TEXAS INSTRUMENTS

Finance Application for the TI-89 / TI-92 Plus

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Where to Find Installation Instructions

For detailed instructions on installing this and other Flash applications, point your web browser to:

http://www.ti.com/calc/docs/guides.htm

Installing this application requires TI-GRAPH LINK™. To download a free copy of TI-GRAPH LINK for the TI-89 / TI-92 Plus, Point your web browser to:

http://www.ti.com/calc/docs/link.htm

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

Use Time-Value-of-Money (**TVM**) functions to analyze financial instruments such as annuities, loans, mortgages, leases, and savings.

The **TVM Solver** screen automatically displays when you run the Finance application. It displays the time-value-of-money (**TVM**) variables: **N**, I%, **PV**, **PMT**, **FV**. Given four variable values, the **TVM Solver** solves for the fifth variable.

To access the variables outside the **TVM** editor, press 2nd [VAR-LINK]. They are located in the Finance folder. **Note**: Exit the **TVM Solver**, and then press 2nd [VAR-LINK] to display the **TVM** variables. Otherwise, the variable currently highlighted by the cursor in the **TVM Solver** will not display in the **VAR-LINK** variable list.

Press ▲ and ▼ to move the cursor between variables. After entering a new value, press ▼ or ENTER to save it. To solve for the unknown variable, press F2 **Compute** or ◆ ENTER.

Note: The **VAR-LINK** Finance folder (where **TVM** variables are stored) is used by this application and previously-stored data can be overwritten without notification. Avoid using this folder for storing personal data.

TVM variables	Default	Definition	Value Type
N	**0**	Number of payment periods	real number
I	**0**	Annual interest rate (converted to a per-period rate based on the values of **PpY** and **CpY**)	real number
PV	**0**	Present value	real number
PMT	**0**	Payment amount	real number
FV	**0**	Future value	real number
PpY	**1**	Payments per year	integer > 0
CpY	**1**	Compounding periods per year	integer > 0
END **BEGIN**	**END**	Set annuity due (i.e. specify whether payment is at the end or beginning of each period)	N/A

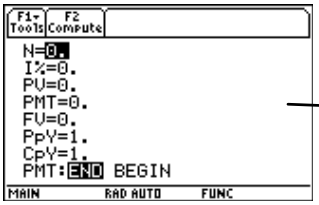
When you store a value to **PpY** in the **TVM Solver** only, the value for **CpY** automatically changes to the same value. To store a unique value to **CpY**, you must store the value to **CpY** after you have stored a value to **PpY**. If you store a value to **PpY** *outside* the **TVM Solver**, the value for **CpY** does not change.

Note: Enter cash inflows as positive numbers, and cash outflows as negative numbers.

To solve for an unknown **TVM** variable, follow these steps.

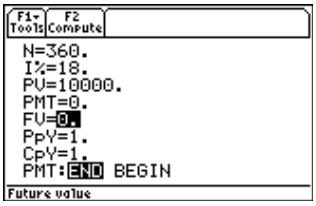
1. Press APPS ENTER to display the **TVM Solver.**

   Highlight **Finance** with cursor and press ENTER.

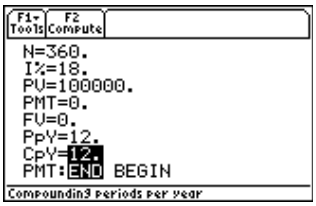


Default **TVM** values.
(F1 **8:Clear Editor**)

2. Enter the known values for **N**, **I%**, **PV** and **FV**. Press ⊙ or [ENTER] to save each new value.

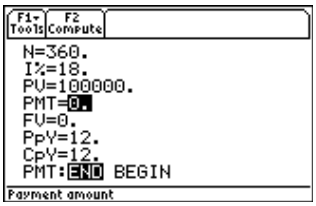


3. Enter a value for **PpY**, which automatically enters the same value for **CpY**; if **PpY** ≠ **CpY**, enter a unique value for **CpY**.

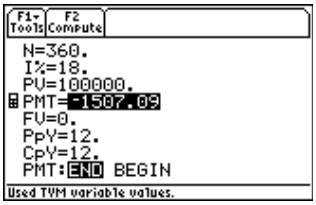


4. Select **END** or **BEGIN** to specify the payment method by highlighting the option with the cursor and pressing [ENTER].

