

Classic Problems at a Glance using the TVM Solver

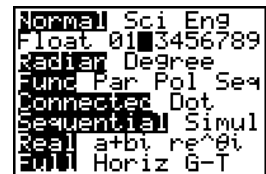
The table below illustrates the most common types of “classic” finance problems. The formulas are given for each calculation. A brief introduction to using the TVM Solver is followed by an example of each of the formulas in the table.

	Future Value	Present Value
Lump Sum	<ul style="list-style-type: none"> Compound Amount Factor $(1+i)^n$ 	<ul style="list-style-type: none"> Present Value Factor $\frac{1}{(1+i)^n} = (1+i)^{-n}$
Annuity	<ul style="list-style-type: none"> Annuity Compound Amount Factor $\frac{(1+i)^n - 1}{i}$ Sinking Fund Factor $\frac{i}{(1+i)^n - 1}$ 	<ul style="list-style-type: none"> Annuity Present Value Factor $\frac{1 - (1+i)^{-n}}{i}$ Capital Recovery Factor or Loan Repayment Factor $\frac{i}{1 - (1+i)^{-n}}$

Calculator Housekeeping Detail — Setting the Mode

- Press the **MODE** key (2B)† and change the Float to 2. This will cause decimal answers to display with 2 digits since most answers in finance are in dollars and cents. Highlight 2 on the second line and press **ENTER** to save your selection. (Figure 1)

(Figure 1)



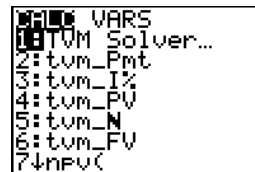
- Use **2nd** [QUIT] (2B) to return to the Home Screen.

† Refer to the section on Key Arrangement in Chapter 1 for an explanation of the key locator codes used in this manual.

Calculator Housekeeping Detail — Using the TVM Solver

1. Press $\boxed{2\text{nd}}$ [FINANCE] (5A). Choose **1:TVM Solver** from the CALC menu by pressing 1 or $\boxed{\text{ENTER}}$. (Figure 2)

(Figure 2)



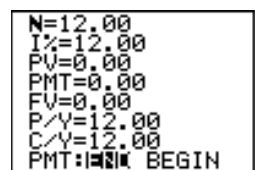
The screen that appears will be similar to Figure 3 but will probably have different values.

Interest is simple or compounded. In the TVM Solver, the number of compounding periods per year (C/Y) is set to 1 for simple interest; otherwise it indicates the number of compounding periods per year. For continuous compounding, set C/Y to a very large number, e.g., 1 E 11. (See *Chapter 6, Continuous Compounding* for details.)

2. When using the TVM Solver, enter values for each of the variables:

N	Number of payment periods
I%	Annual interest rate
PV	Present Value
PMT	Payment Amount
FV	Future Value
P/Y	Number of payment periods per year
C/Y	Number of compounding periods per year
PMT:	Indicates whether payments are made at the end or beginning of each payment period. (Figure 3)

(Figure 3)



Note: Store C/Y after storing P/Y because a change in P/Y always resets C/Y.

3. Enter the number of years for N, I% as a percent (not as a decimal). Enter the money invested as a negative number (cash outflows are considered negative, while cash inflows are considered positive). Enter the payment (PMT) as 0, and the payments per year (P/Y) as 1.
4. To solve, move the cursor to the variable for which you want to solve. Press $\boxed{\text{ALPHA}}$ [SOLVE] (10E) to calculate this value. A small shaded box to the left of the variable indicates a solution.

If you change a value on the screen, you will lose the shaded box and must solve again for a new value.

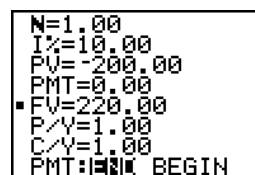
Compound Amount Factor $(1+i)^n$

Example 1:

What can an investor expect to receive at the end of a year if he deposits \$200 in a bank giving 10% interest?

1. Press $\boxed{2\text{nd}}$ [FINANCE] (5A) and choose **1:TVM Solver** from the CALC menu.
2. As in step 3 above, enter N = 1, I% = 10, PV = -200, PMT = 0, P/Y = 1 and C/Y = 1. Leave PMT: set to END.
3. Place the cursor on the Future Value (FV), then press $\boxed{\text{ALPHA}}$ [SOLVE] (10E).

