CASIO

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FINANCIAL CONSULTANT FC-1000 CASIO

FC-1000
OWNER'S MANUAL

Foreword

Congratulations on your selection of the Casio FC-1000 financial calculator. The FC-1000 is a truly sophisticated financial tool made possible by state of-the-art calculator engineering. Financial functions include:

- Simple interest
- Compound interest
- Amortization of loans
- Investment appraisal
- Bond calculations
- Depreciation
- Interest conversion

Besides financial calculations, the FC-1000 is fully capable of standard arithmetic operations, scientific functions, and statistical calculations.
All of this in addition to a useful programming function with 2,470 steps of programming memory and a host of programming functions makes the Casio FC-1000 a wise investment that is bound to keep on paying handsome returns well into the future.

Important

- Be sure to carefully read this manual in order to use the FC-1000 to its full potential.
- Calculation and rounding methods differ according to the type of institution for which the calculation is being performed. It is suggested that the results produced by this calculator be carefully compared with results produced by other means to ensure compatibility.

CONTENTS

Before Using Your Calculator

Note the following safety precautions before using your calculator.

- Never try to take the calculator apart or perform your own maintenance.
- Avoid damage to precision components by guarding your calculator against exposure to temperature extremes, high humidity, dust, sudden temperature changes, and strong impact. Low temperatures can slow down the display speed or even cause the display to fail completely. This is generally temporary, and normal operations should return at warmer temperatures.
- You should replace batteries at least once every two years even if you use the calculator for long periods. Never leave dead batteries in the battery compartment. They can leak and cause damage to the calculator.
- Clean the exterior of the calculator with a soft cloth that has been dampened with a solution of water and a mild neutral detergent. Never use thinner, benzene or other volatile agents for cleaning.
- If the calculator does not seem to be operating properly, first check this manual to confirm that the problem is not due to low battery power, improper programming, or operational errors. If the problem persists, either bring or send the calculator to your retailer or the nearest CASIO dealer. Be sure to clearly explain the problem in detail.
- The manufacturer assumes no responsibility for claims from third parties for loss or damages arising through the use of this calculator.
- The manufacturer assumes no responsibility for any loss or damages arising from loss of data and/or programs incurred while using this calculator.

About the Power Supply

■ Replacing Batteries

Your calculator is powered by three lithium batteries (CR2025). If the display of the calculator seems dim, even when you have the contrast set to the maximum setting, the batteries are probably low. Replace batteries as soon as possible after these symptoms occur. Remember that you should also replace batteries at least once every two years no matter how much the calculator has been used.
Note that the batteries supply power for both normal operation and memory back-up. By following the sequence described below, you can change batteries without losing any of the data stored in the calculator's memory. Remember to remove batteries one at a time when replacing them. Removing more than one battery at the same time can cause data stored in memory to be altered or lost.

① Switch the power of the calculator OFF and remove the four screws holding the back cover in place.

② Remove screw Ⓐ and battery cover A. Then remove the battery under the cover.

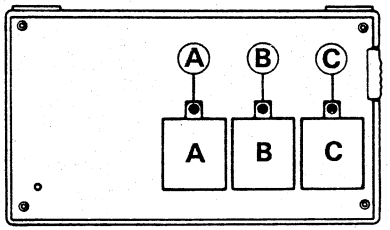
③ Wipe off a new battery with a soft, dry cloth and load it into the calculator with its positive ⊕ pole facing upwards.

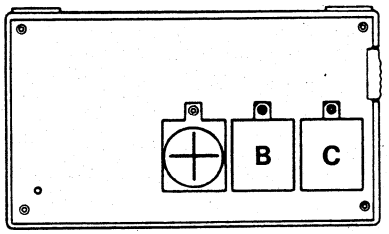
④ Pressing down on the battery with battery cover A, replace screw Ⓐ.

⑤ Repeat steps ① through ④ to replace batteries B and C.

⑥ Replace the back cover of the calculator and secure it in place using the four screws.

⑦ Switch the power of the unit ON and adjust the contrast of the display using the procedures described on page 8.





PRECAUTIONS:
Incorrectly using batteries can cause leakage or bursts, and may damage your product. Note the following precautions:

① Be sure that +/− polarity is correct.

② Do not mix battery type.

③ Do not mix new batteries with old ones.

④ Never leave dead batteries in battery compartment as they may cause malfunctions.

⑤ Remove batteries when not using the product for extended period.

⑥ It is recommended that batteries be replaced once every 2-year to prevent the chance of malfunction.

⑦ The supplied batteries are not rechargeable.

⑧ Do not expose the battery to direct heat, let it become shorted or try to take it apart.

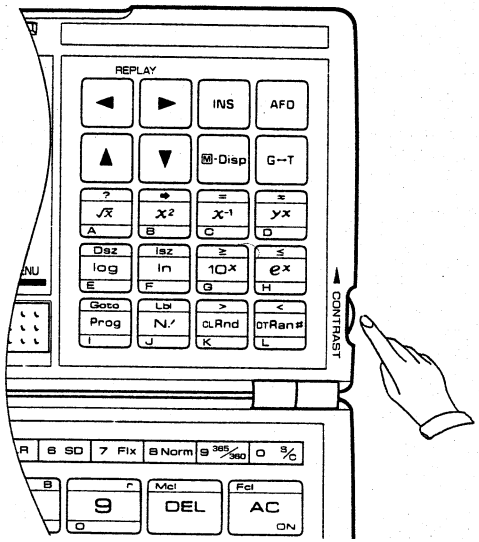
(Keep batteries out of the reach of small children. If swallowed, consult a doctor immediately.)

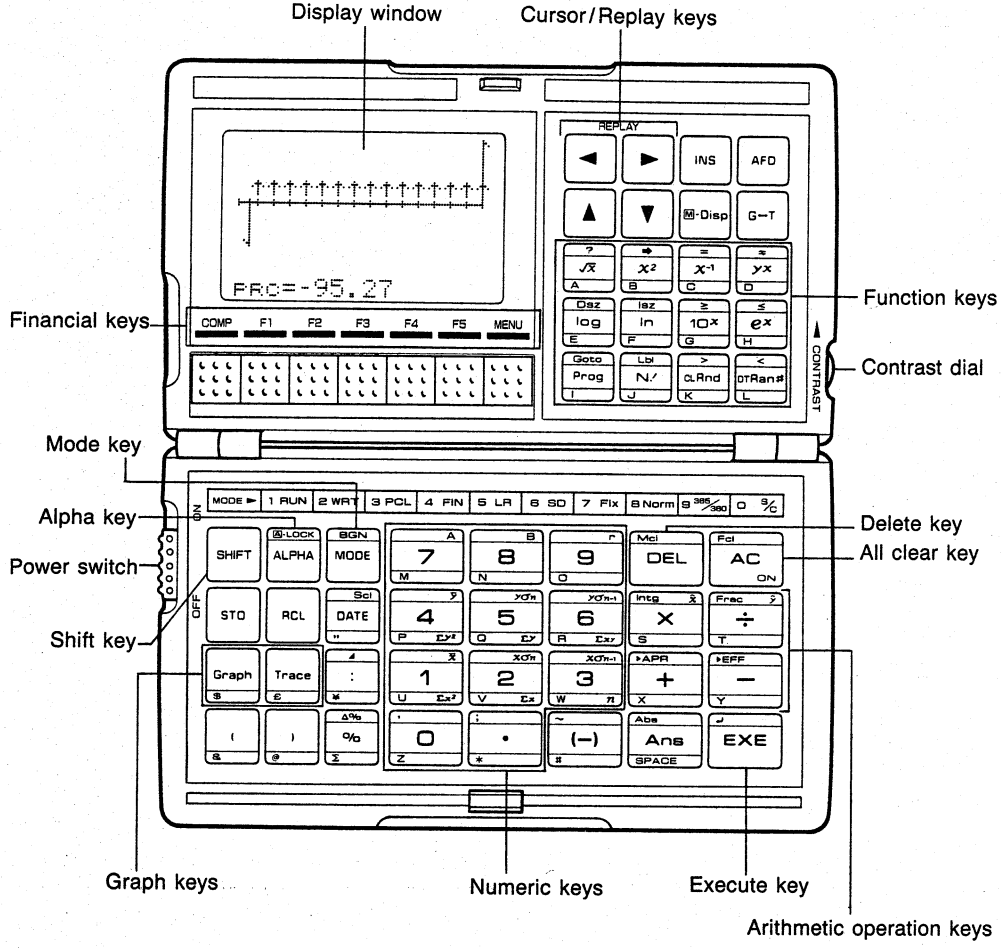
■ Auto Power OFF (APO) Function

The Auto Power OFF function automatically switches power off for you if you do not press any key on the calculator for six consecutive minutes (except, of course, when the calculator is in the middle of a calculation). This does not affect anything in the calculator's memory, and you can restore power by switching power OFF and then ON again, or by pressing the AC key.

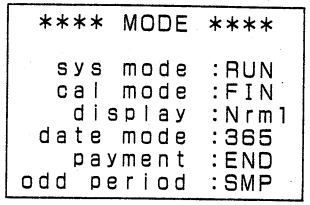
■ Adjusting the Contrast of the Display

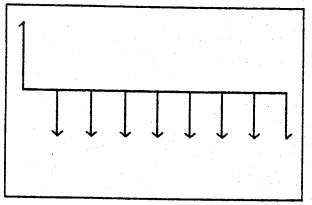
Rotate the contrast adjustment dial upwards to make the characters on the display lighter, and downwards to make them darker.





■ Display





The display of the calculator is capable of showing text and symbols 16-characters across by 8 lines. Graphs are also produced on the display using a 96-dot by 64-dot matrix.
The display shown on the left above is called a ***system display***, and it indicates the current status of the calculator. The symbols shown on the system display have the following meanings:

sys mode — current mode that the system is in
cal mode — current calculation mode
display — number of decimal place or number of significant digits currently specified
date mode — current date mode (365/360) setting
payment — current payment mode (beginning of term/end of term) setting
odd period — calculation mode for compound interest

The display on the right above shows a cash flow diagram as a representative example of the graph capabilities of the display.
The letter "O" is distinguished from the number zero on the display by adding a slash for the zero (Ø).

■ Power Switch

Switch the power of the calculator ON by sliding this switch up. Sliding the power switch down switches power OFF.

■ Special Operation Keys

[SHIFT] Shift key

Press the [SHIFT] key to use the function commands indicated in the silver fields on the key panel of the calculator. The (S) symbol flashes on the display after the [SHIFT] key is pressed, and disappears if you press [SHIFT] again.

[BGN] [MODE] Mode/Beginning/End of term payment key

The status of the calculator and its current function is determined by its ***mode*** setting. You can change the mode of the calculator by pressing the [MODE] key followed by a number.

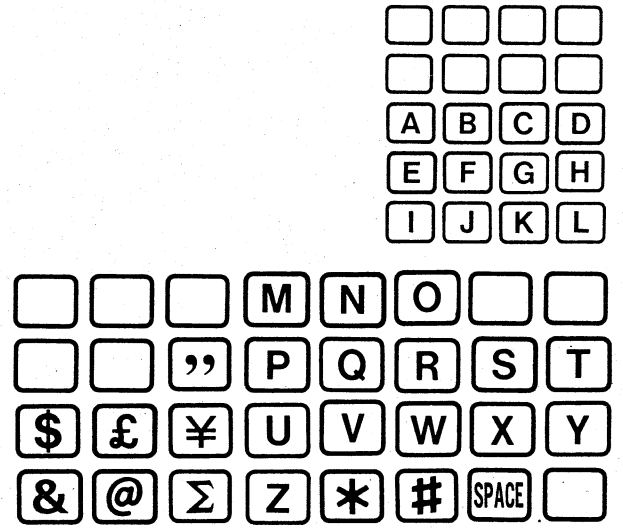
[MODE] [1] — For manual calculations and programmed calculation execution
[MODE] [2] — For inputting or checking programmed calculations
[MODE] [3] — For clearing programmed calculations
[MODE] [4] — For financial calculations
[MODE] [5] — For regression calculations

[MODE] [6] — For standard deviation calculations
[MODE] [7] — For specifying the number of decimal places (by entering a value from 0 through 9)
[MODE] [8] — For cancelling a previously specified number of decimal places.
[MODE] [9] — For specifying the number of days in a year to be used for financial calculations.
[MODE] [0] — For specifying the calculation method procedure to handle odd periods in compound interest calculations.

In compound interest calculations, press this key following [SHIFT] to switch between beginning of term payment and end of term payment. Each press of this key switches from beginning of term, to end, to beginning.

[A-LOCK] [ALPHA] Alphabet key

Press the [ALPHA] key to enter alphabetic characters or special characters. The A symbol appears on the display after the [ALPHA] key is pressed, and disappears as soon as you enter a character. To lock the [ALPHA] key operation to input a number of characters, first press [SHIFT] and then [ALPHA]. Now you will be able to continue entering characters until you release the [ALPHA] key operation by pressing [ALPHA] again.



[Goto] [Prog] [ ] Program/Goto key

Press [Prog] followed by a value from 0 through 9 (to specify a program area number), and then press [EXE] to execute a programmed calculation.

Example: [Prog] [1] [EXE] → Executes Program 1.
Following [SHIFT] this key is used to enter a Goto command into a programmed calculation to tell the calculator to jump to another place and continue execution.

▲ ▼ ◄ ► (REPLAY) Cursor/Replay keys

These keys move the cursor to the left (◄), right (►), up (▲) and down (▼) on the display. Holding down any of the keys causes the cursor to move at high speed in the corresponding direction.
Immediately following operation of the EXE key, ◄ and ► take on a replay function. Pressing ► positions the cursor at the beginning of the calculation you have just executed, while ◄ positions the cursor at the end. Then you can execute the original calculation again, or edit it first and then execute it.

INS Insert key

Press this key to indicate that a character will be inserted at the current cursor position.

DEL (Mcl) Delete key

Pressing this key deletes the character at the current cursor location. When the character is deleted, everything to its right is shifted one space to the left to fill in the space of the character that has been deleted.
The operation SHIFT Mcl EXE will clear all variable memory contents.

AC (Fcl, ON) All clear key

Press to clear all displayed calculations, values, and text.
You should also use this key to clear the "ERROR" display that appears when an error occurs and to restore power after operation of the Auto Power OFF function (see page 7 for details).
Pressing the AC key while a programmed calculation is being executed suspends the execution. The calculation can then be resumed by pressing the EXE key.
Following SHIFT, press this key followed by EXE to clear all of the financial memories.

EXE Execute key

Press the EXE key to perform an operation and obtain its result. This key is also used during programmed calculations to enter values required calculation.

Ans (Abs, SPACE) Answer key

Press Ans EXE to display the last result obtained by operation of the EXE key. This value is always available, even after the power of the calculator has been switched OFF.
During programmed calculation execution, pressing this key obtains the last result obtained by the calculator.
If you press SHIFT Abs followed by a value, the calculator will display the absolute value of the value your entered.

AFD AFD key

Pressing the AFD key during a financial calculation causes the financial memory contents to appear on the display. Press AFD again to return to the original display.

RCL Recall key

Press the RCL key followed by a financial key to display the corresponding memory contents. Pressing the RCL key causes the R symbol to appear in the lower left of the display.

DATE (Scl, ") Date input key

Use this key to input each element of a date as follows:
MONTH DATE DATE DATE YEAR DATE
During statistical calculations (MODE 5 or MODE 6), the following operation clears statistical memories: SHIFT Scl EXE.

STO Store key

Press this key to assign (store) a numeric value to a variable. Pressing the STO key causes the S symbol to appear in the lower left of the display.

1 ~ 9 0 • Numeric keys

Use these keys to enter numbers and the decimal point during arithmetic calculation. Following SHIFT or ALPHA, the numeric keys perform the functions listed below (in the LR and SD modes only — see pages 36 and 38).

- SHIFT 1 $\bar{x}$ (mean of x)
- SHIFT 2 $x\sigma n$ (standard deviation of x)
- SHIFT 3 $x\sigma n-1$ (standard deviation of x)
- SHIFT 4 $\bar{y}$ (mean of y)
- SHIFT 5 $y\sigma n$ (standard deviation of y)
- SHIFT 6 $y\sigma n-1$ (standard deviation of y)
- SHIFT 7 A (constant term of regression formula)
- SHIFT 8 B (regression coefficient)
- SHIFT 9 r (correlation coefficient)
- ALPHA 1 Σx^2 (sum of squares of x)
- ALPHA 2 Σx (sum of x)
- ALPHA 3 n (number of data items)
- ALPHA 4 Σy^2 (sum of squares of y)
- ALPHA 5 Σy (sum of y)
- ALPHA 6 Σxy (sum of products of data)

The above operations are used in standard deviation and regression calculations only. See the ***Performing Statistical Calculations*** starting on page 36 for details.

■ Calculation keys

+ − × ÷ (▶APR, ▶EFF, Intg, Frac) Arithmetic operation keys

Enter arithmetic calculations as they are written from left to right. Press the arithmetic operation key where its corresponding sign appears in the calculation. Following SHIFT, the function of these keys depends on the mode the calculator is in. Note the following:

Key	Mode	Function
+	FIN, SD, LR	Percentage interest rate conversion
−	FIN, SD, LR	Effective interest rate conversion
×	FIN, SD	Cuts off fractional part of value (Intg)
÷	FIN, SD	Cuts off integer part of value (Frac)
×	LR	Calculates estimated value of x ($\hat{x}$)
÷	LR	Calculates estimated value of y ($\hat{y}$)

■ Graph keys

The ***graph keys*** described in this section can be used to produce a variety of graphs.

[M-Disp] Mode display key

Press this key to show the mode display (see page 18). The mode display is shown as long as the [M-Disp] key is depressed.

[G↔T] Graph-text key

Press this key to switch between graph display and text display.

[Graph] [$] Graph key

Press this key to draw a graph after you perform a financial calculation or after you enter data.

[Trace] [£] Trace key

Press this key to trace along a graph and display each value.

■ Function keys

The function keys put a wide variety of useful mathematical functions at your fingertips. Each key is capable of multiple functions, depending on the mode and whether or not the [SHIFT] key is pressed.

[◢] [:] [¥] Multistatement/Display key

Sequential formulas and commands can be linked within a single programmed calculation to form a ***multistatement***. Press this key to insert a colon between formulas and commands to tell the calculator to proceed directly to the following formula or command.
Following [SHIFT], this key inserts a "◢" instead of a colon. This symbol tells the calculator to display the calculation result obtained up to that point.

[?] [$\sqrt{x}$] [A] Square root key

Enter a value and press this key to obtain the square root of the value.
In programmed calculations or continuous calculations, press [SHIFT] [?] to tell the calculator to pause at that point to await input of a value from the keypad.