5. Place the cursor on the **TVM** variable for which you want to solve (i.e. **PMT**).



6. Press [F2] **Compute**. The answer is computed and displayed and stored to the appropriate **TVM** variable. An indicator calculator in the left column designates the solution variable.



Editing Values in the TVM Solver

The following calculator editing keys are available in the **TVM Solver**. For more detailed explanation, see the TI-89 / TI-92 Plus Guidebook.

Cursors: ⊙, ⊙, ⊙, and ⊙

Deletion options: [←], [♦] [←], [F1] **7:Delete**

Insertion: [2nd] [INS]

Clear options: [CLEAR], [F1] **8:Clear Editor**

The [F1] Toolbar

The [F1] Toolbar functions are exactly like the [F1] Toolbar on the TI-89 and TI-92 Plus on the Home screen. You can **Cut**, **Copy**, and **Paste** information within the **TVM Solver**. All information is placed on the calculator clipboard for use either within or outside the application. **Paste** inserts the contents of the clipboard at the current cursor location (both within or outside the application).

4: Cut is not the same as **7: Delete**. When you delete information, it is not placed in the clipboard and cannot be retrieved.

To clear all **TVM** variable values and reset all options to their defaults, select **8:Clear Editor**.

To find out the application software version of the application, select **A: About**. Press ESC or ENTER to close the screen.

Calculating TVM Outside of the TVM Solver

All **TVM** and finance functions are listed in the CATALOG for use outside of the **TVM Solver**. Each **TVM** function takes zero up to six arguments.

Function calculations outside the **TVM Solver** do NOT save the results in memory. To *save* a value to a **TVM** variable use the following syntax:

value STO▸ *TVM_variable* ENTER

Access a *TVM_variable* from the **VAR-LINK** menu, **Finance** folder. **TIFnance** precedes a function name and **finance** precedes a variable name when pasted outside the **TVM Solver**.

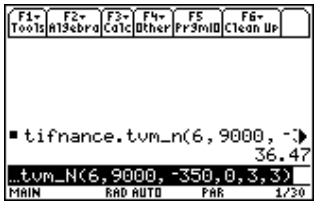
Note: The **VAR-LINK** Finance folder (where **TVM** variables are stored) is used by this application and previously-stored data can be overwritten without notification. Avoid using this folder for storing personal data.

If you enter less than six arguments, the calculator substitutes the currently stored **TVM** variable value for each unspecified argument. If you enter any arguments with a **TVM** function, you must place the argument or arguments in parentheses, separated by commas (,).

tvm_N

The **tvm_N** function calculates the number of payment periods.

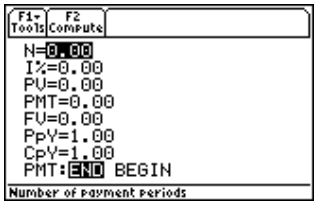
tvm_N(*I*,*PV*,*PMT*,*FV*,*PPY*,*CPY*)

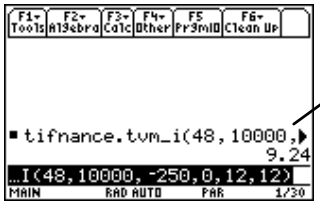


tvm_I

The **tvm_I** function calculates the interest rate per year.

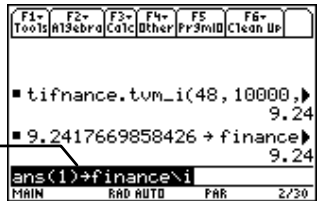
tvm_I(*N*,*PV*,*PMT*,*FV*,*PPY*,*CPY*)

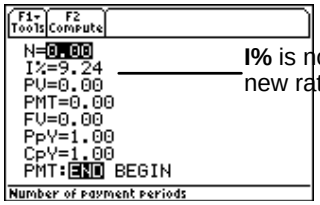




Function calculations do not save results in memory.

Use STO▸ to save the new result for **i** in memory.



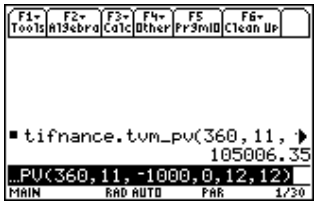


I% is now the new rate.

tvm_PV

The **tvm_PV** function calculates the present value.

