hp calculators
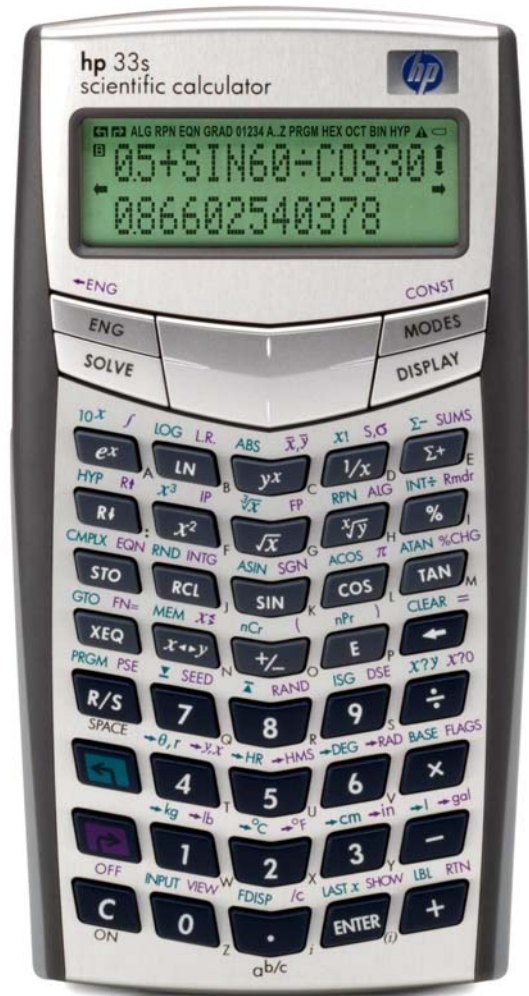
HP 33S Sinking Funds

Sinking Funds

The Time Value of Money on the HP 33S

Practice solving for payment required to achieve a goal

Sinking Funds

A sinking fund is an annuity where a specific value in the future is needed, which is accumulated through a series of regular payments. These types of problems often occur when saving for a goal, such as retirement or college tuition.

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] [⇱] [)] [yˣ]
[−] [RCL] [N] [⇱] [)] [÷] [RCL] [I] [+] [RCL] [F] [×] [⇱] [(] [1] [+] [RCL] [I] [÷] [1] [0] [0] [⇱] [)] [yˣ] [−]
[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.
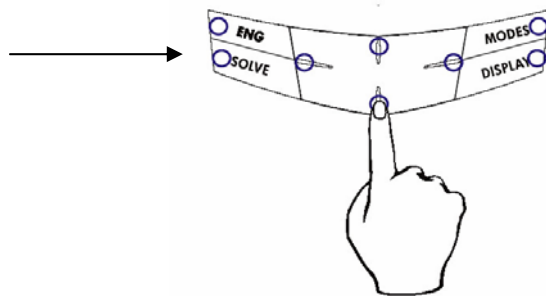

Figure 1

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 for payment required to achieve a goal

Example 1: How much would you need to save at the end of every month to accumulate $10,000 in 6 years? Assume the funds would earn 6%, compounded monthly, and that you begin with nothing in the account.

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 P

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. Follow the keystrokes shown below and the solution should be found as described.

Figure 2

In RPN mode, press: 6 ENTER 1 2 ÷ R/S
In algebraic mode, press: 6 ÷ 1 2 ENTER R/S

Figure 3

In RPN mode, press: 6 ENTER 1 2 × R/S
In algebraic mode, press: 6 × 1 2 ENTER R/S

Figure 4

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

Figure 5
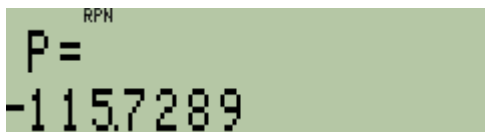
In either RPN or algebraic mode, press: 0 R/S

Figure 6

Answer: The required monthly deposit is $115.73.

Example 2:   John wants to retire as a millionaire. He is 25 years old. How much would he need to deposit each month beginning one month from now and continuing until his 65th birthday in order to achieve his goal? Assume the funds would earn 5%, compounded monthly, and that John begins with nothing in the account.

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 P

The HP 33S SOLVER displays the first variable encountered in the equation as it begins its solution. The value of 0.5000 is leftover from the immediately preceding example. If your HP 33S has been used to make changes to the value stored in any of the time value of money equation variables, the initial values displayed may vary from what is shown below. If this example is worked immediately after the preceding example, the displays below will be shown on an HP 33S. Follow the keystrokes shown below and the solution should be found as described.

Figure 7

In RPN mode, press: `5` `ENTER` `1` `2` `÷` `R/S`
In algebraic mode, press: `5` `÷` `1` `2` `ENTER` `R/S`

Figure 8

In RPN mode, press: `6` `5` `ENTER` `2` `5` `−` `1` `2` `×` `R/S`
In algebraic mode, press: `6` `5` `−` `2` `5` `ENTER` `×` `1` `2` `ENTER` `R/S`
(Since John is 25, he has (65 – 25) x 12, or 480 months until his 65th birthday)

Figure 9

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

Figure 10

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

Figure 11

Answer: $655.30

Example 3:   How much money should you deposit each year into an account, beginning one year from today, to have
             $30,000 in the account after 15 years? Assume the funds would earn 6%, compounded annually, and
             that the account begins with a balance of $1,000.

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` `P`

             The HP 33S SOLVER displays the first variable encountered in the equation as it begins its solution.

The initial values shown in the figures below assume this example is worked immediately after the preceding example. Follow the keystrokes shown below and the solution should be found as described.
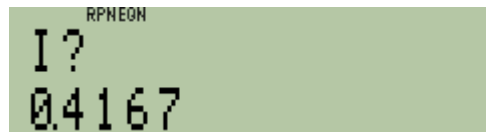
RPNEQN
I?
0.4167

Figure 12

In either RPN or algebraic mode, press: 6 R/S

RPNEQN
N?
480.0000

Figure 13

In either RPN or algebraic mode, press: 1 5 R/S

RPNEQN
F?
1,000,000.0000

Figure 14

In either RPN or algebraic mode, press: 3 0 0 0 0 R/S

RPNEQN
B?
0.0000

Figure 15

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

RPN
P=
-1,185.9202

Figure 16

Answer: $1,185.92