[⇒] [x^2] [B] Square key

Enter a value and press this key to obtain the square of the value.
In programmed calculations or continuous calculations, press [SHIFT] [⇒] to enter the "⇒" symbol which represents "then" in an "if....then" operation (see page 113 for details).

[=] [x^{-1}] [C] Reciprocal key

Enter a value and then press this key to obtain the reciprocal of the value.
This key is also used in combination with the [SHIFT] key to set up a test for equality in "if....then" operations (see page 113) as noted below:

Meaning	Key operation
If A = B	A [SHIFT] [=] B

[≠] [y^x] [D] Power key

Enter y (any number), press this key, and then enter x (any number) to obtain y to the xth power.
This key is also used in combination with the [SHIFT] key to set up a test for inequality in "if....then" operations (see page 113) as noted below:

Meaning	Key operation
If A ≠ B	A [SHIFT] [≠] B

[Dsz] [log] [E] Common logarithm/Decrement and skip on zero key

Press this key followed by a value to obtain the common logarithm (base 10) of that value.
In programmed calculations, press this key following [SHIFT] to tell the calculator to decrease by one the value assigned to a specific variable. If the value equals zero, the following statement is skipped (see page 114).

[Isz] [ln] [F] Natural logarithm/Increment and skip on zero key

Press this key followed by a value to obtain the natural logarithm (base e) of that value.
In programmed calculations, press this key following [SHIFT] to tell the calculator to increase by one the value assigned to a specific variable. If the value equals zero, the following statement is skipped (see page 114).

[≥] [10^x] [G] Anti-common logarithm key

Press this key followed by a value to change that value to an exponent of 10.
This key is also used in combination with the [SHIFT] key to set up a test for relative size in "if....then" operations (see page 113) as noted below:

Meaning	Key operation
If A ≧ B	A [SHIFT] [≧] B

Anti-natural logarithm key

Press this key followed by a value to change that value to an exponent of e. This key is also used in combination with the SHIFT key to set up a test for relative size in "if....then" operations (see page 113) as noted below:

Meaning	Key operation
If A≦B	A SHIFT ≦ B

Factorial key

Enter a value and press this key to obtain the factorial of the value.
In programmed calculations, press this key following SHIFT to input a label (see page 113).

Internal rounding key

Values used internally for calculations are 12 digits long, regardless of how many decimal places are specified for the display. Pressing the Rnd key rounds off the internal value to match the displayed value.
This key is also used in combination with the SHIFT key to set up a test for relative size in "if....then" operations (see page 113) as noted below:

Meaning	Key operation
If A>B	A SHIFT ≧ B

For statistical calculations (SHIFT 5, SHIFT 6), this key is used to modify entered data.

Random number generation key

Press this key followed by EXE to generate a random number (pseudo-random number in the range of 0.000 ~ 0.999).
This key is also used in combination with the SHIFT key to set up a test for relative size in "if....then" operations (see page 113) as noted below:

Meaning	Key operation
If A<B	A SHIFT ≦ B

For statistical calculations (MODE 5, MODE 6), this key is used to enter data.

Minus key

Press this key before entering a value to specify that the value is negative.

Parenthesis keys

Use these keys to input open and closed parentheses as needed.

Percent key

Press this key to perform percent calculations (see page 28).
Following SHIFT, press this key to perform delta percent calculations (see page 28).

Order of Operations and Levels

■ Operations are performed in the following order of precedence:

① Financial: COMP n, COMP i%, COMP PV, COMP PMT, COMP FV, COMP YLD, COMP PRC, COMP CST, COMP SEL, COMP MAR, SI, SFV, PBP, IRR, NPV, NFV, ALOGM1(, LOG1P(, FWF(, PWF(, USFWF(, USPWF(
② Type A functions*: x^2, x^{-1}, N!
③ Powers: y^x
④ Memory preceded by a multiplication operation that does not use a multiplication symbol (including financial memories)
⑤ Type B functions*: square root, log, 10^x, ln, e^x, (−), Abs, Intg, Frac, ( )
⑥ Type B function* preceded by a multiplication operation that does not use a multiplication symbol
⑦ Interest rate conversion: ▶APR, ▶EFF
⑧ ×, ÷
⑨ +, −
⑩ Relational operators: <, >, =, ≠, ≦, ≧

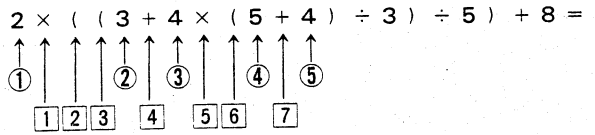
*Functions are divided into Type A and Type B. Type A functions are those for which you enter a value and then input the function. Type B functions are those for which you enter a value after you input the function.

- In the case that the order of precedence is identical, the operation is performed from left to right.
- Complex functions are executed from left to right.
- All expressions contained in parentheses are performed first.
- With special financial functions that use parentheses, the operation inside of the parentheses is performed first. Note the following:
  FWF (COMP i%, COMP n)
  Here, COMP i% and COMP n are performed first, followed by FWF( ).

■ About Stacks

A ***stack*** is an area of memory used to temporarily store data. If you visualize the memory as a series of boxes piled vertically, you can see how such an area came to be called a ***stack***.
When your calculator processes a calculation, it divides the contents into two different stacks: a ***numeric stack*** for values, and a ***command stack*** for commands. The numeric stack has a capacity of eight levels (boxes), while the capacity of the command stack is 20 levels. A stack overflow error (indicated by Stk ERROR on the display) will occur if your calculation exceeds these limitations.

Example
The following example shows how the calculator assigns values and commands to their respective stacks:



Numeric stack

①	2
②	3
③	4
④	5
⑤	4
⋮	

Command stack

1	×
2	(
3	(
4	+
5	×
6	(
7	+
⋮	

- The calculation is performed in accordance with the order of precedence described on the previous page. Once a calculation is performed, the stacks are cleared.

■ Understanding Modes

Before you start your calculations, you much first tell the calculator how to handle the information you are about to input. The condition that the calculator goes into at this time is called a ***mode***. Your financial calculator basically has two types of modes: ***system modes*** and ***calculation mode***.
You can change the mode of the calculator by pressing the MODE key followed by a number.

•System Modes

MODE 1 ..... (RUN mode) You should use this mode for manual calculations (those in which you manually press each key as needed) and to execute programmed calculations.

MODE 2 ..... (WRT mode) Use this mode to create new programmed calculations and to edit existing programs (see page 115 for details).

MODE 3 ..... (PCL mode) Use the PCL mode when you want to erase a programmed calculation that is stored in the memory of the calculator (see page 126 for details).

•Calculation Modes

The following calculation modes are available when you are in the RUN mode or WRT mode.

MODE 4 ..... (FIN mode) This mode is used when you want to perform general calculations (including function calculations) or financial calculations.

MODE 5 ..... (LR mode) Use this mode for regression calculations (paired-variable statistics) and financial calculations.

MODE 6 ..... (SD mode) Use the SD mode for standard deviation (single-variable statistics) and financial calculations.

•Display Modes

MODE 7 ..... (FIX mode) Use the FIX mode to specify the number of decimal places for the fractional part of a value.

MODE 8 ..... (NORM mode) Use the NORMAL mode to cancel specifications made in the FIX mode. Each time you enter MODE 8 EXE, the calculator switches between Nrm 1 and Nrm 2 (see page 20).

•Number of Days Mode

MODE 9 ..... (Number of days mode) Each time you press MODE 9, the calculator switches between a 365-day and 360-day year.

•Simple/Compound Interest Mode

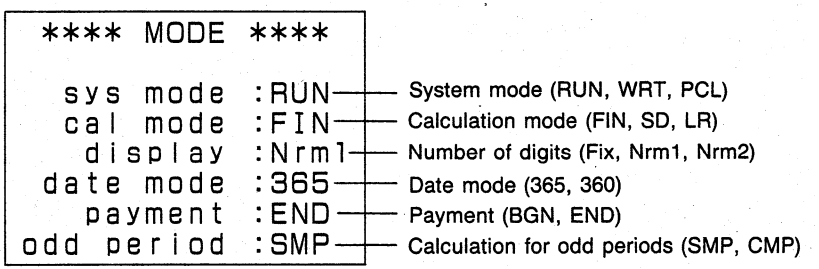
MODE 0 ..... (Simple/compound interest mode) Each time you press MODE 0, the calculator switches between simple (S) and compound (C) interest modes. Select the S mode when odd periods at the beginning and end of the term only are to be calculated using simple interest. Use the C mode when the entire term, including odd periods, are to be calculated using compound interest.

•Payment mode

SHIFT MODE ..... (Payment mode) Each time you press SHIFT MODE, the calculator switches between beginning of term (BGN) and end of term (END) payment mode.

Important

When you switch the calculator OFF, the current system mode is cancelled, so the RUN mode will be in effect when the calculator is switched ON again. The calculation mode, display mode, number of days mode, and simple/compound interest mode specifications are retained when power is OFF.
The system display appears each time you switch the calculator ON, so be sure to confirm the current setting before beginning your calculations.



■ About Input and Display Limitations

The maximum size of a value that you can enter is ten digits for the mantissa and 2 digits for the exponent. Internally, calculations are performed using a 13-digit mantissa, and results are rounded off to 10-digits. The original 13-digit, however, is retained internally. In the case of 11, 12, and 13-digit values, 001 ~ 007 is cut off, while 993 ~ 999 are rounded up, meaning that both cases result in 000.

Example:

$3\times10^5\div7=$

3 [10^x] 5 [÷] 7 [EXE]

3 [10^x] 5 [÷] 7 [−] 42857 [EXE]

42' 857. 14286
0. 14285714

•Nrm1 mode and Nrm2 mode

For Nrm 1, calculation results that are less than 10^{-2}, or greater than or equal to 10^9 are automatically converted to exponential display.

[MODE] [1]

```
**** MODE ****

 sys mode :RUN
 cal mode :FIN
  display :Nrm1
```

← Nrm 1 specified

0.001 [EXE]

```
                1. E -03
```

Mantissa ↑ Exponent

For Nrm 2, calculation results that are less than 10^{-9}, or greater than or equal to 10^9 are automatically converted to exponential display. Since 10^{-3} is greater than 10^{-9}, it is not displayed in exponential format when Nrm 2 is specified.

[MODE] [8]
[EXE]

```
Norm
                0. 001
```

[MODE] [1]

```
**** MODE ****

 sys mode :RUN
 cal mode :FIN
  display :Nrm2
```

← Nrm 2 specified

The calculator switches between Nrm 1 and Nrm 2 each time you enter [MODE] [8] [EXE].

Example:

$3\times10^5\div7=$

3 [10^x] 5 [÷] 7 [EXE]

[−] 42857 [EXE]

42' 857. 14286
0. 14286

■ About Overflows and Errors

When predetermined calculation ranges are exceeded, the calculator will display an "ERROR" message and disable any further calculation. This will occur in the following cases:

① If a final or intermediate result or a value stored in memory exceeds $\pm9.999999999\times10^{99}$ (Ma ERROR).
② If a function calculation exceeds the input range shown on page 156 (Ma ERROR).
③ If an illegal operation (i.e. calculation of $\bar{x}$ or $x\sigma_n$ when $n=0$) is attempted during statistical calculations (Ma ERROR).
④ If the limitations of the numeric or command stack are exceeded (Stk ERROR).
⑤ If [EXE] is pressed to execute an illegal operation (i.e. 5 [+] [+] 3 [EXE]) (Syn ERROR).
⑥ When illegal arguments are used in commands or functions that require arguments (i.e. input of a argument outside the range of 0 ~ 9 for Fix) (Arg ERROR).
⑦ If an attempt is made to perform a financial calculation or to draw a graph when the required data is not available. For other types of errors, see the error message table on page 154.

•When an error occurs, press the [AC] key to clear it and resume normal operation.

■ Understanding Steps

The size of a calculation is measured in ***steps***, with each step representing a value or calculation command. In some cases, one step is the same as one value or one key operation as in the case of arithmetic operators such as [+], [−], [×], and [÷]. In other cases, two key operations represent a single function, and, therefore, one step, such as [SHIFT] [x!].

If you ever have a doubt about what makes up a step, press the [◄] or [►] cursor key. Each press will cause the cursor to move the equivalent of one step on the display. Your financial calculator has a capacity of 127 steps for one calculation. After you input 122 steps the flashing "_" cursor changes to "■" to indicate that you are reaching the limit. Calculations longer than 127 steps can be accomplished by breaking them down into smaller separate calculations, and performing them in series.

•Values and commands are flush with the left side of the display as you enter them, while results are flush right.

■ Editing Calculations

Use the [◄] and [►] cursor keys to locate the cursor at the position to be modified and enter the desired value or function.

Example: 122 + 456 → 123 + 456

[1] [2] [2]
[◄]
[3]

122_
12̲2
123_

*After modifications, you can execute the new calculation by pressing [EXE], or you can move the cursor back to the right of the calculation and continue to enter more values or functions.

•For deletion, use the ◄ and ► cursor keys to locate the cursor at the position of the deletion and press the DEL key. Each press of DEL deletes one command or value (i.e. one step).

Example: 369××2→369×2

3 6 9 × × 2
◄ ◄ DEL

369××2_
369×2̲

•For insertion, use the ◄ and ► cursor keys to locate the cursor at the position of the insertion and press INS. The character at the position of the insertion will blink, surrounded by "[ ]". You can then insert as many characters and commands as you desire at this position. Anything you insert will appear at the left of the blinking character.

Example: 2.36→log 2.36

2 • 3 6
◄ ◄ ◄ ◄
INS
log

2.36_
2̲.36
[ ] 2.36
log2̲.36

The "[ ]" symbol is ignored by the calculator and so you can perform calculations that contain such insert symbols without any problem.

■ About Memories

Your financial calculator comes equipped with a total of 26 variable memories. These memories are "named" using the letters of the alphabet from A through Z, and can hold values made up of a mantissa up to 10 digits long and an exponent up to two digits long. Date data can also be stored in variable memories.

Example: To store 123.45 in Memory A.

123.45 STO A

123.45
123.45

•To store a value to a memory, press the STO key followed by the memory name.

Example: To add 78.9 to the contents of Memory A, and store the result in Memory B.

ALPHA A + 78.9 STO B

A+78.9
202.35

Example: To add 74.12 to the contents of Memory B and store the result in Memory B again.

ALPHA B + 74.12 STO B

B+74.12
276.47

•It is important to remember that memories can hold values with mantissas up to 10 digits long and exponents up to two digits. This means that the precision of the values stored in memory may be less than that used for internal calculations.

•To check the contents of any memory, press the RCL key followed by the memory name.

RCL A

123.45

•You can use one of the following operations to clear the variable memories.

Example: To clear Memory A

0 STO A

0.

Example: To clear all variable memories.

SHIFT Mcl
EXE

Mcl_
0.

Returns to the display that was shown before the memory clear operation.

■ Answer (Ans) Function

The ***Answer*** function automatically stores the last calculation result obtained by pressing EXE. You can recall this result by pressing Ans EXE.
The Answer function even lets you incorporate results of a past execution into calculations. When you press the Ans key, the indicator "Ans" appears within the calculation, just as any other variable such as A, B, C, etc.

Example: 123+456=579
789−579=210

1 2 3 + 4 5 6 EXE
7 8 9 − Ans
EXE

579.
789−Ans_
210.

A value stored by the Answer function can have a mantissa up to 10 digits long and 2-digit exponent. The Answer function value is not cleared when you press the AC key or when you switch the power of the calculator OFF. The current Answer function value is replaced whenever you press the EXE key to execute a calculation.

Example: 78+56=134

7 8 + 5 6 EXE
Ans EXE ··· Confirm Ans memory contents
1 2 3 STO A
Ans EXE

134.
134.
123.
134.

Performing Fundamental Calculations

You can perform fundamental calculations in the RUN mode (MODE 1).

Display mode: Nrm 1

■ Arithmetic Operations

- Enter arithmetic operations just as they are written, from left to right.
- To enter a negative value, press (−) before you enter the value.

Example	Operation	Display
$23+4.5-53=-25.5$	23 + 4.5 − 53 EXE	−25.5
$56\times(-12)\div(-2.5)=268.8$	56 × (−) 12 ÷ (−) 2.5 EXE	268.8
$12369\times7532\times74103$ $=6.903680613\times10^{12}$ (6903680613000)	12369 × 7532 × 74103 EXE	6.903680613E+12
$(4.5\times10^{75})\times(-2.3\times10^{-79})$ $=-1.035\times10^{-3}$ (-0.001035)	4.5 10^x 75 × (−) 2.3 10^x (−) 79 EXE	−1.035E−03
$(1\times10^{5})\div7=14285.71429$	1 10^x 5 ÷ 7 EXE	14'285.71429
$(1\times10^{5})\div7-14285=0.71428571$	1 10^x 5 ÷ 7 − 14285 EXE	0.71428571

*Internal calculations use up to 13 digits for the mantissa, while results are displayed rounded off to 10 digits.

- Multiplication and division are given precedence over addition and subtraction.

Example	Operation	Display
$3+\underline{5\times6}=33$	3 + 5 × 6 EXE	33.
$\underline{7\times8}-\underline{4\times5}=36$	7 × 8 − 4 × 5 EXE	36.
$1+2-\underline{3\times4\div5}+6=6.6$	1 + 2 − 3 × 4 ÷ 5 + 6 EXE	6.6

■ Using Parentheses

Example	Operation	Display
$100-(2+3)\times4=80$	100 − (2 + 3) × 4 EXE	80.
$2+3\times(4+5)=29$	2 + 3 × (4 + 5 EXE	29.
*You can omit any closed parenthesis immediately preceding the EXE key.		
$(7-2)\times(8+5)=65$	(7 − 2) (8 + 5 EXE	65.
*You can omit multiplication signs in front of open parentheses.		
$10-\{2+7\times(3+6)\}=-55$	10 − (2 + 7 (3 + 6 EXE	−55.
$\frac{2\times3+4}{5}=(2\times3+4)\div5=2$	(2 × 3 + 4) ÷ 5 EXE	2.
$\frac{5\times6+6\times8}{15\times4+12\times3}=0.8125$	(5 × 6 + 6 × 8) ÷ (15 × 4 + 12 × 3) EXE	0.8125
$(1.2\times10^{19})-\{(2.5\times10^{20})\times\frac{3}{100}\}=4.5\times10^{18}$	1.2 10^x 19 − (2.5 10^x 20 × 3 ÷ 100) EXE	4.5E+18
$\frac{6}{4\times5}=0.3$	6 ÷ (4 × 5) EXE	0.3
*The above is the same as 6 ÷ 4 ÷ 5 EXE		

■ Specifying the Number of Decimal Places

- Specify the number of decimal places by the operation MODE 7 *n* EXE, where *n* is a value from 0 through 9. You can clear this specification by MODE 8 EXE.
- No matter what you specify, calculations within the calculator are always performed using a 13-digit mantissa. To round the internal value to match the displayed value, press Rnd followed by EXE.