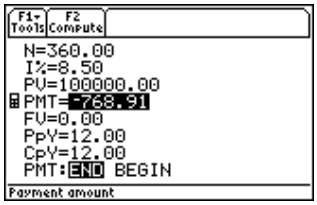
tvm_PV(*N*,*I*,*PMT*,*FV*,*PPY*,*CPY*)

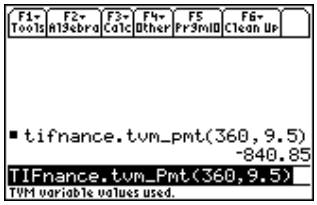


tvm_Pmt

The **tvm_Pmt** function calculates the amount of each payment.

tvm_Pmt(*N*,*I*,*PV*,*FV*,*PPY*,*CPY*)

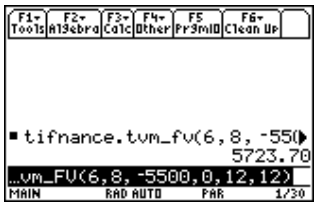




tvm_FV

The **tvm_FV** function calculates the future value of money.

tvm_FV(*N*,*I*,*PV*,*PMT*,*PPY*,*CPY*)



Finance Functions

Catalog

This application adds all Finance functions to the catalog for use in calculations outside of the **TVM Solver**. To access them, press [CATALOG], press [F3] (Flash Apps), and press ⊙ and ⊙ to scroll the list of Finance functions. Pressing [ENTER] while the indicator points to the name pastes it to the previous screen in the form of **TIFinance**.*name*.

To solve for a Finance function, include the appropriate arguments (See Argument Definition Table) separated by [,] and ending with [)].

Sending the Application to Another Calculator with Var-Link

If you send the Finance application to another calculator, the other calculator receives the application, including all finance functions as well as the **TVM** variables defined to their default values (not as they might be currently defined). If you want to send stored variable values, *first* send the application, then send the variables using 2nd [VAR-LINK].

Note: After pressing 2nd [VAR-LINK], the finance variables are listed in the **Finance** folder. To access the *function* names, press F7 on the TI-92 Plus or 2nd [F7] on the TI-89.

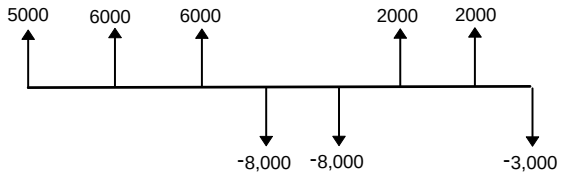
Calculating Cash Flows

Use the cash flow functions, **npv** and **irr**, to analyze the value of money over equal time periods. You can enter unequal cash flows, which can be cash inflows or outflows. The syntax descriptions for **npv(** and **irr(** use these arguments.

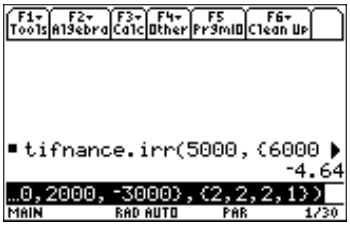
Catalog Variables/ Arguments	Definition
npv(*InterestRate*,*CFO*,*CFList*[*CFFreq*])	net present value; the sum of the present values for the cash inflows and outflows. A positive result for **npv** indicates a profitable investment.
irr(*CFO*,*CFList*[,*CFFreq*])	internal rate of return; the interest rate at which the net present value of the cash flows is equal to zero.

- *interest rate* is the rate by which to discount the cash flows (the cost of money) over one period.
- *CF0* is the initial cash flow at time 0; it must be a real number.
- *CFList* is a list of cash flow amounts after the initial cash flow *CF0*.
- *CFFreq* 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 *CFList*. The default is 1; if you enter values, they must be positive integers < 10,000.

For example, for the following cash flow function:



CF0 = **5000**
CFList = **{6000,-8000,2000,-3000}**
CFFreq = **{2,2,2,1}**



Calculating Amortization

Use the amortization functions (**bal**, Σ**Prn**,Σ**Prn**) to calculate balance, sum of principal, and sum of interest for an amortization schedule.