(Figure 4)



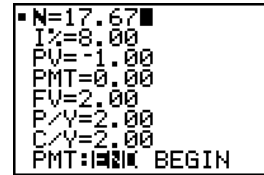
The future value is \$220.00. (Figure 4)

Example 2:

How long will it take a dollar to double at 8% compounded semiannually?

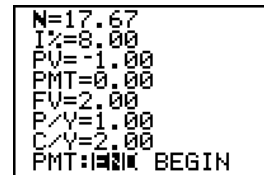
1. Press **2nd** [FINANCE] and choose **1:TVM Solver**
2. In this example, I% = 8, PV = -1, PMT = 0, FV = 2, P/Y = 2 and C/Y = 2. To enter these values, input **8** **↓** **(-)** **1** **↓** **0** **↓** **2** **↓** **2** **↓** **2**.
3. Place the cursor on the N and then press **ALPHA** [SOLVE] (1OE) to find the number of periods. (Figure 5)

(Figure 5)



It takes 17.67 payment periods, or 17.67 half-years. That is about 9 years.

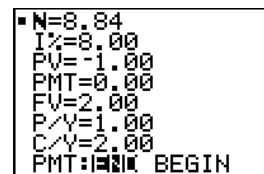
(Figure 6)



4. By changing P/Y to 1, we can find the answer in years. Set P/Y = 1 and C/Y = 2. (Figure 6)

5. Move the cursor to the first line, N= and press **ALPHA** [SOLVE] (1OE). (Figure 7)

(Figure 7)



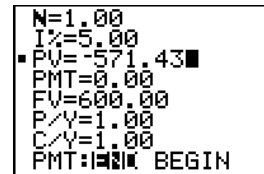
Note: N = 8.84 years since the number of payments per year is set to 1.

Present Value Factor $\frac{1}{(1+i)^n} = (1+i)^{-n}$

Example 3:

What amount needs to be deposited in an investment that yields 5% so that it will be worth \$600 at year end?

(Figure 8)



1. Input 1 for N because the number of payment periods is one, 5 for the interest rate (I%), 0 as the payment (PMT), 600 as the future value (FV), and 1 for both payments per year (P/Y), and compoundings per year (C/Y).
2. Place the cursor on PV and press **ALPHA** [SOLVE] (1OE) to find the present value. (Figure 8)

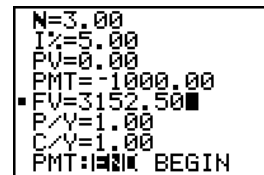
One needs to deposit \$571.43 in an investment that yields 5% so that it will be worth \$600 at year end.

Annuity Compound Amount Factor $\frac{(1+i)^n - 1}{i}$

Example 4:

What can a finance teacher withdraw from her account if she saves \$1,000 a year for 3 years at 5% interest?

(Figure 9)



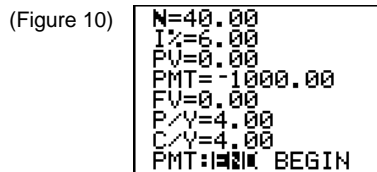
1. Input 3 for N because there are 3 payment periods, 5 for the interest rate (I%), 0 as the present value (PV), -1000 for the payment (PMT), 1 for payments per year (P/Y), and 1 for compounding per year (C/Y). Note that PMT is negative because the teacher is paying out \$1,000 every year.
2. Place the cursor on FV and press **ALPHA** [SOLVE] (1OE) to find the future value. (Figure 9)

In three years, the finance teacher can withdraw \$3,152.50.

Example 5:

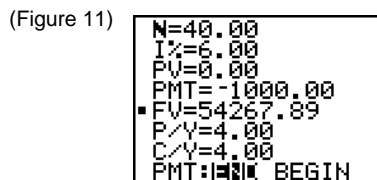
A biologist deposits \$1,000 in her account at the end of each quarter for 10 years. How much money does she have at the end of 10 years if the bank pays 6% interest compounded quarterly?

