TI-86 Financial Functions

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Loading and Installing Finance Features on Your TI-86

To load the financial features onto your TI-86, you need a computer and the TI-86 Graph Link software and cable. You also need to download the finance program file from the Internet and save it on your computer.

Loading the Finance Features into TI-86 Memory

When sending a program Start the TI-86 Graph Link on from your computer to the your computer. TI-86, the calculator must not be in Receive mode. The

(WLink86.exe)

Turn on your TI-86 and display the home screen.



Click on the Send button on the TI-86 Graph Link toolbar to display the Send dialog box.





Specify the finance program file as the file you want to send.

finance1.86g

Send the program to the TI-86. The program and its associated executable file become items on the PRGM NAMES menu.

Exit Graph Link

The executable file associated with the assembly language program (finexe) appears on the PRGM NAMES menu, but you need not do anything with it.

Receive mode is used when

sending programs or data from one calculator to

another.

Installing the Finance Features for Use

Use the assembly language program **Finance** to install the finance features directly into the TI-86's built-in functions and menus. After installation, the finance features are available each time you turn on the calculator. You do not need to reinstall them each time. When you run assembly language programs that do not install themselves into the [2nd] [MATH] [MORE] menu, their features are lost when you turn off the calculator.

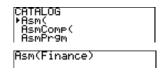
All examples assume that **Finance** is the only assembly language program installed on your TI-86. The position of FIN on the MATH menu may vary, depending on how many other assembly language programs are installed.

programs that must be installed, up to three can be installed at a time (although the TI-86 can store as many as permitted by memory). To install a fourth, you must first Select Asm(from the CATALOG to paste it to a blank line on the home screen.

2nd [CATLG-VARS] F1 (move ▶ to Asm() [ENTER]

[PRGM] [F1] (select

Financ)



Select Financ from the PRGM NAMES menu to paste Finance to the home screen as an argument.

Run the installation program.

Caution: If you have values stored to variables used by the finance features, they will be overwritten. To save your values, press [F5] to exit and then store them to different variables. Then repeat this installation.

ENTER

Caution Var/funct names will be overwritten. See documentation for var/funct(s) used by this program. Continue

For assembly language uninstall (page 3) one of the others.

The variables that will be overwritten are listed on the FIN FUNC and FIN VARS menus (page 12).

Done

Continue the installation. (Your F1 version number may differ from the one shown in the example.)

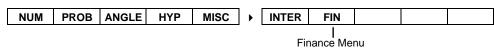
var/funct(s) used by this program. Continue Exit Finance v0.2

Display the home screen.

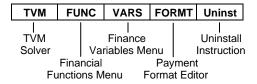
CLEAR

Displaying the FIN (Finance) Menu [2nd] [MATH] [MORE]

When you install the financial program on your TI-86 and activate it, FIN becomes the last item on the MATH menu.



The FIN Menu 2nd [MATH] MORE F2



Uninstalling the Finance Features

When you uninstall the finance features, the finance assembly language programs (Finance and finexec) remain in memory, but the FIN option is removed from the MATH menu.

If other assembly language

programs are installed, FIN

may be in a menu cell other than [2nd] [MATH] [MORE] [F2].

> Display the FIN menu, and then select Uninst.

[2nd] [MATH] [MORE] [F2] [F5]

F4

TVM FUNC VARS FORMT Unins Uņinstall inance v0.2 Pre you sure?

If you are sure you want to uninstall, select Yes from the confirmation menu. The FIN menu is removed and the home screen is displayed. (Your version number may differ from the one shown in the example.)

finexec, and then delete it.

Deleting the Finance Program from TI-86 Memory

Deleting the program does not delete the variables associated with the program.

2nd [MEM] [F2] Select **DELET** from the MEM menu. RAM DELET RESET TOL CIPENT Select **PRGM** from the MEM MORE F5 DELET menu. MATRX STRING EQUI CONS PROM H DELETE: PRGM Move the selection cursor to (as needed) ▶Finance 2413 PRGM Finance, and then delete it. [ENTER] 3110 PRGM finexec DELETE: PRGM (as needed) Move the selection cursor to 3110 PRGM finexec

ENTER

The TVM (Time-Value-of-Money) Variables

FIN VARS (Finance Variables) Menu 2

2nd [MATH] MORE F2 F3

TVM	FUNC	VARS	FORMT	Uninst
N	ı	PV	PMT	FV

PY CY

Prompts that correspond to some TVM variables are shown in parentheses.