Catalog Variables/ Arguments	Definition (for an amortization schedule)
bal(*npmt*[,*roundvalue*]**)**	Schedule balance; based on stored values for **I**, **PV**, **PMT**, **PpY**, and **CpY**.
ΣInt(*PMT1*,*PMT2*[,*roundvalue*]**)**	The sum of the interest during a specified period. Based on stored values for **I**, **PV**, **PMT**, **PpY**, and **CpY**.
ΣPrn(*PMT1*,*PMT2*,[,*roundvalue*]**)**	Sum of the principle during a specified period; based on stored values for **I**, **PV**, **PMT**, **PpY**, and **CpY**.

- *npmt* is the number of the payment at which you want to calculate a balance. It must be a positive integer < 10,000.
- *roundvalue* specifies the internal precision the calculator uses to calculate the balance. If you do not specify *roundvalue*, then the calculator uses **Float 2** decimal-mode setting.
- *PMT1* is the starting payment. *PMT2* is the ending payment in the range. *PMT1* and *PMT2* must be positive integers < 10,000.
- To display Σ on the homescreen, press ◆ and (at the same time, and then press ↑ **S**.

Note: You must enter values for **I**, **PV**, and **PMT** before computing the principal.

Calculating Interest Conversion

Use the interest conversion functions 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**.

Catalog Variables/ Arguments	Definition
nom(*effective_rate*,*compounding_periods***)**	Computes the nominal interest rate.
eff(*nominal_rate*,*compounding_periods***)**	Computes the effective interest rate.

- *effective rate* must be a real number.
- *nominal rate* must be a real number.
- *compounding periods* must be a real number > 0.

Finding Days between Dates

Use the date function **dbd(** to calculate the number of days between two dates using the actual-day-count method.

Catalog Variables/ Arguments	Definition
dbd(*date1*,*date2***)**	Number of days between 2 dates.

- *date1* and *date2* can be numbers or lists of numbers within the range of the dates on the standard calendar. If both *date1* and *date2* are lists, they must be the same length.
- *date1* and *date2* must be between the years 1950 through 2049.

You can enter *date1* and *date2* in either of two formats. The decimal placement differentiates the date formats.

- MM.DDYY (United States)
- DDMM.YY (Europe)

Defining Payment Method

The **Pmt_End** and **Pmt_Bgn** functions specify a transaction as an ordinary annuity or an annuity due. When you execute either command, the **TVM Solver** is updated. Neither function requires any arguments.

Pmt_End ( )

Pmt_End (payment end) 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.

On the **TVM Solver**'s **PMT:END BEGIN** line, select **END** to set **PMT** to ordinary annuity.

Pmt_Bgn ( )

Pmt_Bgn (payment beginning) specifies an annuity due, where payments occur at the beginning of each payment period. Most leases are in this category.

On the **TVM Solver**'s **PMT:END BEGIN** line, select **BEGIN** to set **PMT** to annuity due.

pmt_at

pmt_at is a variable which specifies annuity due depending on what value has been stored to it. If **pmt_at=1**, then annuity due=**Begin**. If **pmt_at=0**, then annuity due=**End**. This is located in the 2nd [VAR-LINK] **Finance** folder.

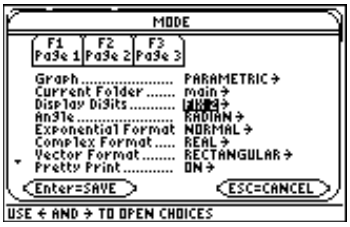
Finance Examples

Example 1 — 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?

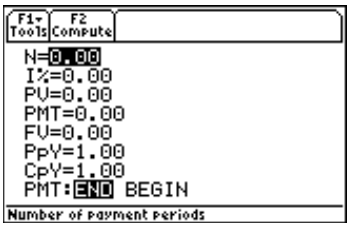
1. Press [MODE]. Press ▼ ▼ ▶ **3** to highlight **FIX 2**.

   Press [ENTER] [ENTER] to return to previous screen.

