hp calculators

HP 33S Property Appreciation

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The Time Value of Money on the HP 33S

Practice solving property appreciation problems
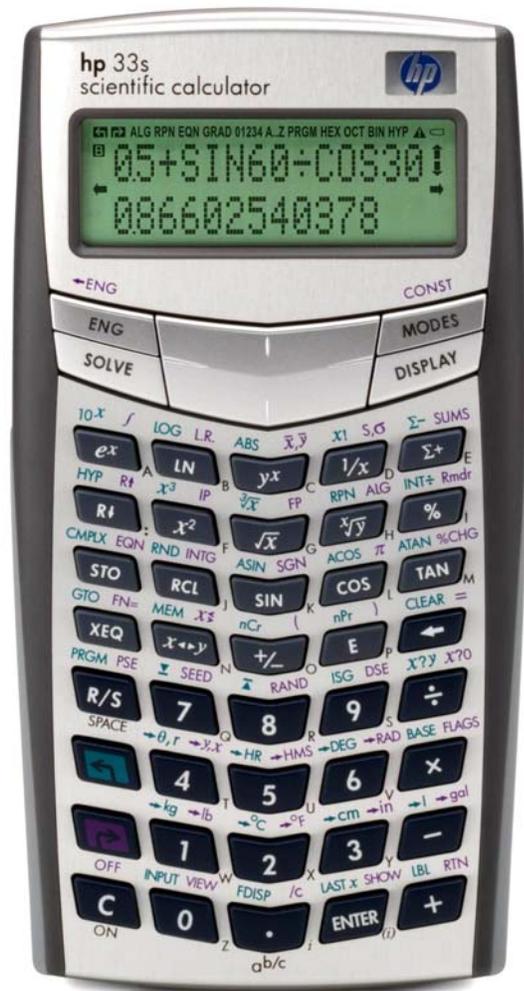
Property Appreciation

When the value of a piece of property increases over time, it has appreciated in value. If a value in the past is known, it is possible to solve the resulting compound interest problem to determine the rate of this appreciation.

The Time Value of Money on the HP 33S

To solve time value of money problems on the HP 33S, the formula below is entered into the flexible equation solver built into the calculator. This equation expresses the standard relationship between the variables in the time value of money formula. The formula uses these variables: *N* is the number of compounding periods; *I* is the *periodic* interest rate as a percentage (for example, if the *annual* interest rate is 15% and there are 12 payments per year, the *periodic* interest rate, *i*, is 15÷12=1.25%); *B* is the initial balance of loan or savings account; *P* is the periodic payment; *F* is the future value of a savings account or balance of a loan.

Equation: P x 100 x (1 - (1 + I ÷ 100)^ -N) ÷ I + F x (1 + I ÷ 100) ^ -N + B

To enter this equation into the calculator, press the following keys on the HP 33S:

⬌ [EQN] [RCL] [P] [×] [1] [0] [0] [×] ⬌ [(] [1] [−] ⬌ [(] [1] [+] [RCL] [I] [÷] [1] [0] [0] ⬌ [)] [y^x]
[−] [RCL] [N] ⬌ [)] [÷] [RCL] [I] [+] [RCL] [F] [×] ⬌ [(] [1] [+] [RCL] [I] [÷] [1] [0] [0] ⬌ [)] [y^x] [−]
[RCL] [N] [+] [RCL] [B] [ENTER]

To verify proper entry of the equation, press

⬌ [SHOW]

and hold down the [SHOW] key. This will display the equation's checksum and length. The values displayed should be a checksum of 382E and a length of 41.

To solve for the different variables within this equation, the [SOLVE] button is used. This key is found on the top of the calculator to the left of the cursor keys. An arrow points to its location in Figure 1 below.

HP 33S displays a menu of possible values. Items on this menu are viewed by pressing the [←] or [→] parts of the cursor key at the top of the HP 33S, as shown in Figure 1 below.
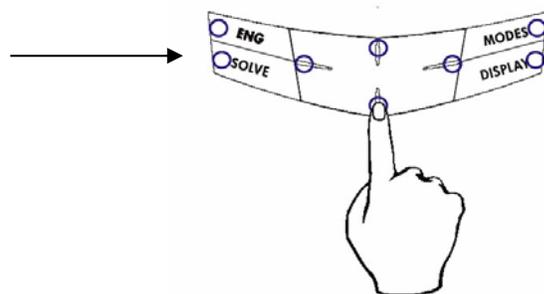

Figure 1

Notes for using the SOLVE function with this equation:

1)   If your first calculation using this formula is to solve for the interest rate I, press [1] [STO] [I] before beginning.