Example	Operation	Display
100÷6=16.6666666……	100 ÷ 6 EXE	16.66666667
(Specifies 4 decimal places.)	MODE 7 4 EXE	16.6667
	MODE 8 EXE	16.66666667

*Though the display value is rounded off to the specified number of decimal places, the fully value is stored internally and used in subsequent calculations.

200÷7×14=400	(Specifies 3 decimal places.) MODE 7 3 EXE	
	200 ÷ 7 EXE	28.571
	(Continuing with the internal 12-digit value) × 14 EXE	400.000
	(Rounds off the internal value to the FIX specification.)	
	(Clears the specification.) 200 ÷ 7 EXE	28.571
	Rnd EXE × 14 EXE	399.994
	MODE 8 EXE	399.994

■ Performing Memory Calculations

- The variable memories are ***non-volatile***, which means that they retain their contents even when you switch the power of the calculator OFF. See page 23 for details on clearing variable memories.

Example	Operation	Display
9.874×7=69.118	9.874 STO A	9.874
9.874×12=118.488	ALPHA A × 7 EXE	69.118
9.874×26=256.724	ALPHA A × 12 EXE	118.488
9.874×29=286.346	ALPHA A × 26 EXE	256.724
	ALPHA A × 29 EXE	286.346

*Use the STO to assign a value to a memory. This replaces the existing contents of the memory, so you don't need to clear it first.

23+9=32	23 + 9 STO B	32.
53−6=47	53 − 6 EXE	47.
−)45×2=90	ALPHA B + Ans STO B	79.
99÷3=33	45 × 2 EXE	90.
Total 22	ALPHA B − Ans STO B	−11.
	99 ÷ 3 EXE	33.
	ALPHA B + Ans STO B	22.
12×(2.3+3.4)−5=63.4	2.3 + 3.4 STO G	5.7
	12 × ALPHA G − 5 EXE	63.4
30×(2.3+3.4+4.5)−15×4.5	4.5 STO H	4.5
=238.5	30 × (ALPHA G + ALPHA H)	
	− 15 ALPHA H EXE	238.5

*The multiplication sign immediately before a memory name can be omitted.

■ Performing Percent Calculations

Example	Operation	Display
•Percent To calculate 26% of 1,500	1500 × 26 %	390.
•Add on To calculate 3,620 increased by 15%.	3620 + 15 %	4'163.
•Decrease To calculate 4,750 decreased by 4%.	4750 − 4 %	4'560.
•Proportion To calculate what percent of 250 is 75.	75 ÷ 250 %	30.(%)
•Increase/decrease a. To calculate what percent of increase changes 120 to 141. b. To calculate what percent of decrease changes 300 to 240.	141 − 120 SHIFT Δ% 240 − 300 SHIFT Δ%	17.5(%) −20.(%)
•Mark-up To calculate the selling price and profit when the purchase price is $480 and the profit rate to the selling price is 25%.	480 × 25 SHIFT Δ% 480 ÷ 25 SHIFT Δ%	640. (Selling price) 160. (Profit)
•Mark-down To calculate the bargain price and loss when the purchase price is $130 and the loss rate is 4%.	130 × (−) 4 SHIFT Δ% 130 ÷ (−) 4 SHIFT Δ%	125. (Bargain price) −5. (Loss)

*Percent calculations can also be used within programs.

Using Special Functions

■ Continuous Calculation Function

The Continuous Calculation Function lets you use the result of one calculation as an element of a successive calculation. Such calculations are performed using the 10 digits for the mantissa used for the displayed value.

Example: 3 × 4 = 12 continuing to ÷ 3.14 =

3 × 4 EXE

÷ 3.14 EXE (continuing)

```
3×4
                12.
12. ÷3. 14
     3. 821656051
```

Example: 1 ÷ 3 × 3 =

1 ÷ 3 × 3 EXE

1 ÷ 3 EXE

× 3 EXE (continuing)

```
1÷3×3
                1.
1÷3
     0. 3333333333
0. 3333333333×3
     0. 9999999999
```

This function can also be used with memory, Type A functions, +, −, ×, ÷, y^x, ▶APR, and ▶EFF.

Example: To store the result of 12 × 45 to Memory C

12 × 45 EXE

STO C (continuing)

```
12×45
              540.
              540.
```

Example: To square the result of 78 ÷ 6 (see page 33)

78 ÷ 6 EXE

x^2 EXE (continuing)

```
78÷6
               13.
13. 2
              169.
```

■ Using the Replay Function

•Press either of the cursor keys after executing of a calculation to display the calculation again. Pressing ▶ positions the cursor at the beginning of the calculation you have just executed, while ◀ positions the cursor at the end. Then you can move through the calculations using the ◀, ▶, ▲, and ▼ cursor keys to confirm that it is correct or to make changes. Finally, you can execute the original calculation again, or edit it first and then execute it.

Example:

123 × 456 EXE

```
123×456
          56' 088.
```

▶

```
123×456
```

The display is cleared and the formula appears.

EXE

```
123×456
          56' 088.
```

◀

```
123×456_
```

Example: 4.12×3.58+6.4=21.1496
4.12×3.58−7.1=7.6496

4.12 × 3.58 + 6.4 EXE

```
4.12×3.58+6.4
          21.1496
```

◀

```
4.12×3.58+6.4_
```

◀◀◀◀

```
4.12×3.58±6.4
```

− 7.1 EXE

```
4.12×3.58-7.1
          7.6496
```

•When an error occurs during a calculation, the most obvious solution would be to clear the calculator and input the formula again. With the Replay Function, you can press the ◀ or ▶ cursor key, make the necessary changes, and then execute the new, correct calculation.

Example: 14÷0×2.3 is entered for 14÷10×2.3

14 ÷ 0 × 2.3 EXE

```
14÷0×2.3
 Ma  ERROR
  Step   4
```

▶ (or ◀)

```
14÷0×2.3
```

Error caused here

◀ INS 1 EXE

```
14÷10×2.3
          3.22
```

•The Replay function is cleared when you press the AC key, when you switch the power of the calculator OFF, or when you switch modes.

■ Using Multistatements

•You can use the ***Multistatement*** Function in programmed calculations and in manual calculations to connect multiple formulas or statements into a single statement. Formulas and statements are separated by colons or the symbol "◢" (SHIFT ◢).
•When a colon is used, the formulas and statements are executed in sequence from left to right without interruption.
•When programmed calculation execution reaches a "◢" symbol, the intermediate result up to that point is displayed until the EXE key is pressed again.

Example: 7÷20=0.35
8÷20=0.4
5÷20=0.25

20 STO A
7 ÷ ALPHA A SHIFT ◢
8 ÷ ALPHA A SHIFT ◢
5 ÷ ALPHA A EXE

```
20
                    20.
7÷A◢
8÷A◢
5÷A
                    0.35
                 -Disp-
```

Indicates intermediate display caused by "◢".

EXE
EXE

```
                    20.
7÷A◢
8÷A◢
5÷A
                    0.35
                     0.4
                    0.25
```

•The final result of the multistatement will be displayed even if you do not put a "◢" symbol at the very end.
•You cannot perform continuous calculations (see page 29) within multistatements.

Example: 123×456: +5
Illegal

Scientific Function Calculations

■ Performing Logarithmic and Exponential Calculations

Example	Operation	Display
$\log 1.23 (\log_{10} 1.23) = 0.08990511144$	[log] 1.23 [EXE]	0.08990511144
$\ln 90 (\log_e 90) = 4.49980967$	[ln] 90 [EXE]	4.49980967
$\log 456 \div \ln 456 = 0.4342944819$ (log/ln ratio = constant M)	[log] 456 [÷] [ln] 456 [EXE]	0.4342944819
$10^{1.23} = 16.98243652$ (Obtains the antilogarithm of common logarithm 1.23)	[10^x] 1.23 [EXE]	16.98243652
$e^{4.5} = 90.0171313$ (Obtains the antilogarithm of natural logarithm 4.5)	[e^x] 4.5 [EXE]	90.0171313
$10^4 \cdot e^{-4} + 1.2 \cdot 10^{2.3} = 422.5878667$	[10^x] 4 [×] [e^x] [(-)] 4 [+] 1.2 [×] [10^x] 2.3 [EXE]	422.5878667
$5.6^{2.3} = 52.58143837$	5.6 [y^x] 2.3 [EXE]	52.58143837

■ Other Functions

Example	Operation	Display
$\sqrt{2} + \sqrt{5} = 3.65028154$	[√x] 2 [+] [√x] 5 [EXE]	3.65028154
$2^2 + 3^2 + 4^2 + 5^2 = 54$	2 [x²] [+] 3 [x²] [+] 4 [x²] [+] 5 [x²] [EXE]	54.
$\frac{1}{\frac{1}{3} - \frac{1}{4}} = 12$	[(] 3 [x⁻¹] [−] 4 [x⁻¹] [)] [x⁻¹] [EXE]	12.
$8! (= 1 \times 2 \times 3 \times \cdots \times 8) = 40320$	8 [N!] [EXE]	40'320.
Random number generation (pseudo-random number between 0.000 and 0.999)	[Ran#] [EXE]	(Ex) 0.792
$\sqrt{13^2 - 5^2} + \sqrt{3^2 + 4^2} = 17$	[√x] [(] 13 [x²] [−] 5 [x²] [)] [+] [√x] [(] 3 [x²] [+] 4 [x²] [)] [EXE]	17.
$\frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + \frac{1}{8!} = 0.5430803571$	2 [N!] [x⁻¹] [+] 4 [N!] [x⁻¹] [+] 6 [N!] [x⁻¹] [+] 8 [N!] [x⁻¹] [EXE]	0.5430803571
Absolute value of common logarithm of 3/4	[SHIFT] [Abs] [log] [(] 3 [÷] 4 [)] [EXE]	0.1249387366
$\left\lvert \log \frac{3}{4} \right\rvert = 0.1249387366$		
Integer part of $\frac{7800}{96}$?	[SHIFT] [Intg] [(] 7800 [÷] 96 [)] [EXE]	81.
Fraction part of $\frac{7800}{96}$?	[SHIFT] [Frac] [(] 7800 [÷] 96 [)] [EXE]	0.25
Aliquot part of 2512549139÷2141?	2512549139 [÷] 2141 [EXE]	1'173'540.
	[SHIFT] [Frac] [(] 2512549139 [÷] 2141 [)] [EXE]	0.999533

Number of Days/Date Calculations

You can perform number of days and date calculations in the 365-day mode (calculated according to 365 days in a year), and number of days calculations only in the 360-day mode (calculated according to 30 day in a month, 360 days in a year). In the 365-day mode, allowance is automatically made for leap years. Also, beginning dates and end dates are not counted in number of day and date calculations.

•Switching between the 365-day and 360-day modes

Each time you press [MODE] [9], the calculator switches between the 365 and 360-day mode. You can confirm the current date mode by pressing [MODE] [1].

•Calculation range

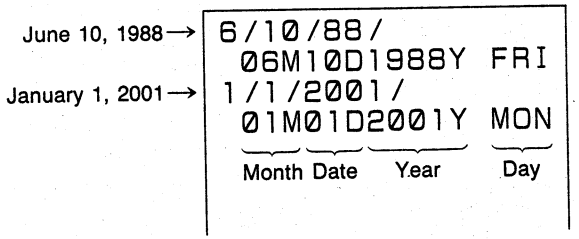
January 1, 1901 ~ December 31, 2099

•Date input

Dates are entered in the format month [DATE] date [DATE] year [DATE]. Years that fall within the 20th century can be entered in two digits (i.e. 1988→88), while 21st century years must be entered in four digits.

Example: To enter June 10, 1988
6 [DATE] 10 [DATE] (19) 88 [DATE] [EXE]

•Reading the display



Days of week display
Sunday = SUN
Monday = MON
Tuesday = TUE
Wednesday = WED
Thursday = THU
Friday = FRI
Saturday = SAT

•Types of calculations

The following four types of number of days and date calculations are possible with this calculator:

① DATE − DATE = NUMBER OF DAYS (365-day and 360-day modes)
② DATE + NUMBER OF DAYS = DATE (365-day mode only)
③ DATE − NUMBER OF DAYS = DATE (365-day mode only)
④ NUMBER OF DAYS + DATE = DATE (365-day mode only)

Example	Operation	Display
To calculate the number of days from July 1, 1988 to January 1, 1992.	([MODE] [9]) 7 [DATE] 1 [DATE] 88 [DATE] − 1 [DATE] 1 [DATE] 92 [DATE]	7/1/88/−1/1/92/_
In 360-day mode	[EXE]	1'260
In 365-day mode	[MODE] [9] [EXE]	1'279
To calculate the date that is 200 days from November 30, 2001 (365-day mode).	11 [DATE] 30 [DATE] 2001 [DATE] + 200 [EXE]	06M18D2002Y TUE
To calculate the dates 50 days, 100 days, and 150 days from June 20, 1988.	6 [DATE] 20 [DATE] 88 [DATE] [STO] [A]	06M20D1988Y MON
	+ 50 [EXE]	08M09D1988Y TUE
	[ALPHA] [A] + 100 [EXE]	09M28D1988Y WED
	[ALPHA] [A] + 150 [EXE]	11M17D1988Y THU
	6 [DATE] 20 [DATE] 88 [DATE] + 50.5 [EXE] (Fractions are always ignored for date calculations.)	08M09D1988Y TUE

Performing Statistical Calculations

Before entering the statistical data, you should clear the statistical memories by pressing [SHIFT] [Scl] ([DATE]) [EXE]. Remember, the memories are not cleared when you press the [AC] key or when you switch the power of the calculator OFF.

■ Performing Standard Deviation Calculations

- Press [MODE] [6] to enter the SD mode for standard deviation calculations.
- Enter each data item, using the following sequence:
  DATA [DT]. Enter negative values using [(-)].
  Example: [(-)] 50 [DT] (inputs −50 as data)
- You can enter identical data items by pressing the [DT] key repeatedly, or by specifying the number of data that are the same.
  Example: Data: 41, 41
  41 [DT] [DT]
  Data: 57, 57, 57, 57, 57, 57, 57, 57
  57 [SHIFT] [;] 8 [DT]
- Standard Deviation Formulas
  The following formulas are used for standard deviation:

$$\sigma n = \sqrt{\frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{n}} = \sqrt{\frac{\Sigma x^2-(\Sigma x)^2/n}{n}}$$

(For calculation of population standard deviation using all data for a finite population.)

$$\sigma n-1 = \sqrt{\frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{n-1}} = \sqrt{\frac{\Sigma x^2-(\Sigma x)^2/n}{n-1}}$$

(For estimation of sample standard deviation for an entire population using a sample from the population.)

- Mean formula

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{\Sigma x}{n}$$

- Variable memories are used during standard deviation calculations as follows:

Value	Variable memory
n	W
Σx	V
Σx^2	U

These values can be recalled by pressing [ALPHA] followed by the memory name and then [EXE].

Example	Operation	Display
Data: 55, 54, 51, 55, 53, 53, 54, 52 *The same results can be obtained no matter in what sequence they are recalled.	[MODE] [6]	
	[SHIFT] [Scl] [EXE]	0.
	55 [DT] 54 [DT] 51 [DT] 55 [DT] 53 [DT] [DT] 54 [DT] 52 [DT]	52.
	(Standard deviation σn) [SHIFT] [$x\sigma n$] [EXE]	1.316956719
	(Standard deviation $\sigma n-1$) [SHIFT] [$x\sigma n-1$] [EXE]	1.407885953
	(Mean $\bar{x}$) [SHIFT] [$\bar{x}$] [EXE]	53.375
	(Number of data n) [ALPHA] [W] [EXE]	8.
	(Sum Σx) [ALPHA] [V] [EXE]	427.
	(Sum of squares Σx^2) [ALPHA] [U] [EXE]	22'805.
Deviation of unbiased variance, difference between each datum, and mean of above data	(Continuing) [SHIFT] [$x\sigma n-1$] [x^2] [EXE]	1.982142857
	55 [−] [SHIFT] [$\bar{x}$] [EXE]	1.625
	54 [−] [SHIFT] [$\bar{x}$] [EXE]	0.625
	51 [−] [SHIFT] [$\bar{x}$] [EXE]	−2.375
	⋮	⋮
	[SHIFT] [Scl] [EXE]	
To calculate $\bar{x}$ and $x\sigma n-1$ for the following table.	110 [SHIFT] [;] 10 [DT]	110.
	130 [SHIFT] [;] 31 [DT]	130.
	150 [SHIFT] [;] 24 [DT]	150.
	170 [DT] [DT]	170.
	190 [DT] [DT] [DT]	190.
	[ALPHA] [W] [EXE]	70.
	[SHIFT] [$\bar{x}$] [EXE]	137.7142857
	[SHIFT] [$x\sigma n-1$] [EXE]	18.42898069

Rank	Value	Frequency
1	110	10
2	130	31
3	150	24
4	170	2
5	190	3

•Correcting and deleting entered data

① To delete 50 [DT] which you have just entered: [CL] [r]
② To delete 49 [DT] which you previously entered: 49 [CL]
③ To clear 120 [SHIFT] [;] which you have just entered: [AC]
④ To clear 120 [SHIFT] [;] 31 which you have just entered: [AC]
⑤ To clear 120 [SHIFT] [;] 30 [DT] which you have just entered: [CL]
⑥ To clear 120 [SHIFT] [;] 30 [DT] which you have previously entered: 120 [SHIFT] [;] 30 [CL]

■ Regression Calculations

- Press [MODE] [5] to enter the LR mode for regression calculations.
- Enter data using the sequence: x-DATA [SHIFT] [,] y-DATA [DT].
- You can enter identical data items by pressing the [DT] key repeatedly, or by specifying the number of data that are the same.

  Example: Data: 41, 55; 41, 55
  41 [SHIFT] [,] 55 [DT] [DT]
  Data: 57, 42; 57, 42; 57, 42; 57, 42; 57, 42; 57, 42; 57, 42; 57, 42; 57, 42
  57 [SHIFT] [,] 42 [SHIFT] [;] 8 [DT]

- Use the following sequences for data entry when the x-data only is identical: [SHIFT] [,] y-data [DT] or [SHIFT] [,] y-DATA [SHIFT] [;] ⟨number of repeats⟩ [DT]
- Use the following sequences for data entry when the y-data only is identical: x-data [DT] or x-DATA [SHIFT] [;] ⟨number of repeats⟩ [DT]
- Regression Formulas
  The following formulas are used for regression:

  $$y = A + Bx$$

  $$\text{Constant term } A = \frac{\Sigma y - B \cdot \Sigma x}{n}$$

  $$\text{Regression coefficient } B = \frac{n \cdot \Sigma xy - \Sigma x \cdot \Sigma y}{n \cdot \Sigma x^2 - (\Sigma x)^2}$$

- You can also calculate estimated values $\hat{x}$ and $\hat{y}$ based on the regression formula.
- You can calculate the correlation coefficient r for input data using the following formula.

  $$r = \frac{n \cdot \Sigma xy - \Sigma x \cdot \Sigma y}{\sqrt{\{n \cdot \Sigma x^2 - (\Sigma x)^2\}\{n \cdot \Sigma y^2 - (\Sigma y)^2\}}}$$

- Variable memories are used during standard deviation calculations as follows:

Value	Variable memory
n	W
Σx	V
Σx^2	U
Σxy	R
Σy	Q
Σy^2	P

These values can be recalled by pressing [ALPHA] followed by the memory name and then [EXE].