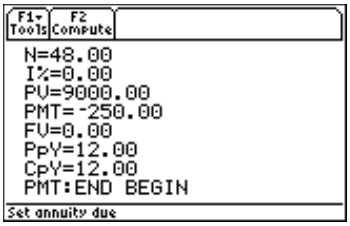


2. Press [APPS] **1: FlashApps** [ENTER].

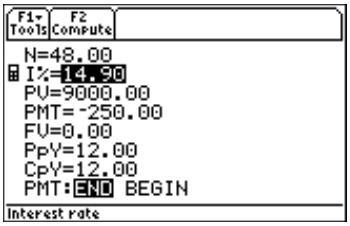
3. Highlight **Finance** with the cursor and press [ENTER] to open the application. The **TVM Solver** is displayed.



4. Enter known values: **N**=48; **PV**=9000; **PMT**=-250 (Negation indicates cash outflow.); **FV**=0; **PpY**=12 (computes an annual percentage rate); **CpY**=12; **PMT**=**END**.



5. Move the cursor to the **I%** prompt. Press [F2] **Compute** to solve for **I%**.



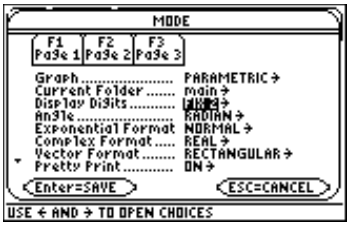
Example 2 — Calculating Interest on a Fixed Payment

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

Note: Because there are no payments when you solve compound interest problems, **PMT** must be set to **0** and **PpY** must be set to **1.**

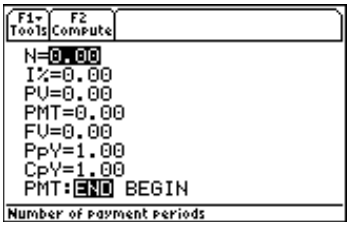
1. Press [MODE]. Press ▼ ▼ ▶ **3** to highlight **FIX 2**.

   Press [ENTER] [ENTER] to return to previous screen.

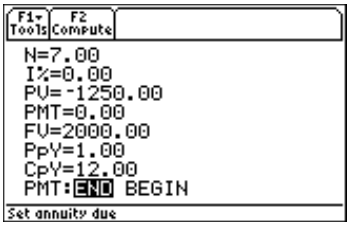


2. Press [APPS] **1: FlashApps** [ENTER].

3. Highlight **Finance** with the cursor and press [ENTER] to open the application. The **TVM Solver** is displayed.

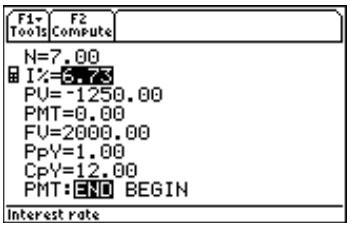


4. Enter known values: **N**=7; **PV**=-1250 (Negation indicates cash outflow or investment.); **PMT**=0; **FV**=2000 (future value is cash inflow or return); **PpY**=1; **CpY**=12; **PMT**=**END**.



5. Place the cursor on the **I%** prompt.

6. Press [F2] to solve for **I%**, the annual interest rate.

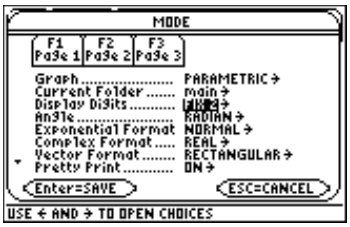


Example 3: — Amortization

You want to buy a home with a 30-year mortgage at 8% APR. Monthly payments are $800. Calculate the outstanding loan balance after each payment and display the results in a graph.

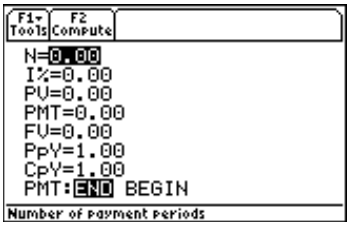
1. Press [MODE]. Press ▼ ▼ ▶ **3** to highlight **FIX 2**.

   Press [ENTER] [ENTER] to return to previous screen.

