into an account. When those deposits are of equal size and spaced apart equally, the problem becomes an annuity.

These types of problems may involve solving for a payment required in order to reach an already stated goal or a known, regular deposit but an unknown future amount available at retirement.

Cash flow diagrams and sign conventions

The sign conventions for cash flows in the HP 20b 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 most common borrower viewpoint and their relationship to the TVM variables.



Practice solving problems involving saving for retirement

Example 1: If you want to retire 40 years from now with $1,000,000 in your account, how much must you deposit beginning next month and continuing for 40 years into the account to achieve this goal? Assume the account earns 6%, compounded monthly.

Solution:
[ ] [Reset] [INPUT] [1] [2] [ ] [P/YR]
[4] [8] [0] [N]
[6] [I/YR]
[1] [0] [0] [0] [0] [0] [0] [+/-] [FV]
[PMT]

Answer: $-489.23 per month. The value at the end of the 40-year period would be a withdrawal and is therefore entered as a negative value.

Example 2: Johnny can save $50 per month. If he is 30 years old today and begins saving next month, how much is in an account paying 8%, compounded monthly, if he continues to save for 35 years?

Solution:
[ ] [Reset] [INPUT] [1] [2] [ ] [P/YR]
[4] [2] [0] [N]
[8] [I/YR]
[5] [0] [PMT]
[FV]

Answer: $-114,694.12. Since the $50 is a deposit, it is entered as a positive number. There are 420 months in 35 years.

Example 3: Billy can save $50 per month. If he is 20 years old today and begins saving next month, how much is in an account paying 8%, compounded monthly, if he continues to save for 45 years?

Solution:
[ ] [Reset] [INPUT] [1] [2] [ ] [P/YR]
[5] [4] [0] [N]
[8] [I/YR]
[5] [0] [PMT]
[FV]

Answer: $-263,726.99. Since the $50 is a deposit, it is entered as a positive number. There are 540 months in 45 years. Notice how much more Billy has because he started to save earlier in his life.

Example 4: Cindy saved $250 per quarter for 10 years and then quit making deposits. How much is in her account 20 years later, if the account earns 8%, compounded quarterly?

Solution:
[ ] [Reset] [INPUT] [4] [ ] [P/YR]
[4] [0] [N]
[8] [I/YR]
[2] [5] [0] [PMT]
[FV]

[STO] [PV]
[8] [0] [N]
[0] [PMT]
[FV]

Answer: $73,621.55. Note how the problem is broken up into two pieces, first calculating the balance in the account immediately after the last deposit, which is then stored as the initial amount for the second portion of the problem, which computes the balance in the account after the period in which no additional deposits were being made.

Example 5: What interest rate would an account need to earn so that monthly deposits of $200 over the next 40 years would grow to become $800,000? Assume the account has $5,000 in it today.

Solution:
[Reset] [INPUT] [1] [2] [P/YR]
[4] [8] [0] [N]
[5] [0] [0] [0] [PV]
[2] [0] [0] [PMT]
[8] [0] [0] [0] [0] [0] [+/-] [FV]
[I/YR]

Answer: 8.47%. The initial deposit and the monthly deposit are both entered as positive values, since they are in fact deposits into the account.

Example 6: How many monthly deposits of $400 per month would you need to make in order to accumulate $500,000 in an account that pays 5.5%, compounded monthly?

Solution:
[Reset] [INPUT] [1] [2] [P/YR]
[5] [•] [5] [I/YR]
[4] [0] [0] [PMT]
[5] [0] [0] [0] [0] [0] [+/-] [FV]
[N]

Answer: 416.91 months, or a little under 35 years. If you forget to make the FV negative, you will get a "ER: No solution" message from the HP 20b.

Example 7: If Harry plans to make deposits of $120 per month each month for the next 20 years and wishes to accumulate $120,000, how much must he deposit today in order to achieve this goal? Assume the money will earn 6.75%, compounded monthly.

Solution:
[Reset] [INPUT] [1] [2] [P/YR]
[2] [4] [0] [N]
[6] [•] [7] [5] [I/YR]
[1] [2] [0] [PMT]
[1] [2] [0] [0] [0] [0] [+/-] [FV]
[PV]

Answer: $15,444.81. In other words, it would require a deposit today of $15,444.81 AND 240 deposits of $120 in order to accumulate $120,000 in 20 years.