•Performing Linear Regression Calculations

Example	Operation	Display
•Length of a steel rod at various temperatures	[MODE] [5]	
	[SHIFT] [Scl] [EXE]	0.
	10 [SHIFT] [,] 1003 [DT]	10.
	15 [SHIFT] [,] 1005 [DT]	15.
	20 [SHIFT] [,] 1010 [DT]	20.
	25 [SHIFT] [,] 1011 [DT]	25.
	30 [SHIFT] [,] 1014 [DT]	30.
To calculate the regression formula and correlation coefficient for the above data. Use the regression formula to calculate the length of the rod at 18°C and the temperature when the rod is 1,000mm long. Also calculate the critical coefficient (r^2) and covariance.	(Constant term A) [SHIFT] [A] [EXE]	997.4
	(Regression coefficient B) [SHIFT] [B] [EXE]	0.56
	(Correlation efficient r) [SHIFT] [r] [EXE]	0.9826073689
	(Length at 18°C) 18 [SHIFT] [$\hat{y}$] [EXE]	1'007.48
	(Temperature for 1,000 length) 1000 [SHIFT] [$\hat{x}$] [EXE]	4.642857143
	(Critical coefficient) [SHIFT] [r] [x^2] [EXE]	0.9655172414
	(Covariance) [(] [ALPHA] [R] [−] [ALPHA] [W] [×] [SHIFT] [$\bar{x}$] [×] [SHIFT] [$\bar{y}$] [)] [÷] [(] [ALPHA] [W] [−] 1 [)] [EXE]	35.

•Correcting and Deleting Entered Data

① To delete 11 [SHIFT] [,] 1003 which you have just entered: [AC]
② To clear 11 [SHIFT] [,] 1003 [DT] which you have just entered: [CL]
③ To clear 11 [SHIFT] [,] 1003 [DT] which you have previously entered: 11 [SHIFT] [,] 1003 [CL]

•Performing Logarithmic Regression Calculations

- The calculator uses the following regression formula:
  $A + B \cdot \ln x$
  Enter the logarithm of x as the x data, and enter y data using the same sequence as that for linear regression.
- You can calculate the correlation coefficient and edit data using the same procedures as those described for linear regression. Other values are obtained as follows:
  Estimated value $\hat{y}$ = [ln] x [SHIFT] [$\hat{y}$] [EXE]
  Estimated value $\hat{x}$ = y [SHIFT] [$\hat{x}$] [EXE] [e^x] [Ans] [EXE]
  $\Sigma x = \Sigma \ln x \quad \Sigma x^2 = \Sigma (\ln x)^2 \quad \Sigma xy = \Sigma \ln xy$

Example

x_i	y_i
29	1.6
50	23.5
74	38.0
103	46.4
118	48.9

To perform logarithmic regression on the above data to determine the regression formula and the correlation coefficient. Then use the regression formula to estimate $\hat{y}$ when $xi = 80$ and $\hat{x}$ when $yi = 73$.

Operation	Display
[MODE] [5]	
[SHIFT] [Scl] [EXE]	0.
[ln] 29 [SHIFT] [,] 1.6 [DT]	3.36729583
[ln] 50 [SHIFT] [,] 23.5 [DT]	3.912023005
[ln] 74 [SHIFT] [,] 38.0 [DT]	4.304065093
[ln] 103 [SHIFT] [,] 46.4 [DT]	4.634728988
[ln] 118 [SHIFT] [,] 48.9 [DT]	4.770684624
(Constant term A) [SHIFT] [A] [EXE]	−111.1283976
(Regression coefficient B) [SHIFT] [B] [EXE]	34.0201475
(Correlation coefficient r) [SHIFT] [r] [EXE]	0.9940139466
($\hat{y}$ when $xi = 80$) [ln] 80 [SHIFT] [$\hat{y}$] [EXE]	37.94879482
($\hat{x}$ when $yi = 73$) 73 [SHIFT] [$\hat{x}$] [EXE] [e^x] [Ans] [EXE]	224.1541313

•Performing Exponential Regression Calculations

- The calculator uses the following regression formula:
  $A \cdot e^{B \cdot x} (\ln y = \ln A + Bx)$
  Enter the logarithm (ln) as the y data, and enter x data using the same sequence as that for linear regression.
- You can edit data using the same procedures as those described for linear regression. Other values are obtained as follows:
  Constant term A = [e^x] [SHIFT] [A] [EXE]
  Estimated value $\hat{y}$ = x [SHIFT] [$\hat{y}$] [EXE] [e^x] [Ans] [EXE]
  Estimated value $\hat{x}$ = [ln] y [SHIFT] [$\hat{x}$] [EXE]
  $\Sigma y = \Sigma \ln y \quad \Sigma y^2 = \Sigma (\ln y)^2 \quad \Sigma xy = \Sigma x \ln y$

Example

x_i	y_i
6.9	21.4
12.9	15.7
19.8	12.1
26.7	8.5
35.1	5.2

To perform exponential regression on the above data to determine the regression formula and the correlation coefficient. Then use the regression formula to estimate $\hat{y}$ when $xi = 16$ and $\hat{x}$ when $yi = 20$.

Operation	Display
[MODE] [5]	
[SHIFT] [Scl] [EXE]	0.
6.9 [SHIFT] [,] [ln] 21.4 [DT]	6.9
12.9 [SHIFT] [,] [ln] 15.7 [DT]	12.9
19.8 [SHIFT] [,] [ln] 12.1 [DT]	19.8
26.7 [SHIFT] [,] [ln] 8.5 [DT]	26.7
35.1 [SHIFT] [,] [ln] 5.2 [DT]	35.1
(Constant term A) [e^x] [SHIFT] [A] [EXE]	30.49758743
(Regression coefficient B) [SHIFT] [B] [EXE]	−0.04920370831
(Correlation coefficient r) [SHIFT] [r] [EXE]	−0.997247352
($\hat{y}$ when $xi = 16$) 16 [SHIFT] [$\hat{y}$] [EXE] [e^x] [Ans] [EXE]	13.87915739
($\hat{x}$ when $yi = 20$) [ln] 20 [SHIFT] [$\hat{x}$] [EXE]	8.574868046

•Performing Power Regression Calculations

•The calculator uses the following regression formula:
$y = A \cdot x^B (\ln y = \ln A + B \ln x)$
Enter both x and y data as logarithms (ln).

•You can edit data using the same procedures as those described for linear regression. Other values are obtained as follows:
Constant term A = [e^x] [SHIFT] [A] [EXE]
Estimated value $\hat{y}$ = [ln] x [SHIFT] [$\hat{y}$] [EXE] [e^x] [Ans] [EXE]
Estimated value $\hat{x}$ = [ln] y [SHIFT] [$\hat{x}$] [EXE] [e^x] [Ans] [EXE]
$\Sigma x = \Sigma \ln x \quad \Sigma x^2 = \Sigma (\ln x)^2 \quad \Sigma y = \Sigma \ln y \quad \Sigma y^2 = \Sigma (\ln y)^2 \quad \Sigma xy = \Sigma \ln x \cdot \ln y$

Example	Operation	Display
x_i / y_i: 28 / 2410; 30 / 3033; 33 / 3895; 35 / 4491; 38 / 5717	[MODE] [5]	
	[SHIFT] [Scl] [EXE]	0.
	[ln] 28 [SHIFT] [,] [ln] 2410 [DT]	3.33220451
	[ln] 30 [SHIFT] [,] [ln] 3033 [DT]	3.401197382
	[ln] 33 [SHIFT] [,] [ln] 3895 [DT]	3.496507561
	[ln] 35 [SHIFT] [,] [ln] 4491 [DT]	3.555348061
	[ln] 38 [SHIFT] [,] [ln] 5717 [DT]	3.63758616
To perform power regression on the above data to determine the regression formula and the correlation coefficient. Then use the regression formula to estimate $\hat{y}$ when $xi = 40$ and $\hat{x}$ when $yi = 1000$.	(Constant term A) [e^x] [SHIFT] [A] [EXE]	0.2388010724
	(Regression coefficient B) [SHIFT] [B] [EXE]	2.771866153
	(Correlation coefficient r) [SHIFT] [r] [EXE]	0.9989062542
	($\hat{y}$ when $xi = 40$) [ln] 40 [SHIFT] [$\hat{y}$] [EXE] [e^x] [Ans] [EXE]	6'587.67458
	($\hat{x}$ when $yi = 1000$) [ln] 1000 [SHIFT] [$\hat{x}$] [EXE] [e^x] [Ans] [EXE]	20.2622568

Before Beginning Financial Calculations

The FC-1000 financial calculator makes it easy to perform the following types of financial calculations:

1. Simple interest calculations
2. Compound interest calculations (annual, monthly)
3. Amortization of loans
4. Investment appraisal
5. Bond calculations
6. Depreciation (straight-line, sum-of-the-years' digits, declining balance)
7. Interest conversion (between percentage rate and effective rate)
8. Cost, selling price, margin calculations

You can also produce graphs for calculations 1 through 6.

■ Before Beginning Financial Calculations

•Except for interest conversion, the first step for all financial calculations is pressing the [MENU] key to display the financial menu. Then you select the type of calculation you wish. You can perform this operation in the FIN, LR, or SD mode and RUN mode.

•The next step before actually performing calculations is to clear the financial memories using the operation: [SHIFT] [Fcl AC] [EXE]. This operation also clears any financial graphs. Remember, you cannot clear the memories by simply pressing the [AC] key.

•Confirm the current mode setting by pressing [MODE] [1] before beginning calculations.

•i% (percent) is always a percentage.

•Be sure that the term and interest rate match. If the term is a year, use an annual interest rate, if a month, use a monthly rate, if a day, use a daily rate.

Important

•The calculator may require a considerable amount of time to perform i%, IRR, and YLD calculations. While calculations are being performed, the lower left of the display changes from " ■ " to " ▒ ", and blinks. If you wish to interrupt such a calculation, press the [AC] key. When you interrupt a calculation, the memories retain any values that were assigned up until the interruption.

•For i%, IRR, and YLD calculations, values less than −100% cannot be performed.

■ Financial Memories

The FC-1000 equipped with independent financial memories for n, i%, PV, PMT, FV, RDV, YLD, CPN, PRC, d_1, d_2, CST, SEL, and MAR. Besides these, a total of 61 memory pairs are available for CFj and Nj in investment appraisal calculations. The contents of the financial memories are retained even when the power of the calculator is switched OFF.

■ Entering Financial Values

When entering values to be used in financial calculations, enter outflow as a negative value, and income as a positive value. Results are represented by the calculator in the same way.

■ Using the Menu

Press the [MENU] key while in the RUN mode to display a financial menu. There are actually two financial menus, and you can switch between FINANCE 1 and FINANCE 2 by pressing the [MENU] key.

```
 ** FINANCE 1 **
F1 SIMPLE
F2 COMPOUND
F3 MONTHLY C.I.
F4 AMORTIZATION
F5 D.C.F.
 SMP CMP MCI AMR DCF
```

F1 [F1] Simple interest calculations
F2 [F2] Compound interest calculations (annual)
F3 [F3] Compound interest calculations (monthly)
F4 [F4] Amortization of loans
F5 [F5] Investment appraisal (discounted cash flow analysis)

[F1] [F2] [F3] [F4] [F5]

[MENU]

```
 ** FINANCE 2 **
F1 BOND
F2 DEP SL
F3 DEP SYD
F4 DEP DB
F5 CST.SEL.MAR.
 BND SL SYD DB CSM
```

F1 [F1] Bond calculations
F2 [F2] Depreciation (straight-line)
F3 [F3] Depreciation (sum-of-the-years' digits)
F4 [F4] Depreciation (declining balance)
F5 [F5] Cost, selling price, margin calculations

[F1] [F2] [F3] [F4] [F5]

Example: payment: BGN

[MODE] 1 [SHIFT] [Fcl] [EXE] [MENU]
Displays FINANCE 1 menu.

```
 ** FINANCE 1 **
F1 SIMPLE
F2 COMPOUND
F3 MONTHLY C.I.
F4 AMORTIZATION
F5 D.C.F.
 SMP CMP MCI AMR DCF
```

[F2]

[CMP] [F2]
Selects annual compound interest calculation.

```
*COMPOUND
  n?0.
 i%?0.
 PV?0.
PMT?0.
 FV?0.
 n i% PV PMT FV
```


•Once you select an item from a financial menu, the display changes to show the contents of the financial memories under a heading that indicates your selection. A number of keys are also shown along the bottom of the display to indicate the financial memory keys used in the particular calculation you are performing. This means that the required financial memory values can be input using function keys [F1] through [F5]. You can also obtained the values stored in the financial memories by pressing [COMP] (C symbol appears at lower left of display) followed by a function key ([n] [F1] ~ [PV] [F5]).

Example: Continuing from the above sequence: (Payment mode — BGN)

24 [n] [F1] (Input value of *n* using [F1] key.)
[(-)] 50 [PMT] [F4] (Input value of PMT using [F4] key.)
.52 [i%] [F2] (Input value of *i*% using [F2] key.)
[COMP] [PV] [F5] (Calculates FV.)

```
PMT=
                -50.
.52
i%=
                 0.52
FV=
          1'281.200511
 n i% PV PMT FV
```

[F1] [F2] [F3] [F4] [F5]

■ Producing Financial Graphs

•The following types of graphs can be produced for each financial calculation:

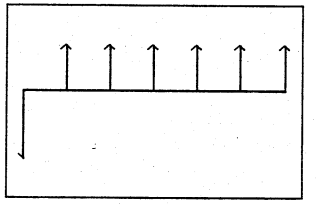
① Simple interest calculations→Cash flow
② Compound interest calculations (annual, monthly)→Cash flow
③ Amortization of loans→Amortization breakdown graph
④ Investment appraisal→Cash flow
⑤ Bond calculations→Cash flow
⑥ Depreciation→Depreciation graph

•You can produce a financial graph by simply pressing the [Graph] key after performing the required financial calculation. Then if you press the [Trace] key, one of the points on the graph begins to flash, and the corresponding value for that point is displayed. Press the [Trace] key again and the next point flashes with its value displayed.

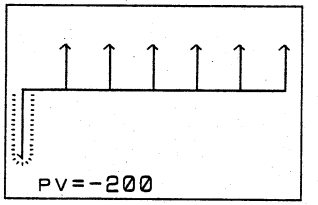
Example: Cash flow for compound interest calculation

Following a compound interest calculation:

[Graph]



[Trace]



Performing Financial Calculations

■ Simple Interest

1. Formulas

The calculator uses the following standard formulas to perform simple interest calculations.

•365-day mode $SI' = \frac{n}{365} \times PV \times i \quad \left(i = \frac{i\%}{100}\right)$

•360-day mode $SI' = \frac{n}{360} \times PV \times i \quad \left(i = \frac{i\%}{100}\right)$

$$SI = -SI'$$

$$SFV = -(PV + SI')$$

PV = Present Value	SFV = Simple Future Value
PMT = Payment	n = Number of Simple Interest Periods
i% = Periodic Interest Rate	SI = Simple Interest

2. Selecting simple interest from the menu

Use the MENU key to display the FINANCE 1 menu. Then press the SMP F1 key to display the SIMPLE screen.

3. Entering data

Press the n F1, I% F2, and PV F3 keys while the value you wish to assign to their financial memories is shown on the display. You can assign values in any sequence (i.e. you can start with key PV F3, or n F1, or any other key).

4. Editing data

You can change any data assigned to memory by simply re-entering new data. The new data replaces the data originally stored.

5. Displaying results

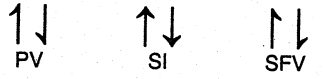
Press SI F4 to display the value for SI, and SFV F5 for SFV. At this time, the SI result is automatically stored in variable memory X, while SFV is stored in memory Y.

6. Checking entered data

You can individually check the values assigned for n, i%, and PV by pressing the RCL key followed by the corresponding key (n F1, I% F2, PV F3).
Pressing the AFD key returns you to the SIMPLE screen which shows the values for n, i%, and PV. Press AFD again to return to the display that was shown when you originally pressed AFD.

7. Producing a graph

•After you have entered all of the necessary data, press the Graph key to calculate SI and SFV, and to produce the corresponding cash flow graph.
•The cash flow graph has the following characteristics:
① The passage of time is represented left to right by the horizontal axis.
② Cash inflow and outflow are represented by vertical lines: inflows pointing upwards and outflows pointing downwards.
③ Arrows also indicate the following information:



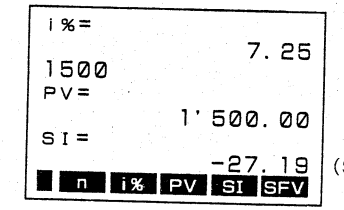
④There are three types of arrows, long, medium, and short.
•After the graph has been produced, you can press the Trace key to cause the PV point on the graph to blink, with its value also displayed. Pressing Trace sequentially shows the points and values for SI and SFV.

Example

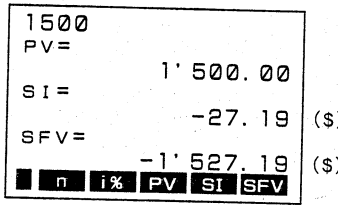
What would the interest amount and principal plus interest be for a loan of $1,500 borrowed for 90 days at 7.25% of annual rate.

Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (360) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	**** MODE **** sys mode :RUN cal mode :FIN display :Fix2 date mode :360 payment :END odd period :CMP
MENU	** FINANCE 1 ** F1 SIMPLE F2 COMPOUND F3 MONTHLY C.I. F4 AMORTIZATION F5 D.C.F. SMP CMP MCI AMR DCF F1
SMP F1	*SIMPLE n?0.00 i%?0.00 PV?0.00 n i% PV SI SFV F1 F2 F3
SHIFT Fd AC EXE 90 n F1 (Term) 7.25 i% F2 (Interest rate) 1500 PV F3 (Principal)	90.00 7.25 i%= 7.25 1500 PV= 1'500.00 n i% PV SI SFV F4

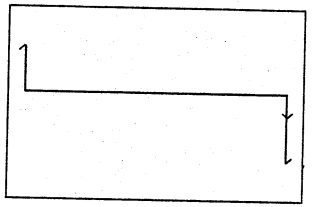
SI F4 (Calculates the interest amount.)



