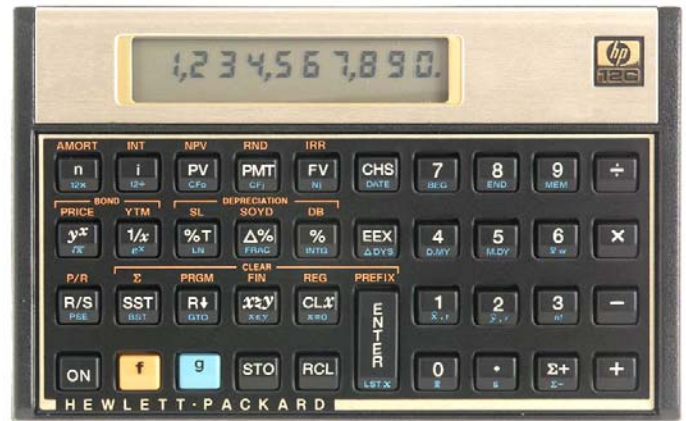




hp calculators

HP 12C Time Value of Money Basics



TVM calculations

The HP12C TVM

TVM sign conventions, payment modes and odd periods

Practice solving simple interest problems

Practice solving compound interest problems

TVM calculations

Based on the fact that an amount of money has different values in different times, the concept of the time value of money (TVM) is the key for anyone who takes monetary decisions. A set of mathematics tools has been developed with the purpose of evaluating the time value of money, and the concepts of the present value of money (*PV*), future value of money (*FV*), periodic payments (*PMT*), interest rates (*i*), and the number of compounding periods (*n*). Two basic calculations in TVM are referred to as Simple Interest and Compound Interest / Annuity calculations, and their math expressions are shown below:

$$I_{360} = \frac{n}{360} \times PV \times i \qquad I_{365} = \frac{n}{365} \times PV \times i \qquad \text{Figure 1}$$

$$PV + PMT \left[\frac{1 - (1+i)^{-n}}{i} \right] + FV(1+i)^{-n} = 0 \qquad \text{Figure 2}$$

In the simple interest expressions, I_{360} and I_{365} are the amount of interest respectively on a (financial) 360- or (actual) 365-day basis.

The HP12C TVM

In the HP12C, five keys give access to the five financial variables: \boxed{n} , \boxed{i} , \boxed{PV} , \boxed{PMT} and \boxed{FV} . To set any of these registers to a known value, enter the value and press the proper key. For a simple interest problem, enter the values for *i* (annual interest rate), *PV* and *n* (days) in any order and press $\boxed{f} \boxed{INT}$ to calculate the amount of interest⁽¹⁾. If it is a compound interest or annuity calculation, enter each of the known TVM values and then press the key of the unknown value.

When annual interest rates are known and month periods are considered in compound interest calculations, two additional functions are helpful. $\boxed{g} \boxed{12X}$ is used to enter the number of known years when months are used in the calculations. $\boxed{g} \boxed{12\div}$ is used to enter annual interest rates when monthly interest rates are considered in the calculations.

TVM sign conventions, payment modes and odd periods

The sign conventions for cash flow in the HP12C follow the simple rule: money received is positive, money paid out is negative. This works perfectly fine for either the lender or the borrower point of view, provided that either view is kept in the same interest calculation.

The HP12C allows setting payment occurrence either in the beginning or in the end of each compounding period. The following keystroke sequence sets payment in the beginning of each compound period. The **BEGIN** annunciator indicates the current mode.

 $\boxed{g} \boxed{BEG}$

 BEGIN

Figure 3

¹ the interest amount for both 360- and 365-day basis is calculated simultaneously.

HP 12C Time Value of Money Basics

The following keystroke sequence sets payments to be at the end of each compound period. This is the default mode, and there is no specific annunciator for it in the display.

9 **END**

An odd period is a fraction of an integer compound period that occurs when any financial agreement is sealed in the middle of a regular compound period. In this case the fraction part of n is used to compose either a simple interest or a compound interest calculation. To apply compound interest to the odd period when calculating compound interest, use the following keystroke sequence:

STO **EEX**

C

Figure 4

To apply simple interest to the odd period when calculating compound interest, press **STO** **EEX** again and make sure the **C** annunciator is off. If n contains an integer value, the status of the **C** annunciator is not considered.

Practice solving simple interest problems

Example 1: The amount of \$800 is borrowed for 90 days at 6.2% simple interest. What is the accrued interest calculated on a 360- and on a 365-day basis?

Solution: First, clear the TVM register contents to zero before starting a new calculation:

f **FIN**

Previous display contents are not changed. Now enter and store the known values for n , i and PV in any order. Consider the borrower view.

6 **.** **2** **i** **9** **0** **n**

90.00

Figure 5

For each entered data, pressing the corresponding TVM key echoes the entered data in the display.

8 **0** **0** **PV**

800.00

Figure 6

From the borrower point of view, the money is received, so it is a positive value. To compute the simple interest amount:

f **INT**

- 12.40

Figure 7

HP 12C Time Value of Money Basics

This is the amount of accrued interest on a 360-day basis. The amount of accrued interest on a 365-day basis is already computed, so to bring it to the display just use the following keystroke sequence:

R↓ **X \rceil Y**

- 12.23

Figure 8

Answer: After 90 days, the amount of accrued interest to be paid on a 360-day basis is \$12.40 and on a 365-day basis it is \$12.23. Considering the view of the borrower, the money is paid out, so the resulting interest is a negative value.

Example 2: The amount of \$1,200 is lent for 120 days at 6.7% simple interest. What is the net amount to be received by the lender if a 365-day basis is considered?

Solution: Clear the TVM register contents to zero prior to start a new calculation:

f **FIN**

Enter and store the known values for n , i and PV in any order. Consider the view of the lender.

6 **.** **7** **i** **1** **2** **0** **n** **1** **2** **0** **0** **CHS** **PV**

- 1200.00

Figure 9

From the lender point of view, the money is paid out, so it is a negative value. To compute the simple interest amount:

f **INT**

26.80

Figure 10

This is the amount of accrued interest in a 360-day basis that is not going to be used here. To compute the net amount to be received on a 365-day basis, use the following keystroke sequence:

R↓ **+**

1,226.43

Figure 11

Answer: After 120 days, the net amount to be received on a 365-day basis it is \$1,226.43. Considering the view of the lender, the money is received, so it is a positive value.

Practice solving compound interest problems

Example 3: The amount of \$1,200 is borrowed for 4 months at a 0.85% per month interest rate. Given that no payments are expected to occur in this 4-month period, what is the amount to be paid out by the borrower after 4 months?

Solution: Clear the TVM register contents to zero and key in the values for the new calculation:

f FIN 4 n 1200 PV • 85 i



Figure 12

As there are no payments and the fourth variable is already set to zero, to compute the amount to be paid out (future value):

FV



(flashing briefly)



Figure 13

Answer: The amount to be paid out by the borrower after 4 months is \$1,241.43.

Example 4: In the previous example, the borrower agrees to make the payment 6 months from today. How much must be paid at that time?

Solution: Do not clear the TVM register contents because many of the existing values are kept from the previous example. All that is needed is to enter the new value for N before computing the future value:

6 n FV

Answer: The amount to be paid out by the borrower after 6 months is \$1,261.52.

Example 5: A savings account is opened with \$1,190. After one year the final balance is \$1,250. What is the compound interest rate applied to this savings account?

Solution: Clear the TVM register contents, store all known values and calculate i :

f FIN 12 n 1190 CHS PV 1250 FV i

Answer: The compound interest rate in this savings account is 0.41% per month, or 4.93%, compounded monthly.