N Number of payment periods
 I Interest rate (I%=)
 PY Payments per year (P/Y=)
 PV Present value of loan or lease
 CY Compounding periods per year (C/Y=)

PMT Payment amount

- When you enter a value at prompts in the payment format editor (page 4) or the TVM Solver (page 5), the corresponding variable values are updated.
- When you solve for a TVM variable using the TVM Solver, the corresponding variable value is updated.
- When you enter numbers as arguments for a TVM function, the corresponding variable values are not updated.
- ♦ When you solve for a TVM variable using a TVM function, the corresponding variable value is *not* updated.

Setting the Payment Format

Payment Format Editor 2nd [MATH] MORE F2 F4

TVM FUNC VARS FORMT Uninst

The payment format settings define the number of payments per year (P/Y), the number of compounding periods per year (C/Y), and whether the payments are received at the end or beginning of each period (PMT:END BEGIN).

P/Y=1 C/Y=1 PMT: |=||||||| BEGIN

You also can change a setting by storing a value to PY or CY or by executing pEnd or pBegin (page 11).

The payment format editor to the right shows the defaults. To change payments per year or compounding periods per year, enter a new value. To change the payment due setting, move the cursor onto **END** or **BEGIN**, and then press [ENTER].

Entering Cash Inflows and Cash Outflows

When using the financial functions, you must enter cash inflows (cash received) as positive numbers and cash outflows (cash paid) as negative numbers. The financial functions follow this convention when computing and displaying answers.

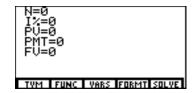
Using the TVM (Time-Value-of-Money) Solver

FIN TVM Solver Menu 2nd [MATH] MORE F2 F1

TVM FUNC VARS FORMT SOLVE

The TVM Solver displays prompts for the five time-value-of-money (TVM) variables.

To solve for an unknown variable, enter the four known variable values, move the cursor to the unknown variable prompt, and then select **SOLVE** (F5) from the FIN TVM Solver menu. Values



When the TVM Solver is displayed, **SOLVE** replaces **Uninst** on the FIN menu.

Solving for an Unknown TVM Variable (Payment Amount)

You want to buy a \$100,000 house with a 30-year mortgage. If the annual percentage rate (APR) is 18%, what are the monthly payments?

displayed on the TVM Solver are stored to corresponding TVM variables.

Set the fixed-decimal mode to 2 [2nd] [MODE] ▼ decimal places to display all ▶ ▶ ENTER numbers as dollars and cents. Select FIN from the MATH menu [2nd] [MATH] [MORE] [F2] to display the FIN menu. TVM FUNC VARS FORMT Uninst Select **FORMT** from the FIN F4 12 **▼** 12 **▼** menu to display the payment ENTER format editor. Set 12 payments per year, 12 compounding periods per year, and payments TVM FUNC VARS FORMT received at the end of each

Enter cash inflows as positive numbers and cash outflows as negative numbers. F1 360 • 18 • 100000 • • 0
ENTER

N=360.00 1%=18.00 PV=100000.00 PMT=0.00 FV=0.00

5 Move the cursor to the **PMT** TVM variable.

payment period.

•

[F5]

N=360.00 1%=18.00 PV=100000.00 PMT=**0**.00 FV=0.00

You cannot leave a variable blank. If you do not have a value, set it to zero.

Sele answ disp varia

Select **SOLVE** to compute the answer. A small square is displayed next to the solution variable. The answer is stored to the corresponding TVM variable.

N=360.00
1%=18.00
PV=100000.00
•PMT=-1507.09
FU=0.00

Financing a Car

You have found a car you would like to buy. The car costs \$9,000. You can afford payments of \$250 per month for four years. What annual percentage rate (APR) will make it possible for you to afford the car?

Set the fixed-decimal mode to 2 decimal places to display all numbers as dollars and cents.

the end of each period.

2nd [MODE] ▼

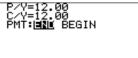
▶ ▶ ENTER

Normal Sci Eng Float 01E345678901 Radian Degree Rectu PolarC Func Pol Param DifEq

When you change PIY, CIY changes automatically.