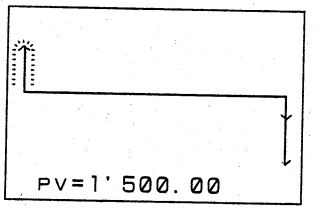
SFV F5 (Calculates the total principal plus interest.)



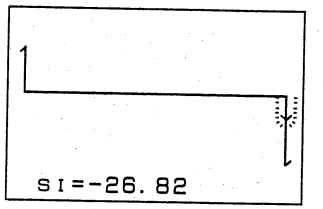
Graph



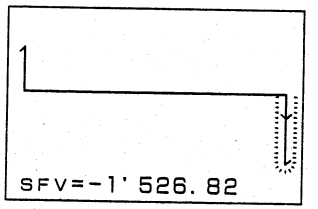
Trace



Trace



Trace



■ Compound Interest Calculations

1. Formulas

The following are the basic compound interest formulas used by the calculator:

•Calculation of odd periods using simple interest

$$PV\{1+i\cdot \mathrm{Frac}(n)\}+(1+i\cdot s)\cdot PMT\cdot\frac{1-(1+i)^{-\mathrm{Intg}(n)}}{i}+FV(1+i)^{-\mathrm{Intg}(n)}=0 \quad \cdots\cdots\langle 1\rangle$$

S = 0: End of term S = 1: Beginning of term

•Calculation of odd periods using compound interest

$$PV(1+i)^{\mathrm{Frac}(n)}+(1+i\cdot s)\cdot PMT\cdot\frac{1-(1+i)^{-\mathrm{Intg}(n)}}{i}+FV(1+i)^{-\mathrm{Intg}(n)}=0 \quad \cdots\cdots\langle 2\rangle$$

•$i\% = 0$

$$PV+PMT\times \mathrm{Intg}(n)+FV=0$$

You can select which formula to use by specifying either S (simple) or C (compound) mode in the simple/compound interest mode (MODE 0). Formula 1 is used when you specify S (SMP shown on the mode display, shown by MODE 1), while Formula 2 is used for C (CMP shown on the display, shown by MODE 1).

PV = Present Value	FV = Future Value
PMT = Payment	n = Number of Compound Periods
$i\%$ = Periodic Interest Rate	

2. Selecting compound interest from the menu

Use the MENU key to display the FINANCE 1 menu. Then press the CMP (F2) key to display the COMPOUND screen for annual compound interest, or the MCL (F3) key to display the MONTHLY C.I. for monthly compound interest.

3. Inputting data

Pressing n (F1) (P×12 (F1)), I% (F2) (I÷12 (F2)), PV (F3), or PMT (F4) enters the currently displayed value.

4. Editing data

You can change any value you have already entered by simply entering the new data.

5. Switching between beginning of term/end of term payments

Each time you press SHIFT BGN the calculator switches between beginning of term and end of term payment. When beginning of term payment is specified, the symbol "BGN" is shown on the mode display, shown by MODE 1. When the end of the term payment is specified, the symbol "END" is shown on the mode display. You can switch at any time, but doing so will only affect PMT calculations.

6. Outputting calculation results

You can obtain the calculation results noted below by performing the corresponding key operation:

COMP n (F1) (P×12 (F1)) ..... number of terms
COMP PMT (F4) ..... payment amount
COMP PV (F3) ..... present value
COMP FV (F5) ..... future value
COMP I% (F2) (I÷12 (F2)) ..... interest rate

•The result for n is determined by the formula used when there are no odd periods.

$$PV+(1+i\cdot s)\,PMT\,\frac{1-(1+i)^{-n}}{i}+FV(1+i)^{-n}=0$$

Fractional parts less than 0.005 are cut off, while those above 0.005 are rounded up, and the result is displayed as an integer.

7. Checking entered data

You can check the values currently stored by pressing n (F1) (P×12 (F1)), I% (F2) (I÷12 (F2)), PV (F3), PMT (F4), or FV (F5), after pressing RCL.

You can also press the AFD key to return to the COMPOUND or MONTHLY C.I. screen where the values for n, $i\%$, PV, PMT, and FV are all displayed. Press the AFD key again to return to the previous screen.

8. Producing a graph

After all of the necessary data are entered, press the Graph key to produce a cash flow graph. The following are the characteristics of such a graph:

- Time is represented by the horizontal axis, from left to right
- Cash flow is represented by vertical lines, with upward lines showing inflow and downward lines outflow.
- PV, PMT and FV values are represented by arrows, with the relative size of the lines representing the size of the values. There are three arrow sizes: large, medium and small.
- The PMT arrow shows the number of the payment (n). When n is 16 or greater, intermediate payments are omitted and displayed using a dotted line.
- Once the graph is complete, you can use the Trace key to locate specific information on the display.

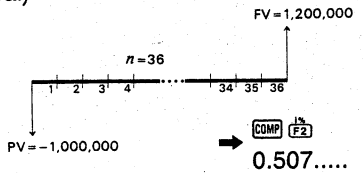
Press Trace to make the PV arrow blink. Each time you press Trace again, PMT and then FV is displayed.

Important

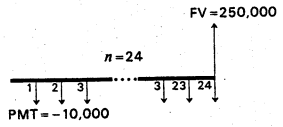
The following shows the input conditions and precision for interest (i%) calculations.

〈Input Condition〉
The term (n) is represented by a positive value. Either the present value (PV) or future value (FV) is positive and the corresponding other value (PV or FV) is negative.

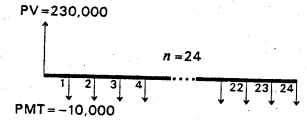
Savings (standard compound interest)

INPUT CONDITION	Future value is greater than present value.
FORMULA REPRESENTATION OF INPUT CONDITION	PMT = 0 |PV| < |FV|
EXAMPLE	PV = −1000000 (Principal) FV = 1200000 (Total of principal and interest) n = 36 (Term)  COMP F2 0.507..... |PV| < |FV|

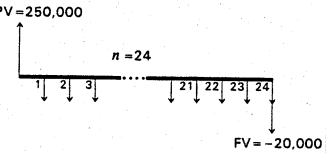
Installment savings, etc.

INPUT CONDITION	Future value is greater than total of payments.
FORMULA REPRESENTATION OF INPUT CONDITION	PMT and FV have different signs (negative/positive) when PV = 0. −FV < n × PMT when FV > 0. −FV > n × PMT when FV < 0
EXAMPLE	PMT = −10000 (Installment amount) FV = 250000 (Total of principal and interest) n = 24 (Number of installments)  −FV < n × PMT (−250000 < 24 × (−10000)) COMP F2 0.353.....

Loan, etc.

INPUT CONDITION	Total of payments is greater than loan amount.
FORMULA REPRESENTATION OF INPUT CONDITION	PMT and PV have different signs (negative/positive) when FV = 0. −PV > n × PMT when PV > 0 −PV < n × PMT when PV < 0
EXAMPLE	PV = 230000 (Amount borrowed) PMT = −10000 (Payment amount) n = 24 (Number of payments)  −PV > n × PMT (−230000 > 24 × (−10000)) COMP F2 0.343.....

Loan where final payment represents full payment, etc.

INPUT CONDITION	Total of equal amount payments is greater than difference of loan amount and final full payment.
FORMULA REPRESENTATION OF INPUT CONDITION	When neither PV, PMT, FV equals zero. PV + FV > −n × PMT when FV > PV PV + FV < −n × PMT when FV < PV
EXAMPLE	PV = 250000 (Amount borrowed) FV = −20000 (Final full payment) PMT = −10000 (Equal repayment) n = 24 (Term)  PV + FV < −n × PMT (250000 − 20000 < (−24) × (−10000)) COMP F2 0.295.....

〈Precision〉

i% calculations are performed using Newton's Method (approximation). Generally, calculations are performed with a precision of at least six decimal places. It should be noted, however, that the idiosyncrasies of Newton's Method can sometimes result in incorrect results.

Therefore, it is suggested that PV (COMP PV F3), PMT (COMP PMT F4) or FV (COMP FV F5) be determined for comparison with input values to see if the calculated values fall within the allowable range.

Savings

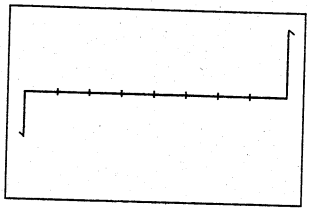
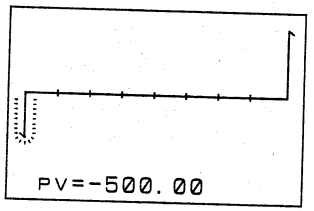
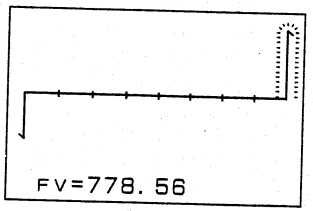
•Total of principal and interest

Example 1

To calculate the total principal and interest after 7.6 years for a principal of $500 at 6%, compounded annually.

*Since the principal is remitted to a bank, it is treated as an outflow (negative value)

Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (365) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	**** MODE **** sys mode :RUN cal mode :FIN display :Fix2 date mode :365 payment :END odd period :CMP
SHIFT AC EXE MENU (FINANCE 1 menu)	** FINANCE 1 ** F1 SIMPLE F2 COMPOUND F3 MONTHLY C.I. F4 AMORTIZATION F5 D.C.F. SMP CMP MCI AMR DCF F2
CMP F2	*COMPOUND n?0.00 i%?0.00 PV?0.00 PMT?0.00 FV?0.00 n i% PV PMT FV F1 F2 F3
7.6 n F1 (Term) 6 i% F2 (Interest rate) (−)500 PV F3 (Principal)	7.60 6 i%= 6.00 -500 PV= -500.00 n i% PV PMT FV F5

Operation	Display
COMP FV F5 (Total of principal and interest)	i%= 6.00 -500 PV= -500.00 FV= 778.56 n i% PV PMT FV ($) (Odd period: compound)
Graph	
Trace	
Trace Trace	
G-T MODE 0	PV= -500.00 FV= 778.56 done
COMP FV F5	FV= 778.88 n i% PV PMT FV F5 ($) (Odd period: simple)

Example 2

To calculate the principal and interest for Example 1 if compounding is performed semimonthly.

Operation	Display

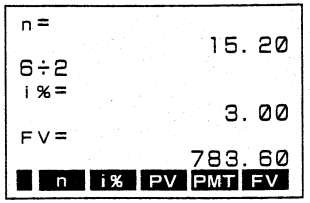
(Continuing from the operation on the previous page.)

MODE 0

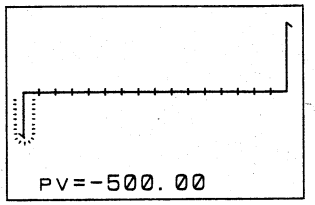
7.6 × 2 n (F1) (Term)

6 ÷ 2 i% (F2) (Interest rate)

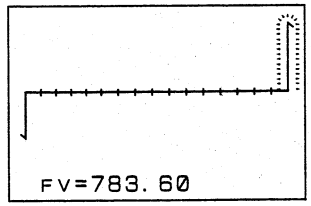
COMP FV (F5) (Total of principal and interest)



Graph Trace



Trace Trace



•Principal

Example

To calculate the principal required at 5.5%, compounded monthly, to attain a total of $20,000 in 20 years.

Operation	Display

MODE 4 (FIN)

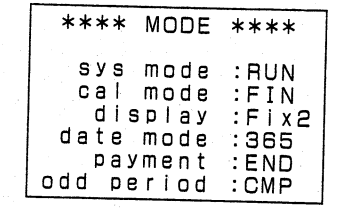
MODE 7 2 EXE (Fix 2)

MODE 9 (365)

SHIFT BGN (END)

MODE 0 (CMP)

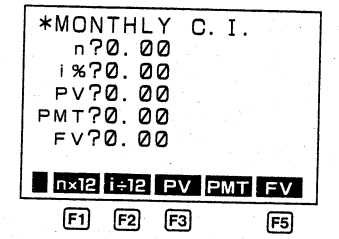
MODE 1 (RUN)



SHIFT AC (FCL) EXE

MENU (FINANCE 1 menu)

MCL (F3)

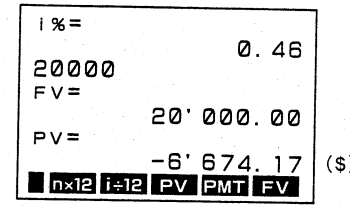


20 n×12 (F1) (Term)

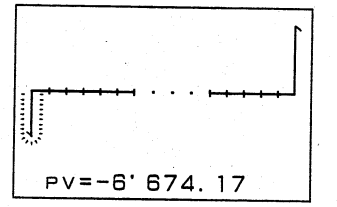
5.5 i÷12 (F2) (Interest rate)

20000 FV (F5) (Total of principal and interest)

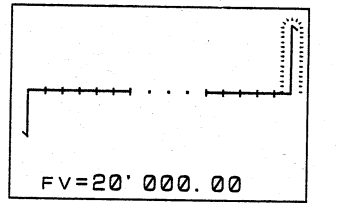
COMP PV (F3) (Principal)



Graph Trace



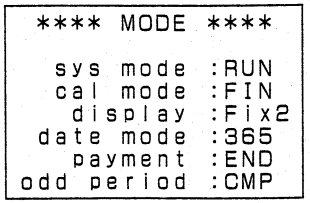
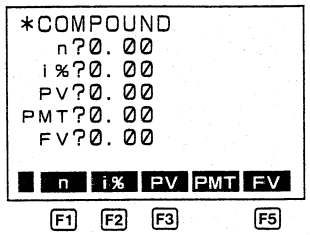
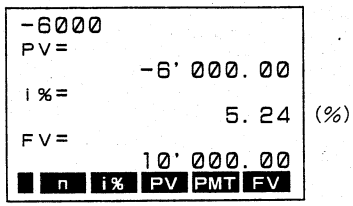
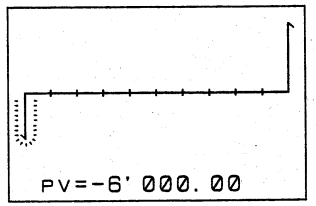
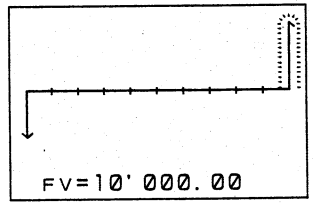
Trace Trace



•Compound interest rate

Example

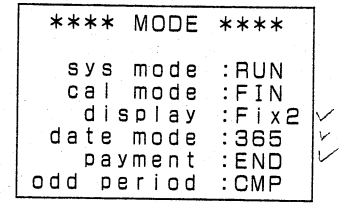
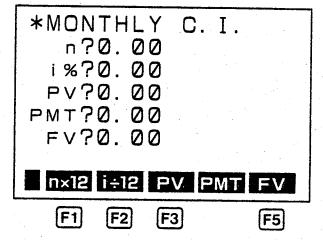
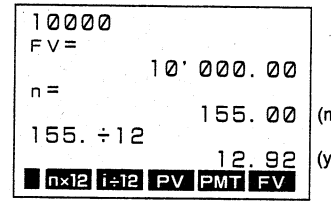
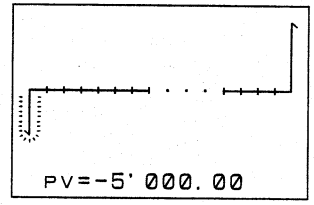
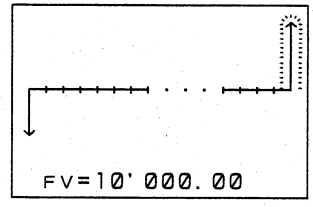
To calculate the interest rate required, compounded annually, to attain a total of $10,000 in 10 years on an initial investment of $6,000.

Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (365) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	
SHIFT Fcl AC EXE MENU (FINANCE 1 menu) CMP F2	
10 n F1 (Term) 10000 FV F5 (Total of principal and interest) (−) 6000 PV F3 (Principal) COMP i% F2 (Interest rate) COMP FV F5 (Confirmation)	
Graph Trace	
Trace Trace	

•Calculation of compound interest period

Example

To calculate the amount of time needed to increase an initial investment of $5,000 to a total of $10,000 at an annual interest rate of 5.4%, compounded monthly.

Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (365) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	
SHIFT Fcl AC EXE MENU (FINANCE 1 menu) MCl F3	
5.4 i÷12 F2 (Interest rate) (−) 5000 PV F3 (Principal) 10000 FV F5 (Total of principal and interest) COMP n×12 F1 (Term — number of months) ÷ 12 EXE (Term — number of years)	
Graph Trace	
Trace Trace	

Installment savings

•Total of principal and interest

Example

To calculate the total of principal and interest for $250 monthly deposits for five years at 6% annual interest, compounded monthly. Calculate for payment at the end of each month as well as at the beginning of each month. Calculate to two decimal places.

Operation	Display

[MODE] [4] (FIN)
[MODE] [7] [2] [EXE] (Fix 2)
[MODE] [9] (365)
[SHIFT] [BGN] (END)
[MODE] [0] (CMP)
[MODE] [1] (RUN)

```
**** MODE ****

  sys mode :RUN
  cal mode :FIN
   display :Fix2
 date mode :365
   payment :END
odd period :CMP
```

[SHIFT] [Fol AC] [EXE]
[MENU] (FINANCE 1 menu)

```
 ** FINANCE 1 **
F1 SIMPLE
F2 COMPOUND
F3 MONTHLY C.I.
F4 AMORTIZATION
F5 D.C.F

■ SMP CMP MCI AMR DCF
```

[F3]

[MCI F3]

```
*MONTHLY C.I.
  n?0.00
 i%?0.00
 PV?0.00
PMT?0.00
 FV?0.00

■ n×12 i÷12 PV PMT FV
```

[F1] [F2] [F4]

5 [n×12 F1] (Term)
6 [i÷12 F2] (Interest rate)

(-) 250 [PMT F4] (Installment amount)

```
                60.00
6
i%=
                 0.50
-250
PMT=
             -250.00
■ n×12 i÷12 PV PMT FV
```

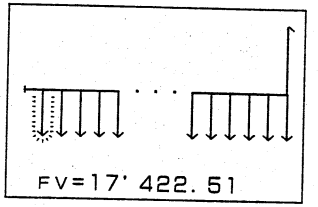
[F5]

[COMP] [FV F5] (Total of principal and interest)

```
i%=
                 0.50
-250
PMT=
             -250.00
FV=
          17'442.51
■ n×12 i÷12 PV PMT FV
```

(End of term payment) ($)

[Graph] [Trace] [Trace] [Trace]



[SHIFT] [BGN]
[M-Disp]

```
**** MODE ****

  sys mode :RUN
  cal mode :FIN
   display :Fix2
 date mode :365
   payment :BGN
odd period :CMP
```

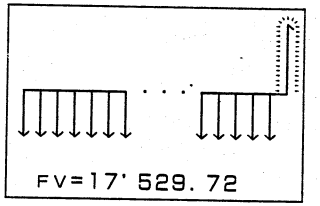
[COMP] [FV F5] (Total of principal and interest)

```
PMT=
             -250.00
FV=
          17'442.51
                done
FV=
          17'529.72
■ n×12 i÷12 PV PMT FV
```

[F5]

(Beginning of term payment) ($)

[Graph] [Trace] [Trace] [Trace]



•Installment amount

Example

To calculate the amount required for each installment to achieve a total of $10,000 in 10 years at an annual interest rate of 6%, compounded monthly.