2) Press 🔁 EQN. If the time value of money equation is not at the top of the list, press ⬆️ or ⬇️ to scroll through the list until the equation is displayed.
3) Determine the variable for which you wish to solve and press:
   a) SOLVE N to calculate the number of compounding periods.
   b) SOLVE I to calculate the periodic interest rate. Note: this will need to be multiplied by the number of compounding periods per year to get the annual rate. If the compounding is monthly, multiply by 12.
   c) SOLVE B to calculate the initial balance (or Present Value) of a loan or savings account.
   d) SOLVE P to calculate the periodic payment.
   e) SOLVE F to calculate the future value of a loan or savings account.
4) When prompted, enter a value for each of the variables in the equation as you are prompted and press R/S. The solver will display the variables' existing value. If this is to be kept, do not enter any value but press R/S to continue. If the value is to be changed, enter the changed value and press R/S. If a variable had a value in a previous calculation but is not involved in this calculation (as might happen to the variable P (payment) when solving a compound interest problem right after solving an annuity problem), enter a zero for the value and press R/S.
5) After you press R/S for the last time, the value of the unknown variable will be calculated and displayed.
6) To do another calculation with the same or changed values, go back to step 2 above.

The SOLVE feature will work effectively without any initial guesses being supplied for the unknown variable with the exception noted above about the variable I in this equation. This equation follows the standard convention that money in is considered positive and money out is negative.

The practice problems below illustrate using this equation to solve a variety of sinking fund problems.

Practice solving property appreciation problems

Example 1: Greg bought a house 10 years ago for $120,000. He sold it last week for $180,000. On an annual basis, what was the compound rate of increase or appreciation?

Solution: First, enter the time value of money equation into the HP 33S solver as described earlier in this document.

Then press 🔁 EQN and press ⬆️ or ⬇️ to scroll through the equation list until the time value of money equation is displayed. Then press:

SOLVE I

The HP 33S SOLVER displays the first variable encountered in the equation as it begins its solution. The value of 0.0000 is displayed below if this is the first time the time value of money equation has been solved on the HP 33S calculator. If any previous equations have used a variable used in the time value of money equation, they may already have been assigned a value that would be displayed on your HP 33S display. If this is the first time a solution for I has been attempted, press 1 STO I, then follow the keystrokes shown below and the solution should be found as described. If previous solutions for I have been found, follow the instructions below.

```
      RPNEQN
P?
0.0000
```

Figure 2

In either RPN or algebraic mode, press: 0 R/S

```
              RPNEQN
N?
0.0000
```
Figure 3

In either RPN or algebraic mode, press: `1` `0` `R/S`

```
              RPNEQN
F?
0.0000
```
Figure 4

In either RPN or algebraic mode, press: `1` `8` `0` `0` `0` `0` `+/_` `R/S`

```
              RPNEQN
B?
0.0000
```
Figure 5

In either RPN or algebraic mode, press: `1` `2` `0` `0` `0` `0` `R/S`

```
              RPN
I =
4.1380
```
Figure 6

Answer: An annual appreciation rate of 4.138%

Example 2:   Johanna bought a house 5 years ago for $310,000. She sold it today for $400,000. At what rate, compounded monthly, did Johanna's house appreciate over this period?

Solution: First, enter the time value of money equation into the HP 33S solver as described earlier in this document.

Then press `⤊` `EQN` and press `↑` or `↓` to scroll through the equation list until the time value of money equation is displayed. Then press:

`SOLVE` `I`

The HP 33S SOLVER displays the first variable encountered in the equation as it begins its solution. These displays are not shown in the rest of this example. Follow the keystrokes shown below and the solution should be found as described.

In either RPN or algebraic mode, press: `0` `R/S`   (Enters P)
`6` `0` `R/S`   (Enters N)
`4` `0` `0` `0` `0` `0` `+/_` `R/S`   (Enters F)
`3` `1` `0` `0` `0` `0` `R/S`   (Enters B)

Figure 7

Answer: When multiplied by 12 to convert to the annual appreciation rate, the answer is 5.108%

Example 3: Howard bought some land 8 years ago for $800,000. He has an offer to sell it today for $1,400,000. What is the annual appreciation rate reflected by this offer?

Solution: First, enter the time value of money equation into the HP 33S solver as described earlier in this document.

Then press [◄] [EQN] and press [↑] or [↓] to scroll through the equation list until the time value of money equation is displayed. Then press:

[SOLVE] [I]

The HP 33S SOLVER displays the first variable encountered in the equation as it begins its solution. These displays are not shown in the rest of this example. Follow the keystrokes shown below and the solution should be found as described.

In either RPN or algebraic mode, press:

[0] [R/S]	(Enters P)
[8] [R/S]	(Enters N)
[1] [4] [0] [0] [0] [0] [0] [+/−] [R/S]	(Enters F)
[8] [0] [0] [0] [0] [0] [R/S]	(Enters B)

Figure 8

Answer: The property appreciated at a rate of 7.245%, compounded annually.