The number of payment periods is 40 because she is making deposits four times a year for 10 years. Enter 0 for the present value (PV). The PMT must be entered as a negative number because it represents an outflow from the pocket of the biologist. The payments per year (P/Y) and the compounding per year (C/Y) are both 4 for quarterly compounding. The payments are at the end of each quarter, so highlight END rather than BEGIN in the last line of the **TVM Solver**. (Figure 10)



1. Input the information, then move the cursor to FV and press **[ALPHA]** **[SOLVE]** (10E) to find the present value. (Figure 11)

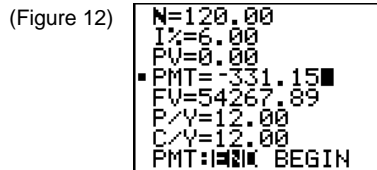
At the end of 10 years, the biologist has \$54,267.89.



Example 6:

The biologist in the last exercise decided that she wanted to have \$54,267.89 in her account in 10 years and she found a bank which compounded monthly at 6%. What are her monthly payments to achieve her goal of \$54,267.89?

1. Change the number of payments (N) to 120 because the payments are now monthly for 10 years, and change the P/Y and C/Y to 12 because both now occur monthly.
2. Place the cursor on the payment (PMT) and press **[ALPHA]** **[SOLVE]** (10E) to find the amount of the payments. (Figure 12)



The biologist must make monthly payments of \$331.15 to achieve her goal of \$54,267.89.

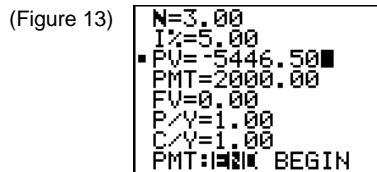
Notice that 120 payments at \$331.15 amounts to \$39,738 out of the pocket versus 40 payments of \$1,000 each which amounts to \$40,000.

Annuity Present Value Factor $\frac{1 - (1 + i)^{-n}}{i}$

Example 7:

What would grandparents have to spend to establish a payout of \$2,000 per year for 3 years to their grandson at 5% interest?

1. Let the number of payments (N) be 3 because the payout is annual for 3 years. The interest rate (I%) is 5, the payment (PMT) of 2000 is positive because it is coming to the grandson. Enter 0 for the future value (FV), 1 for payments per year (P/Y) and 1 for compounding per year (C/Y).
2. Place the cursor on the present value (PV) and press **[ALPHA]** **[SOLVE]** (10E) to find the present value. (Figure 13)



The grandparents should invest \$5,446.50.

The present value is negative on the calculator screen because that is the amount that the grandparents must pay out to establish the grandson's annuity.

Sinking Fund Factor $\frac{i}{(1+i)^n - 1}$

Example 8:

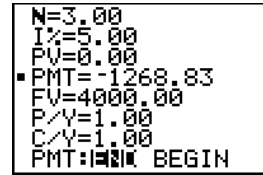
At the end of 3 years, a business person needs to have \$4,000 available to buy a new computer. How much money must he deposit each year at 5% interest?

1. Input 3 for the number of payments (N), 5 for the interest rate (I%), 0 for the present value (PV), 4000 as a positive value for the future value (FV), 1 for the payments per year (P/Y), and 1 for the compounding per year (C/Y).
2. Place the cursor on the payment (PMT) and press **[ALPHA]** **[SOLVE]** (10E) to find the annual payment. (Figure 14)

The annual payment is \$1,268.83.

The annual payment is negative on the calculator screen because it represents the amount that the business person must pay out every year.

(Figure 14)



Capital Recovery Factor or Loan Repayment Factor $\frac{i}{1 - (1+i)^{-n}}$

Example 9:

What monthly payment would a college senior make to pay off a used car loan of \$2,000 at 12% by the end of the year?

1. Because there are monthly payments for a year, enter 12 for the number of payments (N), enter 12 for the interest rate (I%), 2000 for the present value (PV), 0 for the future value (FV), 12 for the payments per year (P/Y), and 12 for the compounding per year (C/Y). Note that (PV) is entered as a positive 2000 because the student has the money in hand.
2. Place the cursor on the payment (PMT) and press **[ALPHA]** **[SOLVE]** (10E) to find the monthly payment. (Figure 15)

The monthly payment will be \$177.70.

The monthly payment is negative on the calculator screen because the amount represents the amount that the college senior must pay out every month.

(Figure 15)