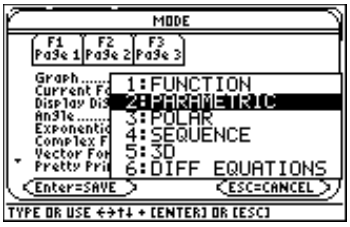


2. Press [APPS] **1: FlashApps** [ENTER].

3. Highlight **Finance** with the cursors and press [ENTER] to open the application. The **TVM Solver** is displayed.

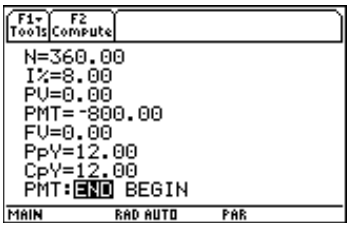


4. Press [MODE]. Press ▶ ▼ to highlight **PARAMETRIC** graphing mode.



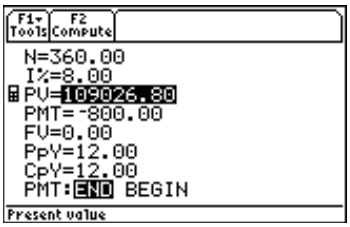
5. Press [ENTER] [ENTER] to return to the **TVM Solver**.

6. Enter known values: **N**=360; **I%**=8; **PMT**=-800; **FV**=0; **PpY**=12; **CpY**=12; **PMT**=**END**.



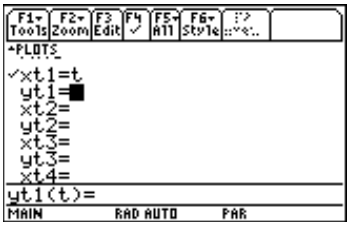
7. Place cursor on the **PV** prompt.

8. Press [F2] to solve for **PV**.

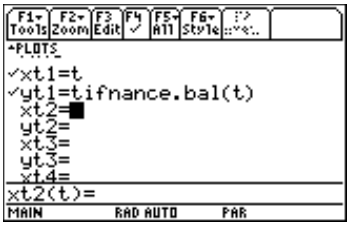


9. Press ♦ [Y=] to display the parametric **Y=** editor. Turn off all stat plots.

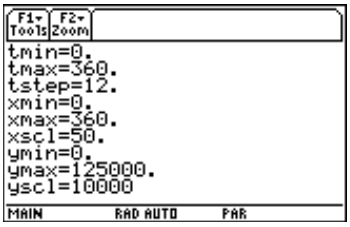
10. Press [T] [ENTER] to define **XT_1** as **T**.



11. Press [CATALOG] [F3] and highlight **bal(**. Press [ENTER] [T] [)] [ENTER] to define **YT_1** as **bal(T)**.

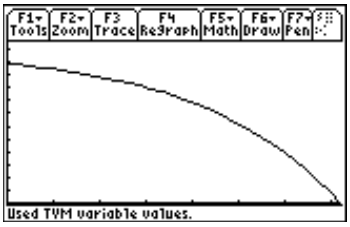


12. Press ♦ [WINDOW] to display the window values. Enter the values below:

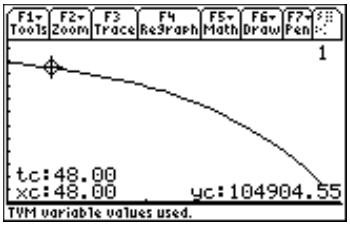


Tmin=0	**Xmin=0**	**Ymin=0**
Tmax=360	**Xmax=360**	**max=125000**
Tstep=12	**Xscl=50**	**Yscl=10000**

13. Press ♦ [GRAPH] to draw the graph.



14. Press [F3] **Trace** to activate the trace cursor. Press ▶ and ◀ to explore the graph of the outstanding balance over time. Press a number and then press [ENTER] to view the balance at a specific time **T**.