Display the payment format editor. Set payments per year and compounding periods per year to 12. Set payment due at

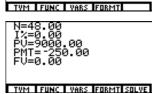
2nd [MATH] MORE F2 F4 **12** ▼ ENTER



As you enter a value at any TVM Solver prompt, the corresponding TVM variable value is updated.

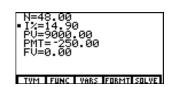
3 Display the TVM Solver. Enter 48 monthly payments, present value of \$9,000, payment amount of ¬\$250 (negation indicates cash outflow), and future value of \$0. The **N** value (48) was derived from 4 (years) ⋈ 12 (months).

F1 48 ▼ ▼ 9000 ▼ → 250 ▼ 0 ENTER



4 Move the cursor to I%= (interest rate) and then select SOLVE from the TVM Solver menu. A small square is displayed next to the solution. The solution value is stored to the TVM variable I.

▲ ▲ F5



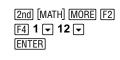
Computing Compound Interest

At what annual interest rate, compounded monthly, will \$1,250 accumulate to \$2,000 in 7 years?

Because there are no payments when you solve compound interest problems, you must set PMT to 0 and set PIY to 1.

The decimal mode is fixed at **2** from the previous example.

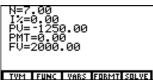
Display the payment format editor. Set payments per year to 1 and compounding periods per year to 12. Set payment due at the end of each period.





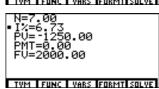
2 Display the TVM Solver. Enter 7 annual payments, present value of -\$1,250 (negation indicates cash outflow), payment amount of \$0, and future value of \$2,000.





Move the cursor to I%= (interest rate) and then select **SOLVE** from the TVM Solver menu. A small square is displayed next to the solution. The solution value is stored to the TVM variable I.





Using the Financial Functions

Entering Cash Inflows and Cash Outflows

When using the financial functions, you must enter cash inflows (cash received) as positive numbers and cash outflows (cash paid) as negative numbers. The financial functions follow this convention when computing and displaying answers.

FIN FUNC (Financial Functions) Menu [2nd] [MATH] [MORE] [F2]

TVM	FUNC	VARS	FORMT	Uninst						
tvmN	tvml	tvmPV	tvmP	tvmFV	•	npv	irr	bal	Σprn	Σint
					•	nom	eff	dbd	pBegin	pEnd

Calculating Time-Value-of-Money

The first five items on the FIN FUNC menu are the time-value-of-money (TVM) functions. You can use them to analyze financial instruments, such as annuities, loans, mortgages, leases, and savings, on the home screen or in a program.

tvmN [(I%,PV,PMT,FV,P/Y,C/Y)] Computes the number of payment periods
tvmI [(N,PV,PMT,FV,P/Y,C/Y)] Computes the annual interest rate
tvmPV [(N,I%,PMT,FV,P/Y,C/Y)] Computes the present value
tvmP [(N,I%,PV,FV,P/Y,C/Y)] Computes the amount of each payment

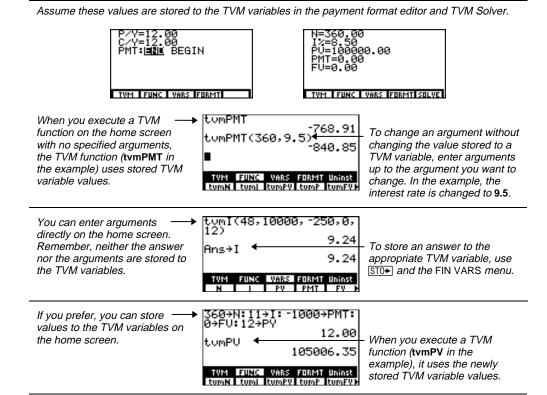
 $\mathsf{tvmFV}\ [(N,I\%,PV,PMT,P/Y,C/Y)]$ Computes the future value

Each TVM function takes zero to six arguments. Each argument must be a real number or a TVM variable. The values that you specify as arguments for these functions are not stored to the TVM variables.

If you enter less than six arguments, you must enter arguments in the order of the syntax, up to the last argument you want to enter. The program substitutes a previously stored TVM variable value for each subsequent unspecified argument. If you enter any arguments with a TVM function, you must place the argument or arguments in parentheses. The following examples show some ways to use the TVM functions.