Operation	Display

[MODE] [4] (FIN)
[MODE] [7] [2] [EXE] (Fix 2)
[MODE] [9] (365)
[SHIFT] [BGN] (END)
[MODE] [0] (CMP)
[MODE] [1] (RUN)

```
**** MODE ****

  sys mode :RUN
  cal mode :FIN
   display :Fix2
 date mode :365
   payment :END
odd period :CMP
```

[SHIFT] [Fci] [AC] [EXE]
[MENU] (FINANCE 1 menu)
[MCI] [F3]

```
*MONTHLY C. I.
  n?0. 00
 i%?0. 00
 PV?0. 00
PMT?0. 00
 FV?0. 00
 n×12 i÷12 PV PMT FV
```

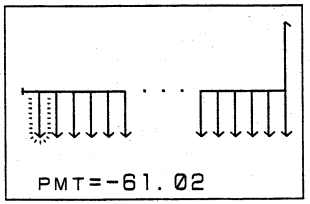
[F1] [F2] [F4] [F5]

10 [n×12] [F1] (Term)
6 [i÷12] [F2] (Interest rate)
10000 [FV] [F5] (Total of principal and interest)
[COMP] [PMT] [F4] (Installment amount)

```
i%=
                0. 50
10000
FV=
           10' 000. 00
PMT=
              -61. 02
 n×12 i÷12 PV PMT FV
```

(End of term payment) ($)

[Graph] [Trace] [Trace]



[SHIFT] [BGN]
[Disp]

```
**** MODE ****

  sys mode :RUN
  cal mode :FIN
   display :Fix2
 date mode :365
   payment :BGN
odd period :CMP
```

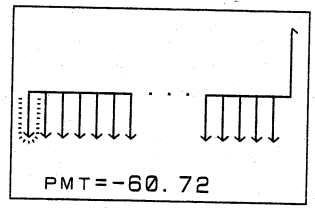
[COMP] [PMT] [F4] (Installment amount)

```
FV=
           10' 000. 00
PMT=
              -61. 02
                done
PMT=
              -60. 72
 n×12 i÷12 PV PMT FV
```

(Beginning of term payment) ($)

[F4]

[Graph] [Trace] [Trace]



•Number of installments

Example

To calculate the number of $84 installments required to attain an amount of $6,000 at an annual interest rate of 6%, compounded monthly.

Operation	Display

[MODE] [4] (FIN)
[MODE] [7] [2] [EXE] (Fix 2)
[MODE] [9] (365)
[SHIFT] [BGN] (END)
[MODE] [0] (CMP)
[MODE] [1] (RUN)

```
**** MODE ****

  sys mode :RUN
  cal mode :FIN
    display :Fix2
 date mode :365
    payment :END
odd period :CMP
```

[SHIFT] [Fci] [AC] [EXE]
[MENU] (FINANCE 1 menu)
[MCI] [F3]

```
*MONTHLY C. I.
  n?0.00
 i%?0.00
 PV?0.00
PMT?0.00
 FV?0.00
 n×12 i÷12 PV PMT FV
```

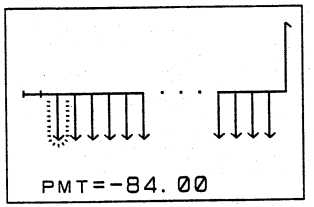
[F1] [F2] [F4] [F5]

6 [i÷12] [F2] (Interest rate)
[(−)] 84 [PMT] [F4] (Installment amount)
6000 [FV] [F5] (Total of principal and interest)
[COMP] [n×12] [F1] (Term — number of months)
[÷] 12 [EXE] (Term — number of years)

```
6000
FV=
            6'000.00
n=
              62.00
62.÷12
               5.17
 n×12 i÷12 PV PMT FV
```

(End of term payment)
(End of term payment)

[Graph] [Trace] [Trace]



[SHIFT] [BGN]
[M-Disp]

```
**** MODE ****

  sys mode :RUN
  cal mode :FIN
    display :Fix2
 date mode :365
    payment :BGN
odd period :CMP
```

[G-T]

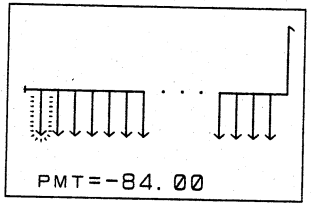
[COMP] [n×12] [F1] (Term — number of months)
[÷] 12 [EXE] (Term — number of years)

```
62.÷12
               5.17
              done
n=
              61.00
61.÷12
               5.08
 n×12 i÷12 PV PMT FV
```

(Beginning of term payment)
(Beginning of term payment)

[F1]

[Graph] [Trace] [Trace]



•Interest rate

Example

To calculate the annual interest rate required to attain an amount of $10,000 in 10 years with $60 monthly installments.

Operation	Display

MODE 4 (FIN)
MODE 7 2 EXE (Fix 2)
MODE 9 (365)
SHIFT BGN (END)
MODE 0 (CMP)
MODE 1 (RUN)

```
**** MODE ****

  sys mode  :RUN
  cal mode  :FIN
   display  :Fix2
 date mode  :365
   payment  :END
odd period  :CMP
```

SHIFT FCI AC EXE
MENU (FINANCE 1 menu)
MCI F3

```
*MONTHLY C. I.
  n?0.00
 i%?0.00
 PV?0.00
PMT?0.00
 FV?0.00
 n×12 i÷12 PV PMT FV
```

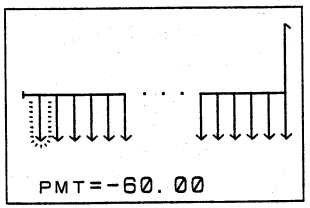
F1 F2 F4 F5

10 n×12 F1 (Term)
(−) 60 PMT F4 (Installment amount)
10000 FV F5 (Total of principal and interest)
COMP i÷12 F2 (Interest rate — monthly)
× 12 EXE (Interest rate — annual)
COMP FV F5 (Confirmation)

```
                10'000.00
i%=
                    0.53
0.5258409839×12
                    6.31
FV=
            10'000.00
 n×12 i÷12 PV PMT FV
```

(End of term payment) (%)
(End of term payment) (%)

Graph Trace Trace



SHIFT BGN
M-Disp

```
**** MODE ****

  sys mode  :RUN
  cal mode  :FIN
   display  :Fix2
 date mode  :365
   payment  :BGN
odd period  :CMP
```

G-T

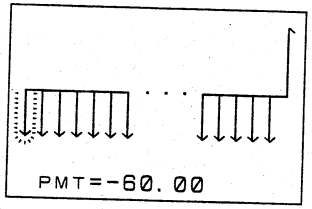
COMP i÷12 F2 (Interest rate — monthly)
× 12 EXE (Interest rate — annual)
COMP FV F5

```
                done
i%=
                0.52
0.517937606×12
                6.22
FV=
          10'000.00
 n×12 i÷12 PV PMT FV
```

(Beginning of term payment) (%)
(Beginning of term payment) (%)

F2 F5

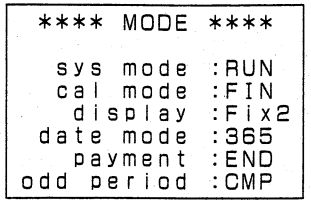
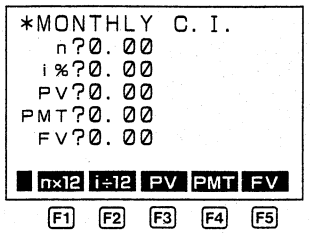
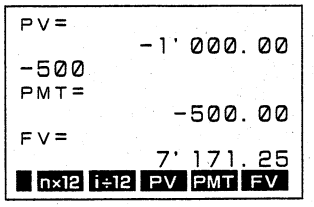
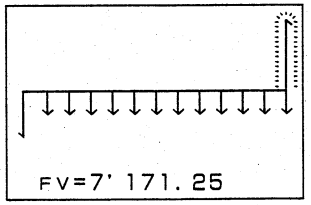
Graph Trace Trace



•Principal and interest with initial deposit

Example

To calculate the total principal and interest after one year for an installment savings account opened with an initial deposit of $1,000 and $500 additional monthly deposits at an interest rate of 4.5%, compounded monthly.

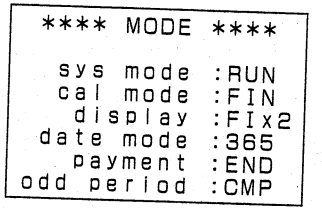
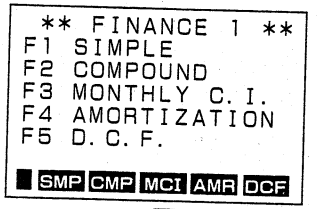
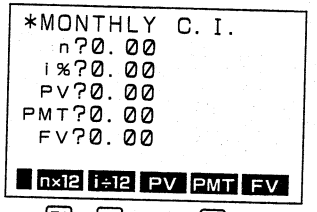
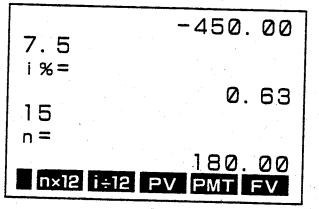
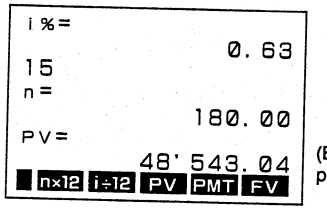
Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (365) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	
SHIFT AC EXE MENU (FINANCE 1 menu) MCI F3	
1 nx12 F1 (Term) 4.5 i÷12 F2 (Interest rate) (−) 1000 PV F3 (Principal) (−) 500 PMT F4 (Installment amount) COMP FV F5 (Total of principal and interest)	 ($)
Graph Trace Trace Trace	

Loans (equal repayments of principal and interest)

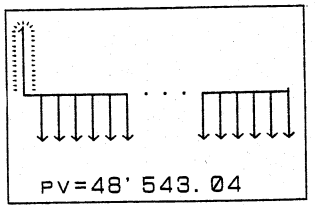
•Borrowing power

Example

To calculate how much can be borrowed on a 15-year loan at a 7.5% annual interest rate, if $450 per month can be repaid.

Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (365) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	
SHIFT AC EXE MENU (FINANCE 1 menu)	
MCI F3	
(−) 450 PMT F4 (Monthly payment) 7.5 i÷12 F2 (Interest rate)	
15 nx12 F1 (Term)	
COMP PV F3 (Loan amount)	 (End of term payment) ($)

[Graph] [Trace]



[SHIFT] [BGN]
[M-Disp]

```
**** MODE ****

  sys mode :RUN
  cal mode :FIN
   display :Fix2
 date mode :365
   payment :BGN
odd period :CMP
```

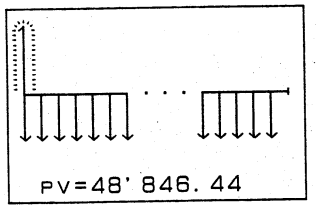
[COMP] [PV F3] (Loan amount)

```
n=
                180. 00
PV=
             48' 543. 04
                   done
PV=
             48' 846. 44
 nx12 i÷12 PV PMT FV
```

[F3]

(Beginning of term payment) ($)

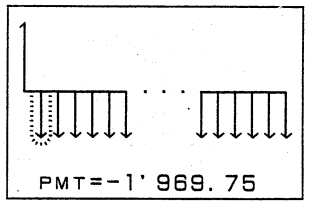
[Graph] [Trace]



•Loan payments

Example

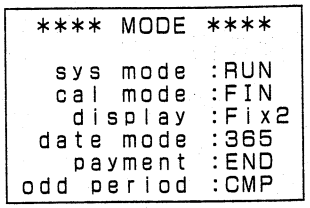
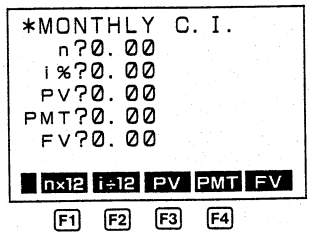
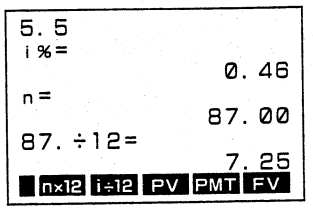
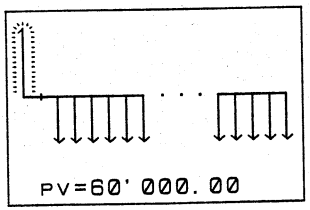
To calculate the size of monthly payments for a 25-year $300,000 home loan at 6.2%. Calculate for end of term payment.

Operation	Display
[MODE] [4] (FIN) [MODE] [7] [2] [EXE] (Fix 2) [MODE] [9] (365) [SHIFT] [BGN] (END) [MODE] [0] (CMP) [MODE] [1] (RUN)	**** MODE **** sys mode :RUN cal mode :FIN display :Fix2 date mode :365 payment :END odd period :CMP
[SHIFT] [Fci AC] [EXE] [MENU] (FINANCE 1 menu) [MCl F3]	*MONTHLY C. I. n?0. 00 i%?0. 00 PV?0. 00 PMT?0. 00 FV?0. 00 nx12 i÷12 PV PMT FV [F1] [F2] [F3] [F4]
300000 [PV F3] (Loan amount) 6.2 [i÷12 F2] (Interest rate) 25 [n×12 F1] (Term) [COMP] [PMT F4] (Monthly payment)	i%= 0. 52 25 n= 300. 00 PMT= -1' 969. 75 ($) nx12 i÷12 PV PMT FV
[Graph] [Trace] [Trace]	

•Number of payments

Example

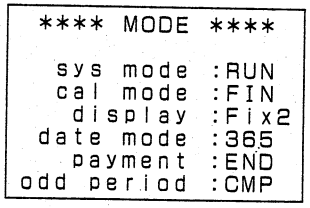
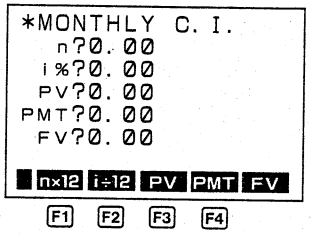
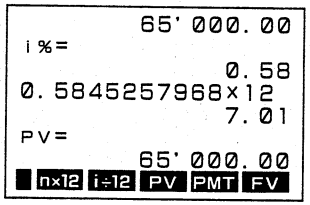
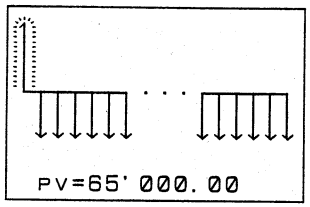
To calculate how many years it will take to repay a $60,000 loan borrowed at 5.5% interest, with $840 monthly payments.

Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (365) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	
SHIFT Fci AC EXE MENU (FINANCE 1 menu) MCI F3	
60000 PV F3 (Loan amount) (−) 840 PMT F4 (Monthly payment) 5.5 i÷12 F2 (Interest rate) COMP n×12 F1 (Term — number of months) ÷ 12 EXE (Term — number of years)	
Graph Trace	

•Effective interest rate

Example

To calculate the effective interest rate on a 25-year $65,000 loan repaid with $460 monthly payments. Calculate to two decimal places.

Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (365) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	
SHIFT Fci AC EXE MENU (FINANCE 1 menu) MCI F3	
25 n×12 F1 (Term) (−) 460 PMT F4 (Monthly payment) 65000 PV F3 (Loan amount) COMP i÷12 F2 (Interest rate — monthly) × 12 EXE (Interest rate — annual) COMP PV F3 (Confirmation)	 (End of term payment) (%) (End of term payment) (%)
Graph Trace	

[SHIFT] [BGN]
[M-Disp]

```
**** MODE ****

  sys mode :RUN
  cal mode :FIN
    display :Fix2
 date mode :365
   payment :BGN
odd period :CMP
```

[G-T]

[COMP] [i÷12 F2] (Interest rate — monthly)
[×] 12 [EXE] (Interest rate — annual)

[COMP] [PV F3] (Confirmation)

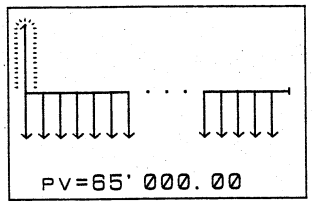
```
                done
i%=
                0.59
0.5899696266×12
                7.08
PV=
          65'000.00
■ n×12 i÷12 PV PMT FV
```

(Beginning of term payment) (%)

(Beginning of term payment) (%)

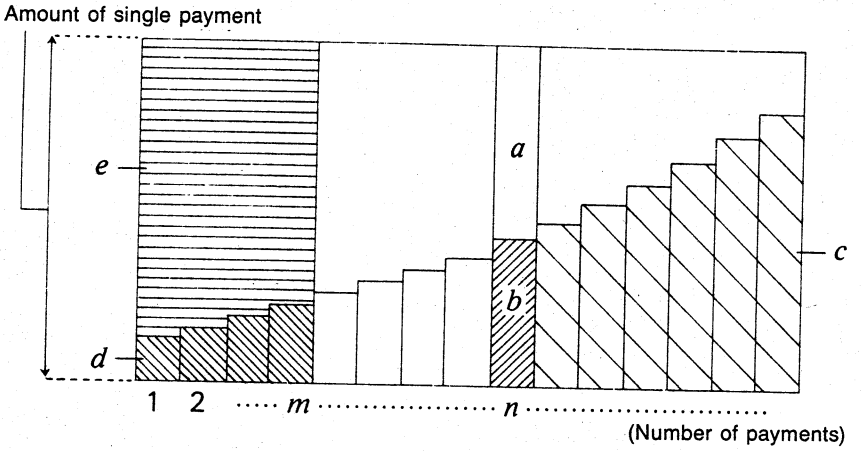
[F2] [F3]

[Graph] [Trace]



■ Amortization of a Loan

Your calculator makes it possible for you to calculate the amount of principal, the amount of interest, the balance of the principal and the total amount of principal and interest repaid from the initial payment up to any point in time.



a: Interest portion of *n*th payment (INT)
b: Principal portion of *n*th payment (PRN)
c: Balance if principal at *n*th payment (BAL)
d: Total principal paid from 1st through *m*th payment (ΣPRN)
e: Total interest paid from 1st through *m*th payment (ΣINT)
**a* + *b* = one repayment (PMT)

1. Formulas

a: $\mathrm{INT}_n = |\mathrm{BAL}_{n-1} \times i| \times$ (PMT sign)

b: $\mathrm{PRN}_n = \mathrm{PMT} + \mathrm{BAL}_{n-1} \times i$

c: $\mathrm{BAL}_n = \mathrm{BAL}_{n-1} + \mathrm{PRN}_n$

d: $\Sigma\,\mathrm{PRN}_m = \mathrm{PRN}_1 + \mathrm{PRN}_2 + \cdots\cdots + \mathrm{PRN}_m$

e: $\Sigma\,\mathrm{INT}_m = \mathrm{INT}_1 + \mathrm{INT}_2 + \cdots\cdots + \mathrm{INT}_m$

$\mathrm{BAL}_0 = \mathrm{PV}$ ($\mathrm{INT}_1 = 0$ and $\mathrm{PRN}_1 = \mathrm{PMT}$ for beginning of term payment)

2. Selecting loan amortization from the menu

Use the [MENU] key to display the FINANCE 1 menu, and then press [AMR F4] to select the AMORTIZATION screen. Use this screen to calculate the amortization of a loan. When entering data required for the calculation, use the COMPOUND screen or MONTHLY C.I. screen.