Error Messages

Message	Description
No Sign Change	You attempted to compute **I** when **FV**, **(N∗PMT)**, and **PV** are all ≥ 0, or when **FV**, **(N∗PMT)**, and **PV** are all ≤ 0. You attempted to compute **irr(** when no elements of *CFList* nor *CFO* is > 0, or when no elements of *CFList* nor *CFO* < 0.
One or more **TVM Solver** variables are invalid. Press Enter to overwrite or Escape to return to the Home screen.	An invalid solver variable encountered within the application. • Press [ENTER] to overwrite. • Press [ESC]. Go to the Home screen or **VAR-LINK** menu to check the variables. Unarchive or unlock any variables, if necessary. If the value stored to a variable is not a number, delete it or save it as a new a new name. Delete the finance variable. • Delete the entire folder
TVM Solver variable is locked or archived. Can not overwrite variable. Exiting application.	Go to the **VAR-LINK** menu and unlock or unarchive any variables. If none are locked or archived, delete the variable. If N is defined as a data variable or matrix, rename it and delete the finance variable.
One or more **TVM Solver** variables are invalid. Operation canceled.	An invalid solver variable encountered outside the application. This applies to **TVM** functions and Amortization functions, which both use the stored **TVM Solver** variables. Go to the **VAR-LINK** menu and unlock or unarchive any variables. If none are locked or archived, delete the variable.

Error Recovery Instructions

Low Battery Condition

Do not attempt a Flash download if the low-battery message appears on the calculator. Low battery indication is shown on the initial screen. If you receive this error during an installation, change the batteries before trying again.

Memory or Full Memory Error

This error occurs when the TI-89 / TI-92 Plus does not have sufficient memory to store the application. You must delete an application and/or archived variables from the TI-89 / TI-92 Plus in order to make room for another application. You can back up an application to your computer by using the **Link > Receive Flash Application...** menu in **TI-GRAPH LINK** for the TI-89 / TI-92 Plus. Once saved, you can reload it to the TI-89 / TI-92 Plus later using the **Link > Send Flash Software** menu in **TI-GRAPH LINK**.

Communication Error

This error indicates the Flash Installer is unable to communicate with the TI-89 / TI-92 Plus. The problem is usually associated with the **TI-GRAPH LINK** cable and its connection to the TI-89 / TI-92 Plus and/or to the computer. Make sure the cable is firmly pushed in to the calculator and the computer.

If this does not correct the problem, try a different **TI-GRAPH LINK** cable and reboot your computer. If you continue to get this error, please contact TI-Cares™ Customer Support for assistance.

Flash Application Did Not Install

Follow the steps below to install the flash application.

1. If the **TI-GRAPH LINK** cable was disconnected either from the TI-89 / TI-92 Plus or the computer, reconnect the cable prior to restarting the installation.

2. Within about 30 seconds after interrupting the download, an error will appear on your computer. Press [ENTER] [ENTER] to exit the two error dialog boxes.

3. Reconnect the cable, if necessary.

4. Try to download the application again.

If you continue to have problems, contact TI-Cares.

Validation Error

Either this calculator does not have a certificate to run the application, or electrical interference caused a link to fail. Try to install the application again. If you continue to receive this error, contact TI-Cares.

Checksum Error

The Flash installer was not able to verify that the application was fully installed. Try to download the application again. If this problem persists, contact TI-Cares.

Other Errors

See *Appendix B: Reference Information* in the TI-89 / TI-92 Plus Guidebook (**http://www.ti.com/calc/docs/guides.htm**) for information about the specific error or contact TI-Cares.

Miscellaneous

Verify Maintenance Upgrade Version and Serial Number

1. From the Home screen, press F1.
2. Select **A:ABOUT**.

The version number has the format **x.yy**. The serial number appears on the line beneath the product ID number.

Check Amount of Flash Application Free Space

1. Press 2nd [MEM].
2. Select **2:MEM MGMT/DEL...**

The Finance application requires at least 36K of RAM memory to load the application. There is approximately 720K total archive memory in the TI-89 / TI-92 Plus. For more information about memory and memory management, refer to the TI-89 / TI-92 Plus guidebook.

The TI-89 / TI-92 Plus guidebook is available in electronic format at **http://www.ti.com/calc/docs/guides.htm.**

How to Contact Customer Support

Customers in the US, Canada, Mexico, Puerto Rico, and the Virgin Islands

For general questions, contact Texas Instruments Customer Support:

Phone: **1-800-TI-CARES (1-800-842-2737)**
E-mail: **ti-cares@ti.com**

For technical questions, call the Programming Assistance Group of Customer Support:

Phone: **1-972-917-8324**

Customers outside the US, Canada, Mexico, Puerto Rico, and the Virgin Islands

Contact TI by e-mail or visit the TI calculator home page on the World Wide Web.

E-mail: **ti-cares@ti.com**
Internet: **http://www.ti.com/calc**