All arguments and punctuation inside the [] brackets are optional.

To store a value to a TVM variable, use the TVM Solver or use \$100 and any TVM variable on the FIN VARS menu.



Calculating Cash Flows

The next FIN FUNC menu items are cash flow functions. Use them to analyze the value of money over equal time periods. You can enter unequal cash flows. You can enter cash inflows or outflows.

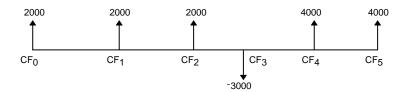
npv(interestRate,cashFlow0, cashFlowList[,cashFlowFrequency]) Returns the sum of the present values for the cash inflows and outflows

irr(cashFlow0,cashFlowList
 [,cashFlowFrequency])

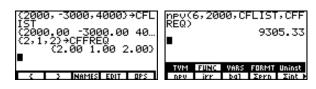
Returns the interest rate at which the net present value of the cash flows is equal to 0

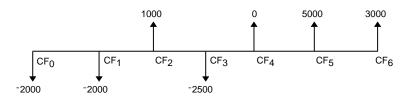
- interestRate is the rate by which to discount the cash flows (the cost of money) over one period.
- ♦ *cashFlow0* is the initial cash flow at time 0; it must be a real number.
- cashFlowList is a list of cash flow amounts after the initial cash flow cashFlow0.
- ◆ cashFlowFrequency is a list in which each element specifies the frequency of occurrence for a grouped (consecutive) cash flow amount, which is the corresponding element of cashFlowList. The default is 1; if you enter values, they must be positive integers <10,000.

The uneven cash flow below is expressed in lists. cashFlowFrequency indicates that the first element in cashFlowList (2000) occurs twice (2), the second element (-3000) occurs once (1), and the third element (4000) occurs twice (2).

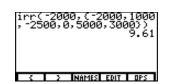


cashFlow0 = 2000 cashFlowList = {2000, -3000,4000} cashFlowFrequency = {2,1,2} I% = 6





 $cashFlow0 = \verb|-2000| \\ cashFlowList = \{\verb|-2000,1000|, \verb|-2500,0,5000,3000|\} \\ cashFlowFrequency = \verb|N/A| \\$



Calculating Amortization

Items eight, nine, and ten are the amortization functions. Use them to calculate balance, sum of principal, and sum of interest for an amortization schedule.

bal(nPayment[,roundValue])

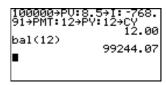
Computes the balance for an amortization schedule; nPayment (the number of the payment at which to calculate a balance) must be a positive integer <10,000

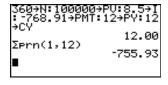
Σ**Prn(**paymentA,paymentB [,roundValue])

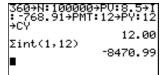
Computes the sum of the principal during a specified period for an amortization schedule; *paymentA* (the starting payment) and *paymentB* (the ending payment in the range) must be positive integers <10,000

ΣInt(paymentA,paymentB [,roundValue])

Computes the sum of the interest during a specified period for an amortization schedule; *paymentA* (the starting payment) and *paymentB* (the ending payment in the range) must be positive integers <10,000







roundValue specifies the internal precision used to calculate the balance.

effectiveRate, nominalRate, and compoundingPeriods must be real numbers; compoundingPeriods must be > 0.

bal(, \(\Sigma \text{Prn(} \), and \(\Sigma \text{Int(} \) use stored values for \(\frac{1}{9} \), \(\text{PV} \), and \(\text{PMT} \). You must store values to these variables before computing the principal.

Amortization Example: Calculating an Outstanding Loan Balance

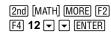
You want to buy a home with a 30-year mortgage at 8 percent annual percentage rate (APR). Monthly payments are \$800. Calculate the outstanding loan balance after each payment and display the results in a graph and in the table.

Display the mode screen and set the fixed-decimal setting to 2, as in dollars and cents. Also, set Param graphing mode.



Eng 45678901 <mark>Param</mark> DifE⊲ SpĥêreV

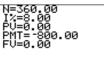
Display the payment format editor, and then set payments and compounding periods per year to 12, to be received at the end of each period.





