Compound Interest Calculations

The HP-12C Compound Interest calculations involves the n , i , PV , PMT and FV keyboard keys.

These keys correspond to the so called "Financial Registers" and represent the variables in the well known "Time Value of Money" equation.

$$PV + (1 + S \cdot i') \cdot PMT \cdot [1 - (1 + i')^{-n}] \div i' + FV \cdot (1 + i')^{-n} = 0$$

Variable	Description
n	Number of compounding periods or the total number of payments.
i	Interest rate per compounding period in percent ($i' = i \div 100$).
PV	Present value amount.
PMT	Payment amount.
FV	Future value amount.
S	Payment mode: for "BEG" mode is equal to 1, for "END" mode is equal to 0.

Any of the n, i, PV, PMT or FV variables can be calculated if the other four are known. If any other key is pressed before one of these keys, the displayed number is stored in the corresponding variable. Otherwise, the variable will be calculated.

Cash Flow Sign Convention:
The values entered in the PV , PMT or FV registers must consider the proper sign. Positive numbers correspond to money received (**Cash-In**). Negative numbers correspond to money paid (**Cash-Out**).

Payment Mode:

The results of calculations involving payments in advance are different from those considering payments arrears. To specify the proper mode press:

`g` `END` : to set the PMT at the end of each compounding period or,

`g` `BEG` : to set the PMT at the beginning of each compounding period.

The "**BEGIN**" status indicator is lit in the display when the payment mode is set to Begin. If "**BEGIN**" is not lit, the payment mode is set to end.

Number of Periods `n` & Interest Rate `i`:

In compound interest problems, the number entered in `n` correspond to the total number of compounding periods where payments are made. `n` is normally given in years or months, but can be any other time unit. Nevertheless, the interest rate entered into `i`, must be expressed in terms of the same time unit. For example, if `n` is in quarters, `i` should be the interest rate per quarter.

If the number of periods is given in years, the interest rate is given as annual rate (usually called nominal rate). If there are 12 compounding periods per year (monthly payments), then two convenient shortcut functions can be used to store the monthly values:

`g` `12x` : Multiplies the displayed number by 12 and store the result in `n`. For example, 4 years is stored as 48 compounding periods (months).

`g` `12÷` : Divides the displayed number by 12 and store the result in `i`. For example a nominal rate of 7.25% is stored as 0.60% per month.

Also, to recover the values stored in "**n**" and " **i** " in a year basis press:

`RCL` `g` `12x` : To recall and display the value stored in `n` divided by 12.

`RCL` `g` `12÷` : To recall and display the number stored in `i` multiplied by 12.

[n] Compounding Periods Calculation

To calculate the number of periods [n], do the next general sequence:

1)	Press [f] **clear** [FIN] to clear all the financial registers to 0.
2)	Enter the periodic interest rate in percent, using [i] or [g] [12÷] .
3)	Enter at least two of the other three variables (PV, PMT or FV) using [PV] , [PMT] and [FV] (Remember the Sign Convention).
4)	If **PMT** was entered, press [g] [END] or [g] [BEG] to set the payment mode.
5)	Press [n] to calculate the number of payments or compounding periods. If the result is non-integer, the calculator rounds "n-0.005" to the next higher integer.

Example : Calculating [n]

How long should be a $25,000.00 loan with an interest rate for 6.7% per year if you can paid only $500.00 per month?.

Keystrokes	Description
[f] **clear** [FIN] [g] [END]	Clear the Financial Registers and set payment mode to END.
Type"6.7" [g] [12÷]	Stores the monthly interest rate percent. **Result = 0.56**
Type"25000" [PV]	Type the loan amount and store it in "**PV**" (Cash-In).
Type"500" [CHS] [PMT]	Type the periodic payment and store it in "**PMT**" (Cash-Out).
[n]	Calculate the number of payments required. **Result = 59.00**
[RCL] [g] [12x]	Recall "**n**" in years. **Result = 4.92**

ⓘ Periodic Interest Rate Calculation

To calculate the interest rate ⓘ, do the next general sequence:

1)	Press `f` `clear` `FIN` to clear all the financial registers to 0.
2)	Enter the number of payments or periods, using `n` or `g` `12x` .
3)	Enter at least two of the other three variables (PV, PMT or FV) using `PV`, `PMT` and `FV` (Remember the Sign Convention).
4)	If **PMT** was entered, press `g` `END` or `g` `BEG` to set the payment mode.
5)	Press `i` to calculate the periodic interest rate in percent.

Example : Calculating ⓘ

What annual interest rate must be obtained to accumulate $10,000 in 8 years on an investment of $6,000 with quarterly compounding?

Keystrokes	Description
`f` `clear` `FIN` `g` `END`	Clear the Financial Registers and set payment mode to END.
In **RPN**: Type "8" `ENTER` "4" `X` `n` In **ALG**: Type "8" `X` "4" `n`	Type the number of years, multiply by "4" quarters per year and press "n" to store the total number of quarters. **Result = 32.00**
Type"6000" `CHS` `PV`	Type the loan amount, change sign and press "**PV**" (Cash-Out).
Type"10000" `FV`	Type the periodic payment and store it in "**FV**" (Cash-In).
`i`	Calculate the quarterly interest rate percent. **Result = 1.61**
In **RPN**: Type "4" `X` In **ALG**: `X` "4" `=`	Calculate the annual interest rate percent. **Result = 6.44**

PV **Present Value Calculation**

To calculate the present value PV, do the next general sequence:

1)	Press f **clear** FIN to clear all the financial registers to 0.
2)	Enter the number of payments or periods, using n or g 12x .
3)	Enter the periodic interest rate in percent, using i or g 12÷ .
4)	Enter "PMT" or "FV" or both using PMT and FV (Remember the Sign Convention).
5)	If **PMT** was entered, press g END or g BEG to set the payment mode.
6)	Press PV to calculate the present value.