3. Entering data

Basically, four data items are required for calculation: PV, *i*%, *n*, and PMT. If only three are available, first calculate the fourth data items and then proceed with the calculations described in this section.

4. Editing data

You can change any value that you have already entered by simply re-entering another value.

5. Displaying calculation results

To obtain the results of the calculation, enter a value that represents which payment (i.e. 1 for first payment, 2 for second payment, etc.) you want the result for, and then press one of the following keys.

PRN (F1) — Principal portion of the specified payment
INT (F2) — Interest portion of the specified payment
BAL (F3) — Balance of the principal at the specified payment

You can also calculate total interest and total principal for specific periods using the following operations:

(starting payment) → (F4) (ending period) PRN (F1) — Total principal for the period
(starting payment) → (F4) (ending period) INT (F2) — Total interest for the period

Here again, the starting period and ending period are specified using a value (i.e. 3 for third payment, 10 for tenth payment, etc.).
With above operations, PRN and ΣPRN are automatically entered into Memory X, while INT and ΣINT are entered into Memory Y. The value for BAL is entered into Memory Z.

- In the above operation, you can enter natural numbers less than 10 digits long. Any other type of value will result in an Arg ERROR.

6. Checking entered data and results

Press the AC key to return to the COMPOUND screen (MONTHLY C.I. screen), which will show the values currently assigned for n ($n \times 12$), i% ($i \div 12$), PV, PMT, and FV.
You can also check the values for Memories X (PRN/ΣPRN), Y (INT/ΣINT), and Z (BAL) by pressing RCL followed by the X, Y, or Z.

7. Producing a graph

After all of the necessary data are entered, press the Graph key to calculate INT and PRN for each payment and produce a amortization graph. The following are the characteristics of such a graph:

- Time (n) is represented by the horizontal axis, from left to right.
- Each payment (PMT) is plotted by a vertical line.
- Each payment is represented on the graph, so you can use the Trace key to locate specific information on the display.

Press Trace to make the portion of the graph that represents INT blink.

Enter and value and press Trace to display the INT for the payment that corresponds to the entered value.

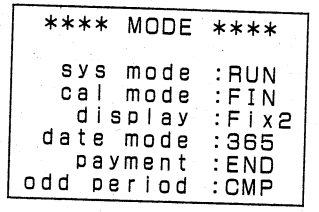
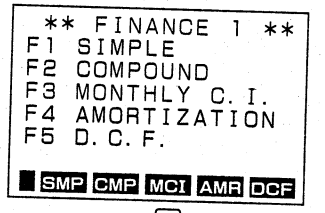
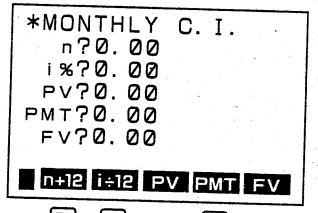
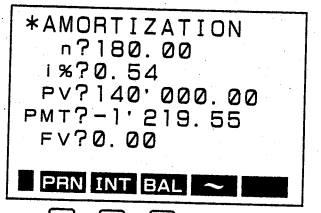
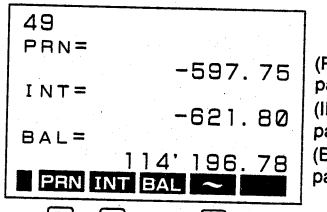
Press SHIFT Trace to go from INT to a display of PRN.

Press SHIFT Trace again to go from PRN to a display of n.

- You can also tell the calculator to display points for a specific number of payments. When n is 95 or more, all points are plotted, but some points may overlap.

Example

To calculate the monthly payment due on a 140,000 15-year home mortgage at an annual interest rate of 6.5%. Also calculate PRN, INT and BAL for the fifth year (49th payment) as well as ΣPRN and ΣINT for the second year (24th payment). Calculate for payment at the end of the term.

Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (365) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	
SHIFT Ad AC EXE MENU	 F3
MCI (F3)	 F1 F2 F4
140000 PV (F3) 15 n×12 (F1) 6.5 i÷12 (F2) (Enter each value.) COMP PMT (F4) (Installment amount) MENU AMR (F4)	 F1 F2 F3
49 PRN (F1) INT (F2) BAL (F3)	 F1 F2 F4 (PRN at 49th payment) (INT at 49th payment) (BAL at 49th payment)

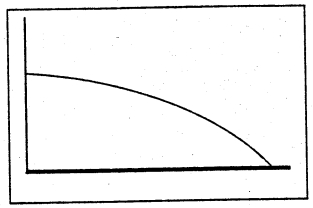
1 [~F4] 24 [PRN F1]

[INT F2]

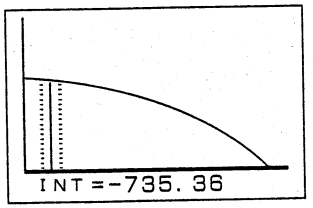
```
BAL=
          114' 196. 78
1~24
ΣPRN=
          -11' 786. 91
ΣINT=
          -17' 482. 30
 PRN INT BAL ~
```

(ΣPRN at 24th payment)
(ΣINT at 24th payment)

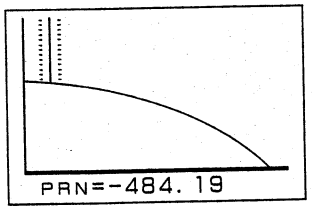
[Graph]



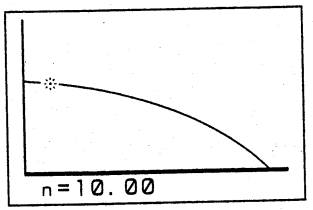
10 [Trace]



[SHIFT] [Trace]



[SHIFT] [Trace]

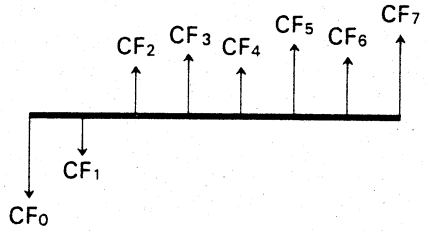


■ Investment Appraisal

Your financial calculator applies the Discounted Cash Flow (DCF) Method to let you perform four types of investment appraisal. Investment appraisal entails totaling the cash flow for fixed periods of time in order to evaluate the effectiveness of an investment. The following two types of investment appraisal are available:

① Net Present Value (NPV)
② Net Future Value (NFV)
③ Internal Rate of Return (IRR)
④ Payback Period (PBP)

A cash flow diagram such as the one illustrated below helps to visualize the movement of funds:



With this graph, the initial investment amount is represented by CF_0. The cash flow a year later is shown by CF_1, two years later by CF_2, etc.
Investment appraisal is used to clearly show whether an investment is realizing the profits that were originally targeted.

1. Formulas

①NPV

$$NPV = CF_0 + \frac{CF_1}{(1+i)} + \frac{CF_2}{(1+i)^2} + \frac{CF_3}{(1+i)^3} + \cdots\cdots + \frac{CF_n}{(1+i)^N}$$

CF_n is maximum value of CF_j
N is the total number of CF_js

②NFV

$$NFV = NPV \times (1+i)^N$$

③IRR

$$0 = CF_0 + \frac{CF_1}{(1+i)} + \frac{CF_2}{(1+i)^2} + \frac{CF_3}{(1+i)^3} + \cdots\cdots + \frac{CF_j}{(1+i)^j}$$

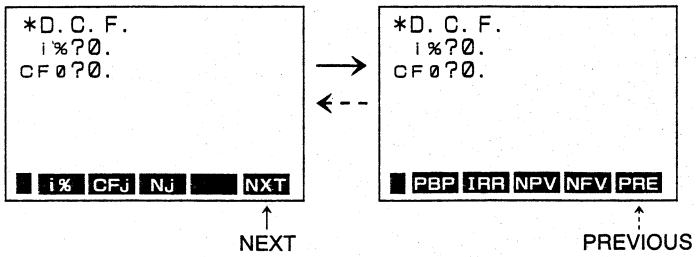
In this formula, NPV = 0, and the value of IRR is equivalent to $i \times 100$. During the consecutive calculations that are performed internally by the calculator, however, minute fractional values tend to accumulate, so NPV never actually reaches exactly zero. The closer that NPV approaches to zero, the more accurate is the IRR.

④PBP Initial N value when NPV ≧ 0.

2. Selecting investment appraisal (D.C.F.) from the menu

Use the MENU key to display the FINANCE 1 menu, and then press D.C.F. (F5) to select the D.C.F. screen. There are a total of seven keys that are displayed for investment appraisal, so they are divided between two screens. Press the NXT (F5) (PRE (F5)) key to switch between the two screens.

Using F5 to switch screens



3. Entering data

a. Before entering data, you should clear the *i*%, CF*j*, and N*j* memories. But note that this operation will also clear the financial, cost, selling price, and margin memories. To clear the memories, press SHIFT CA (F1) EXE.

b. Enter data for the i% (F1), CFj (F2), and Nj (F3) keys (except when calculating IRR — *i*% entry is not necessary). Remember that the amount for the initial investment CF_0 should be entered as a negative value, so you will have to press the (-) key. Also, inflows of cash should be entered as positive values, and outflows as negatives.

c. Each time you press CFj (F2), the currently displayed value is entered as CF_0 through CF_{60}. This means that you can enter up to 61 cash flow values.

d. Multiple entries of the same cash flow value can be entered by repeatedly pressing CFj (F2), or by performing a multiplication operation with the Nj (F3) key.

Example: To enter two consecutive $3,200 inflows.
3200 CFj (F2) CFj (F2)
To enter four consecutive $3,500 inflows.
3500 CFj (F2) 4 Nj (F3)

- Be sure to enter the Nj (F3) value immediately following the corresponding CFj (F2) key operation.

*Up to 99 N*j* entries may be made per CF*j*.

- The value entered using N*j* must be a natural number. Entering any other value will cause an Arg ERROR. When an error occurs, press the AC key and restart data entry.

4. Editing data

After you have entered data, you can make any changes necessary using the following procedures:

- ⟨new CF*j* data⟩ STO CFj (F2) ⟨cash flow number⟩ EXE
- ⟨new N*j* data⟩ STO Nj (F3) ⟨cash flow number⟩ EXE

The cash flow number is an integer in the range of 0 ~ 60. An Arg ERROR will occur if you try to use any other value.

Example: To change the following data so that CF_1 is 2,500

	CF*j*	N*j*
CF_0	−1000	1
CF_1	2000	1
CF_2	3000	3
CF_3	4000	1

Operation: 2500 STO CFj (F2) 1 EXE
(2500: New value; 1: Cash flow number)

If you now enter another value, it is entered as the next cash flow (CF_2 in this case).

5. Displaying calculation results

After entering all necessary data, you can display calculation results by pressing the keys noted below. Each time you press one of the keys, a prompt appears on the display to identify the value, and the value is automatically stored in a memory as noted.

Key	Display prompt	Memory
PBP (F1)	PBP =	Z
IRR (F2)	IRR =	*i*%
NPV (F3)	NPV =	X
NFV (F4)	NFV =	Y

The result may take some time to appear, so if you wish to interrupt the calculation, press AC. The IRR is automatically stored in the *i*% memory for recall at any time by the operation RCL i% (F1).

6. Evaluating the calculated NPV

Once you have calculated a value for NPV, you can evaluate your investment as follows:

NPV	Evaluation	
Positive	Revenue target exceeded	Effective investment
0	Revenue target met	
Negative	Revenue target not attained — Ineffective investment	

7. Confirming calculated IRR values

IRR calculations are quite complex, so certain entered data can cause errors or multiple results. In this case, use the following sequence to enter a value that is approximately what you expect IRR to be:
(expected result) STO IRR (F5)
Next, calculation begins, and if a calculated value is close to the approximation that you entered, you can assume that the calculated value is correct. When you use this procedure, you won't be able to tell how many different values were produced by the calculation, so we recommend that you enter a number of approximate IRR values and repeat the sequence.

- If *i*% calculation is interrupted by an error or by pressing the AC key, the *i*% memory will contain the data present immediately before the AC key operation or the error.

8. Checking entered data

a. CF*j*
Press [RCL] [CFj (F2)], enter the number of the cash flow to be recalled, and press [EXE].

b. N*j*
Press [RCL] [Nj (F3)], enter the number of the cash flow to be recalled, and press [EXE].

c. *i*%
Press [RCL] [i% (F1)].

〈Cash flow numbers〉

Cash flow	Cash flow number
CF_0	0
CF_1	1
CF_2	2
CF_3	3
CF_4	4
CF_5	5
CF_6	6
CF_7	7
CF_8	8
CF_9	9
CF_{10}	10
CF_{11}	11
CF_{12}	12
CF_{13}	13
CF_{14}	14
CF_{15}	15
CF_{16}	16
CF_{17}	17
CF_{18}	18
CF_{19}	19
⋮	⋮
CF_{59}	59
CF_{60}	60

Example: To recall data for CF_{11} → [RCL] [CFj (F2)] [1] [1] [EXE]

9. Producing a graph

After all of the necessary data are entered, press the [Graph] key to produce a cash flow graph. The following are the characteristics of such a graph:

- Time (*n*) is represented by the horizontal axis, from left to right.
- Cash flow is represented by vertical lines, with upward lines showing inflow and downward lines outflow.
- Each CF*j* is shown by a line (↑↓), with the relative size of the line representing the size of the CF*j*.
- Up to 61 CF*j* lines can be displayed. When there are two or more N*j*'s, a " ■ " symbol appears above or below the arrow.
- Once the graph is complete, you can use the [Trace] key to locate specific information on the display.

Press [Trace] to make the CF_0 arrow blink and display the corresponding value. Each time you press [Trace] again, the next sequential CF*j* arrow blinks (i.e. CF_0, CF_1, CF_2, etc.), and the corresponding values are displayed.

Press [SHIFT] [Trace] to display the value of N*j*.

Example

According to your projection you can rent a condominium for 10 years, and then sell it, with a resulting yield of 8% per annum. Can you realize your target if the purchase price is $170,000, the monthly rent is $1,000, and the future selling price is $220,000?

Operation	Display
[MODE] [4] (FIN) [MODE] [7] [2] [EXE] (Fix 2) [MODE] [9] (365) [SHIFT] [BGN] (END) [MODE] [0] (CMP) [MODE] [1] (RUN)	**** MODE **** sys mode :RUN cal mode :FIN display :Fix2 date mode :365 payment :END odd period :CMP
[SHIFT] [Cal (AC)] [EXE] [MENU] (FINANCE 1 menu)	** FINANCE 1 ** F1 SIMPLE F2 COMPOUND F3 MONTHLY C.I. F4 AMORTIZATION F5 D.C.F. ■ SMP CMP MCI AMR DCF [F5]
[DCF (F5)]	*D.C.F. i%?0.00 CFo?0.00 ■ i% CFj Nj ■ NXT [F1] [F2] [F3]

(−) 170000 CFj F2 (Initial investment: CF_0)
12000 CFj F2 9 Nj F3 (CF_1 ~ CF_9)
12000 + 220000 CFj F2 (CF_{10})
8 i% F1 (Yield)

```
                    9.00
12000+220000
CF2=
            232'000.00
8
i%=
                    8.00
■ i% CFj Nj    NXT
```

F5

NXT F5

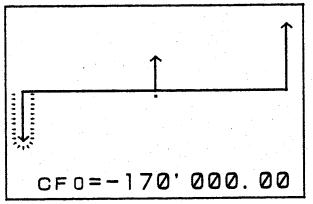
```
CF2=
            232'000.00
8
i%=
                    8.00
NPV=
           12'423.54 ($)
■ PBP IRR NPV NFV PRE
```

NPV F3 (Net present value)

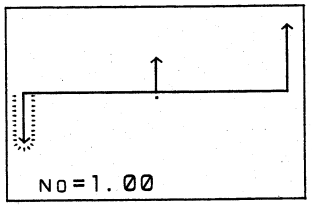
F3

The resulting NPV is a positive value, so you can assume that the investment would be effective.

Graph Trace



SHIFT Trace



G↔T

```
NPV=
           12'423.54
                done
NFV=
           26'821.50 ($)
PBP=
                10.00 (years)
■ PBP IRR NPV NFV PRE
```

NFV F4 (Net future value)

PBP F1

F1 F4

Example

If you invest $86,000 in machinery, the yearly revenues of your company are expected to be as shown in the table below (all revenues realized at the end of the fiscal year). What will the net profit or loss of this investment be if the useful service life of the equipment is six years, the resale value after five years is $14,000, and the capital cost is 11%?