Display the TVM Solver, and then enter the known TVM variable values:



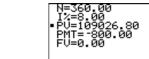


N = 360PMT = -800I=8 FV=0

▲ **F**5



Move the cursor to the **PV**= prompt and solve for the present value of the loan. A small square specifies the solution.



TVM FUNC VARS FORMT SOLVE

A stat plot is turned on if it is highlighted with a box.

Display the parametric equation editor. Turn off all stat plots.

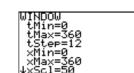
GRAPH [F1] (if a plot is on, press , . to highlight it, and ENTER; then ▼)



Define xt1 as t and yt1 as bal(t).

F3 2nd F1)

F1 ▼ 2nd [MATH] MORE F2 F2 MORE



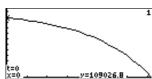
Display the window variable editor, and then enter these window variable values as shown.





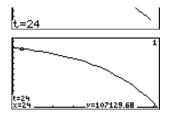
Draw the graph and activate the trace cursor. Explore the graph of the outstanding balance over time.





Enter a value for t to view the balance at a specific time.

24 ENTER



10 Display the table setup editor, and then enter these values: TblStart=0

Indpnt: Auto

∆Tbl=12

Display the table of outstanding balances, where **xt1** represents time and vt1 represents balance at that point in time.





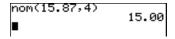
L	t	XtI	<u> 9tı </u>
	0.00	0.00	109026.8
	12.00	12.00	108116.0
	24.00	24.00	107129.7
	36.00	36.00	106061.5
	48.00	48.00	104904.6
ļ	60.00	60.00	103651.6
	t=0		
	TBLST SEL	CT t	xt yt

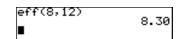
Calculating Interest Conversion

Use the interest conversion functions nom and eff to convert interest rates from an annual effective rate to a nominal rate (nom), or from a nominal rate to an annual effective rate (eff).

nom(effectiveRate,compoundingPeriods) Computes the nominal interest rate eff(nominalRate,compoundingPeriods) Computes the effective interest rate

F1





Finding Days Between Dates

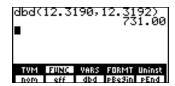
Use the date function **dbd** to calculate the number of days between two dates using the actual-day-count method. dateA and dateB can be numbers or lists of numbers within the range of the dates on the standard calendar.

Dates must fall between the years 1950 and 2049.

dbd(dateA,dateB)

pEnd

Calculates the number of days between dates; enter dateA and dateB in either of two formats: MM.DDYY (for U.S.) or DDMM.YY (for Europe)



Defining the Payment Method

pEnd and pBegin specify a transaction as an ordinary annuity or an annuity due. Executing either instruction sets the payment method for subsequent financial calculations. The current setting is displayed in the payment format editor (page 4).

On the payment format editor's PMT:END BEGIN line, select END to set ordinary annuity or select BEGIN to set annuity due.

pBegin Specifies an annuity due, where payments occur at the beginning

of each payment period (Most leases are in this category.)

Specifies an ordinary annuity, where payments occur at the end of each payment period (Most loans are in this category;

Pmt_End is the default.)

Menu Map for Financial Functions

MATH Menu (where FIN is automatically placed) 2nd [MATH]

r										
١	NUM	PROB	ANGLE	HYP	MISC	•	INTER	FIN		

(MATH) FIN (Financial) Menu 2nd [MATH] MORE F2

TVM FUNC VARS FORMT Uninst

FIN TVM (Time-Value-of-Money) Solver Menu 2nd [MATH] MORE F2 F1

TVM FUNC VARS FORMT SOLVE

FIN FUNC (Financial Functions) Menu 2nd [MATH] MORE F2 F2

I	TVM	FUNC	VARS	FORMT	Uninst
	tvmN	tvml	tvmPV	tvmP	tvmFV

•	npv	irr	bal	Σprn	Σ int
•	nom	eff	dbd	pBegin	pEnd

FIN VARS (Financial Variables) Menu 2nd [MATH] MORE F2 F3

TVM	FUNC	VARS	FORMT	Uninst	
N	ı	PV	PMT	FV	



FIN FORMT (Financial Format) Menu 2nd [MATH] MORE F2 F4

TVM FUNC VARS FORMT