Example : Calculating PV

What is the maximum purchase price of an asset that gives a monthly net cash flow of $1,230?. The expected holding period is 5 years, the estimated selling price at that time is $10,000, and you want at least a 15% return per year.

Keystrokes	Description
f **clear** FIN g END	Clear the Financial Registers and set payment mode to END.
Type"5" g 12x	Store the number of periodic payments. **Result = 60.00**
Type"15" g 12÷	Store the monthly interest rate percent. **Result = 1.25**
Type"1230" PMT	Type the monthly payments and store it in "**PMT**" (Cash-In).
Type"10000" FV	Type the selling price and store it in "**FV**" (Cash-In).
PV	Calculate the present value. **Result = -56,448.22** (Cash-Out)

PMT Periodic Payment Calculation

To calculate the periodic payment PMT, do the next general sequence:

1)	Press f clear FIN to clear all the financial registers to 0.
2)	Enter the number of payments or periods, using n or g 12x .
3)	Enter the periodic interest rate in percent, using i or g 12÷ .
4)	Enter "PV" or "FV" or both using PV and FV (Remember the Sign Convention).
5)	Press g END or g BEG to set the payment mode.
6)	Press PMT to calculate the periodic payment value.

Example : Calculating PMT

What is the monthly payment on 25-year, $89,560 mortgage at 5.25% annual interest, compounding monthly?.

Keystrokes	Description
f clear FIN	Clear the Financial Registers.
Type"25" g 12x	Store the number of periodic payments. **Result = 300.00**
Type"5.25" g 12÷	Store the monthly interest rate percent. **Result = 0.44**
Type"89560" PV	Type the monthly payments and store it in "**PV**" (Cash-In).
g END	Set the payment mode to END.
PMT	Calculate the periodic payment. **Result = -536.69** (Cash-Out)

[FV] Future Value Calculation

To calculate the future value [FV], do the next general sequence:

1)	Press [f] **clear** [FIN] to clear all the financial registers to 0.
2)	Enter the number of payments or periods, using [n] or [g] [12x] .
3)	Enter the periodic interest rate in percent, using [i] or [g] [12÷] .
4)	Enter "PV" or "PMT" or both using [PV] and [PMT] (Remember the Sign Convention).
5)	If **PMT** was entered, press [g] [END] or [g] [BEG] to set the payment mode.
6)	Press [FV] to calculate the future value amount.

Example : Calculating [FV]

A saving account offers a nominal rate of 4%. If you open that account with a initial deposit of $2,000.00 and each month for now on you will save $300. What is the balance of the account after 5 years?.

Keystrokes	Description
[f] **clear** [FIN]	Clear the Financial Registers.
Type"5" [g] [12x]	Store the number of periodic payments. **Result = 60.00**
Type"4" [g] [12÷]	Store the monthly interest rate percent. **Result = 0.33**
Type"2000" [CHS] [PV]	Type the present value and store it in "**PV**" (Cash-Out).
[g] [END]	Set the payment mode to END.
Type"300" [CHS] [PMT]	Type the monthly payments and store it in "**PMT**" (Cash-Out).
[FV]	Calculate the future value. **Result = 22,331.69** (Cash-In)

Odd-Period Calculations

Interest often begins to accrue prior to the beginning of the first payment. This result in a first period longer than the regular payment period sometimes called "odd first period". For simplicity, the calculator always consider the first period as equal to the remaining periods, and the period between the date interest begin accruing and the date of the beginning of the first payment period is the "odd period".

To calculate $\boxed{i}$, $\boxed{PV}$, $\boxed{PMT}$ or $\boxed{FV}$ for odd period cases, simply enter a non integer $\boxed{n}$. In this way, the integer part of $\boxed{n}$ specifies the number of full payment periods, and the fractional part specifies the "odd period" as a fraction of a full period. Therefore, the "odd period can't be grater than one full period.

Normally the calculation for the "odd period" is performed using simple interest. To use compound interest calculation for the "odd period" press $\boxed{STO}$ $\boxed{EEX}$ to lit the status indicator "**C**" in the display.

Example : "Odd-Period" Calculation

A 36 months loan for $4,500.00 accrues interest at a 5% annual percentage rate (APR), with the payments made at the end of each month. If interest begins accruing on February 15, 2004 (so that the first period begins on March 1, 2004), calculate the monthly payment, with the odd days counted on the basis of a 30-day month and compound interest used for the "odd period".

Keystrokes	Description
f clear FIN	Clears the Financial Registers.
g M.DY	Set Month-Day-Year format.
g END	Sets the payment mode to END.
STO EEX	Set the odd period interest calculation to compound. The status indicator "**C**" should be in the display.

Keystrokes	Description
Type"2.152004" ENTER "3.012004"	Type the date of Interest begin accrued, press "ENTER" and type the date of the beginning of the first period.
g ΔDYS	Calculate the number of the Odd-period days using the actual calendar. **Result = 15**
x⤲y	Show the number of the Odd-period days using the 30/360 calendar. **Result = 16**
In RPN: Type "30" ÷ In ALG: Type ÷ "30" =	Divide by 30 days to calculate the fractional part of the number of periods. **Result = 0.53**
In RPN: Type "36" + n In ALG: Type + "36" n	Add 36 months to the fractional part and press "**n**". **Result = 36.53**
Type "5" g 12÷	Store the monthly interest rate percent. **Result = 0.42**
Type "4500" PV	Type the monthly payments and press "**PV**" (Cash-In).
PMT	Calculate the monthly payment. **Result = -135.17** (Cash-Out).