Year	Income
1	−5000
2	42000
3	31000
4	24000
5	23000
6	12000+14000

Operation — Display

MODE 4 (FIN)
MODE 7 2 EXE (Fix 2)
MODE 9 (365)
SHIFT BGN (END)
MODE 0 (CMP)
MODE 1 (RUN)

```
**** MODE ****

  sys mode :RUN
  cal mode :FIN
   display :Fix2
 date mode :365
   payment :END
odd period :CMP
```

SHIFT FCJ AC EXE
MENU (FINANCE 1 menu)

```
 ** FINANCE 1 **
F1 SIMPLE
F2 COMPOUND
F3 MONTHLY C.I.
F4 AMORTIZATION
F5 D.C.F.
■ SMP CMP MCI AMR DCF
```

F5

DCF F5

```
*D.C.F.
 i%?0.00
CF0?0.00
■ i% CFj Nj    NXT
```

F1 F2

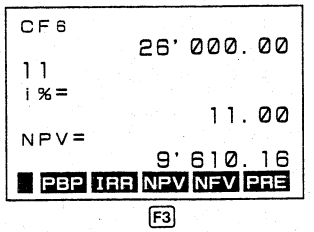
(−) 86000 CFj F2 (−) 5000 CFj F2 42000 CFj F2
31000 CFj F2 24000 CFj F2 23000 CFj F2
12000 + 14000 CFj F2 (Input each CF*j* value)
11 i% F1 (Capital cost)

```
           23'000.00
12000+14000
CF6=
            26'000.00
11
i%=
                11.00
■ i% CFj Nj    NXT
```

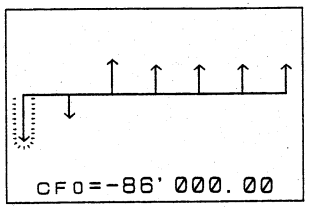
F5

NXT F5

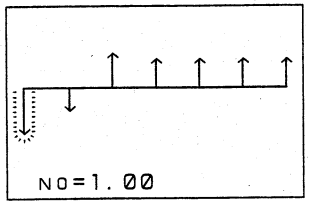
NPV F3 (Net present value)



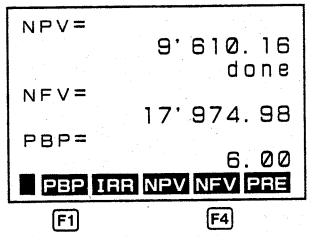
Graph Trace



SHIFT Trace



G↔T



NFV F4 (Net future value)

PBP F1 (Payback period)

Example

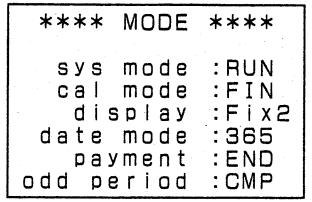
To calculate the yearly IRR for investment in a new plant in accordance with the following data:

Initial investment: $17-million
Useful life: 8 years
Yearly revenues due to plant: $2.8-million

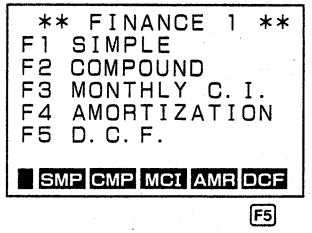
Calculate the result to two decimal places.

Operation	Display

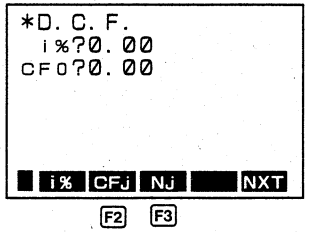
MODE 4 (FIN)
MODE 7 2 EXE (Fix 2)
MODE 9 (365)
SHIFT BGN (END)
MODE 0 (CMP)
MODE 1 (RUN)



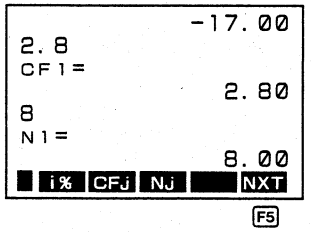
SHIFT Fci AC EXE
MENU (FINANCE 1 menu)



DCF F5



(−) 17 CFi F2 (CF_0)
2.8 CFi F2 (CF_1)

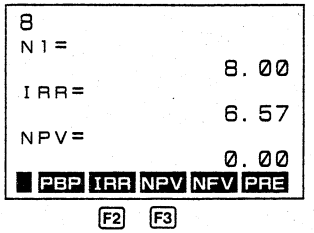


8 Nj F3 (N_1)

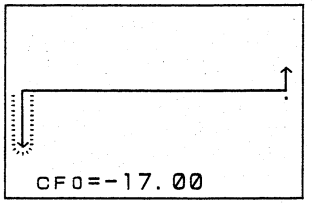
NXT F5

IRR F2 (Internal rate of return)

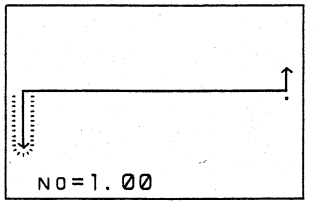
NPV F3 (Net present value)



Graph Trace



SHIFT Trace



■ Bond Calculations

The FC-1000 lets you perform such bond-related calculations as yield to maturity (%) and price of bonds. You can also calculate the accrued interest as well as the price of the bond including interest from the last coupon payment date until the settlement date. You can also input the redemption value for any point and calculate the interest rate for the last interest payment before the maturity date.

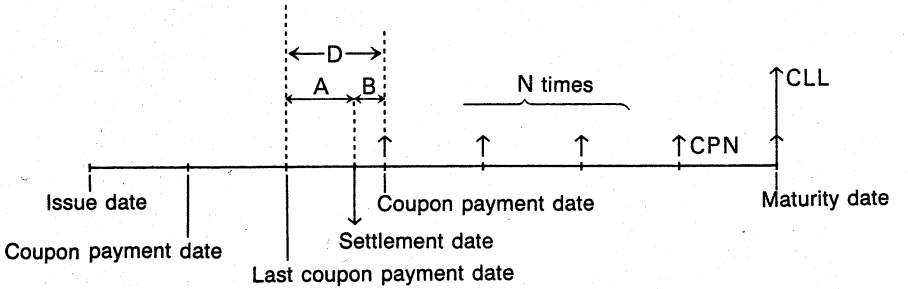
1. Formulas

Six months or less from the settlement date to the maturity date

$$PRC = \frac{RDV + \frac{CPN}{M}}{1 + \left(\frac{B}{D} \times \frac{YLD/100}{M}\right)} - \left(\frac{A}{D} \times \frac{CPN}{M}\right)$$

More than six months from the settlement date to the maturity date

$$PRC = \frac{RDV}{\left(1 + \frac{YLD/100}{M}\right)^{N-1+\frac{B}{D}}} + \sum_{k=1}^{N} \frac{\frac{CPN}{M}}{\left(1 + \frac{YLD/100}{M}\right)^{K-1+\frac{B}{D}}} - \frac{A}{D} \times \frac{CPN}{M}$$



$$PRC = -PRC'$$

$$\text{Accrued interest} = -\frac{A}{D} \times \frac{CPN}{M}$$

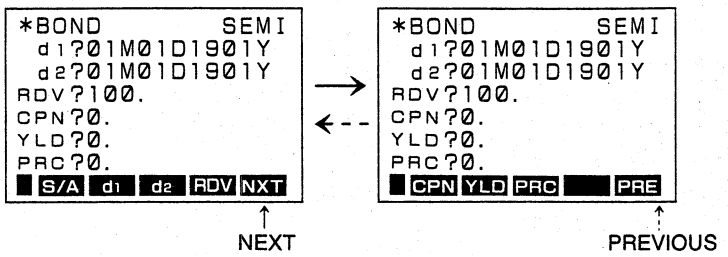
$$\text{Price including interest} = -\left(PRC' + \frac{A}{D} \times \frac{CPN}{M}\right)$$

PRC: Price per $100 of face value
CPN: Annual coupon rate (%)
YLD: Annual yield (%)
A: Accrued days
M: Number of coupon payments per year (1 = annual, 2 = semi annual)
N: Number of coupon payments between settlement date and maturity date
RDV: Redemption price or call price per $100 of face value
D: Number of days in coupon period where settlement occurs
B: Number of days from settlement date until next coupon payment date = D − A

2. Selecting bond calculations from the menu

Use the MENU key to display the FINANCE 2 menu, and then press 8 (BOND) to select the BOND screen. There are a total of seven keys that are displayed for bond calculations, so they are divided between two screens. Press the F5 key to switch between the two screens.

Using F5 to switch screens



3. Selecting the coupon payment method

Use the S/A (F1) key to switch between annual and semiannual coupon payments. And indicator will appear in the upper right of the BOND screen, indicating SEMI for semiannual payments and ANNU for annual payments.

4. Entering data

a. Before entering data you must first clear the applicable memories, but note that the following operation also clears all of the other financial memories. Press SHIFT AC EXE to clear the d_1, d_2, RDV, CPN, PRC, and YLD memories. This operation assigns January 1, 1901 to d_1 and d_2, and 100 to RDV.

b. A total of five items require data input before calculations can be performed. d_1, d_2, RDV, CPN all require input, as well as either PRC or YLD. PRC is generally a cash outflow, and so should be entered as a negative value.

c. Use the standard date input procedure (see page 34) to assign a date to d1 (F2) and d2 (F3), pressing each key after entering the date.

Each time you press RDV (F4), CPN (F1), YLD (F2) or PRC (F3), the value that is currently displayed is assigned to the corresponding memory. You can assign values in any sequence (i.e. you can start with key RDV (F4), or CPN (F1), or any other key).

When calculating the yield of maturity, RDV should be 100, and for zero coupons CPN should be 0.

When calculating the yield on a call, input the redemption price to RDV, and the call date to d_2.

5. Editing data

After you have entered data, you can make any changes necessary by simply re-entering the correct data.

6. Displaying calculation results

After entering all necessary data, you can display calculation results using the COMP key as noted below:

Operation	Result
COMP YLD (F2)	Calculates the yield to maturity or yield on a call.
COMP PRC (F3)	Calculates the bond price per $100 face value.

- The operation COMP PRC (F3) stores the interest accrued from the last coupon payment date until the settlement date in Memory X and the bond price, including interest in Memory Y. You can display these value using the RCL key.

RCL X	Memory X: Accrued interest
RCL Y	Memory Y: Bond price including interest

7. Checking entered data

Press RCL followed by a function key (d1 (F2), d2 (F3), RDV (F4), CPN (F1), YLD (F2), PRC (F3)) to display the value currently assigned to that key.

You can also press the AC key to return to the BOND screen where the values for d_1, d_2, RDV, CPN, YLD, and PRC, in addition to the SEMI/ANNU indicator are all displayed. Press the AC key again to return to the previous screen.

8. Producing a graph

After all of the necessary data are entered, press the Graph key to calculate values for PRC, CPN and RDV, and then to produce a cash flow graph. The following are the characteristics of such a graph:

- Time (n) is represented by the horizontal axis, from left to right. The left end of the line is the last interest payment date or settlement date, while the right end is the maturity date.
- Cash flow is represented by vertical lines, with upward lines showing inflow and downward lines outflow.
- PRC, CPN and RDV values are represented by arrows, with the relative size of the PRC and RDV lines representing the size of the values. The length of the CPN arrow is fixed.
- The actual number of n is displayed for CPN. When n is 16 or greater, some of the n arrows are omitted at the center, because of display limitations. The missing arrows are represented by a series of dots.
- Once the graph is complete, you can use the Trace key to locate specific information on the display.
  Press Trace to make the PRC arrow blink. Each time you press Trace again, CPN and then RDV is displayed.

Example 1

What price should you pay on May 25, 1988 for a 6.5%, 30/360 bond with semiannual coupon payments that matures on December 15, 1999, if you want a yield of 7.45%?

Operation	Display

[MODE] [4] (FIN)
[MODE] [7] [2] [EXE] (Fix 2)
[MODE] [9] (360)
[SHIFT] [BGN] (END)
[MODE] [0] (CMP)
[MODE] [1] (RUN)

```
**** MODE ****

 sys mode :RUN
 cal mode :FIN
  display :Fix2
date mode :360
  payment :END
odd period :CMP
```

← Set date mode to 360

[SHIFT] [AC] [EXE]
[MENU] (FINANCE 2 menu)

```
 ** FINANCE 2 **
F1 BOND
F2 DEP SL
F3 DEP SYD
F4 DEP DB
F5 CST. SEL. MAR.

 BND SL SYD DB CSM
```

[F1]

[BND] [F1]

```
*BOND          ANNU
 d1?01M01D1901Y
 d2?01M01D1901Y
RDV?100.00
CPN?0.00
YLD?0.00
PRC?0.00
 S/A d1 d2 RDV NXT
```

[F1] [F2] [F3] [F5]

[S/A] [F1] (Switches to semiannual)
5 [DATE] 25 [DATE] 88 [DATE] [d1] [F2] (Purchase date)
12 [DATE] 15 [DATE] 99 [DATE] [d2] [F3] (Maturity date)
[NXT] [F5]
6.5 [CPN] [F1] (Coupon payment)
7.45 [YLD] [F2] (Yield)

```
 12M15D1999Y WED
6.5
CPN=
                6.5
7.45
YLD=
                7.45
 CPN YLD PRC  PRE
```

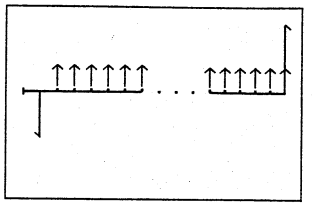
[F1] [F2] [F3]

[COMP] [PRC] [F3] (Bond price)
[RCL] [X] (Accrued interest)
[RCL] [Y] (Total price, including accrued interest)

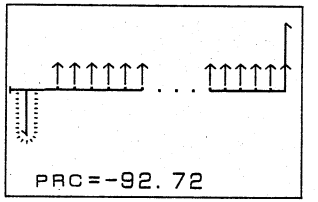
```
7.45
YLD=
                7.45
PRC=
             -92.72 ($)
              -2.89 ($)
             -95.61 ($)
 CPN YLD PRC  PRE
```

[F5]

[Graph]



[Trace]



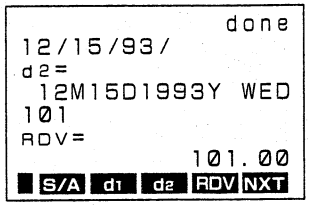
Example 2

What would the yield be for the bond described in Example 1, if it is sold for $101 on December 15, 1993.

Operation	Display

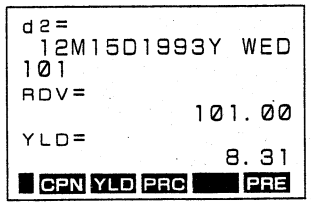
Continuing from Example 1:

[G-T]
[PRE F5]
12 [DATE] 15 [DATE] 93 [DATE] [d2 F3] (Call date)
101 [RDV F4] (Call value)



[F3] [F4] [F5]

[NXT F5]

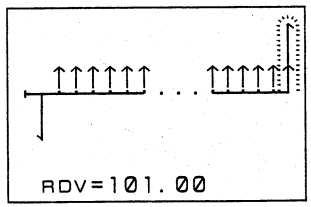


(%)

[COMP] [YLD F2] (Yield to call)

[F2]

[Graph] [Trace] [Trace] [Trace]



■ Depreciation

The FC-1000 lets you calculate depreciation values and the remaining depreciable values using straight-line, sum-of-the years'-digits, and declining balance methods.

1. Formulas

•Straight-line

$$SL_j = \frac{PV - FV}{n}$$

•Sum-of-the-years' digits

$$SYD_j = \frac{n-j+1}{\frac{n(n+1)}{2}} \cdot (PV - FV)$$

•Declining balance

$$DB_j = PV \cdot (1-r)^{j-1} \cdot r \qquad DB_n = RDV_{n-1}$$

$$r = \frac{i}{n} \qquad i = \frac{i\%}{100}$$

n = useful life (number of years)
FV = remaining book value
j = number of depreciation ($1 \leqq j \leqq n$)
RDVj = remaining depreciable value (after j depreciations) (RDV$_{j-1}$—DEP$_j$)
PV = purchase value
i% = declining balance factor (%)
SLj, SYDj, DBj = depreciation value as of j-th depreciation

2. Selecting depreciation calculations from the menu

Use the [MENU] key to display the FINANCE 2 menu. Then press one of the following function keys to select the type of depreciation method:

Key	Screen	Method
[SL F2]	DEP SL	Straight-line
[SYD F3]	DEP SYD	Sum-of-the-years' digits
[DB F4]	DEP DB	Declining balance

3. Entering data

a. Before entering data, you must first clear the applicable memories, but note that the following operation also clears all of the other financial memories.

[SHIFT] [Fcl AC] [EXE]

b. Enter the required data by pressing a function key while the value you wish to enter is shown on the display. The type of data required depends on the depreciation method you are using.

Depreciation method	Required data
SL or SYD	[n F1] [PV F2] [FV F3]
DB	[n F1] [i% F2] [PV F3] [FV F4]

You can assign values in any You can assign values in any sequence (i.e. you can start with key [n F1], or [PV F4], or any other key).

- *n* must be an integer within the range of 1 ~ 999.
- PV and FV must be positive values.

4. Editing data

After you have entered data, you can make any changes necessary by simply re-entering the correct data.

5. Displaying calculation results

For any of the depreciation methods, just enter the year for which you wish to calculate the depreciation value (natural number up to 999) and press the function key to display the value you want. This operation stores the depreciation value in Memory X and the remaining depreciable value in Memory Y.

6. Checking entered data

Press [RCL] followed by a function key to display the value currently assigned to that key.

7. Producing a graph

After all of the necessary data are entered, press the [Graph] key to produce a graph that shows the depreciation amount for each depreciation. The following are the characteristics of such a graph:

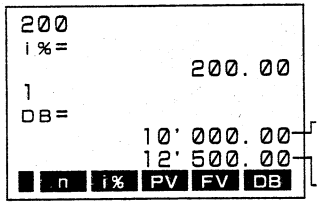
- *n* is represented by the horizontal axis, while PV is represented on the vertical axis.
- The depreciation value for each depreciation is represented by the points plotted on the graph.
- Once the graph is complete, you can use the [Trace] key to locate specific depreciation points on the display, and show the value. The point that is currently selected blinks.

Example

A company invest $25,000 in new machinery, to be depreciated over a five-year period. If the remaining book value of the machinery is $2,500 use the double declining balance method to calculate the depreciation and remaining depreciable value for each of the first three years of the machinery's life.

Operation	Display
[MODE] [4] (FIN) [MODE] [7] [2] [EXE] (Fix 2) [MODE] [9] (365) [SHIFT] [BGN] (END) [MODE] [0] (CMP) [MODE] [1] (RUN)	**** MODE **** sys mode :RUN cal mode :FIN display :Fix2 date mode :365 payment :END odd period :CMP
[SHIFT] [Fcl AC] [EXE] [MENU] (FINANCE 2 menu)	** FINANCE 2 ** F1 BOND F2 DEP SL F3 DEP SYD F4 DEP DB F5 CST. SEL. MAR. BND SL SYD DB CSM [F4]
[DB F4]	*DEP DB n?0.00 i%?0.00 PV?0.00 FV?0.00 n i% PV FV DB [F1] [F2] [F3] [F4]
5 [n F1] (Useful life — years) 25000 [PV F3] (Purchase value) 2500 [FV F4] (Remaining book value) 200 [i% F2] (Declining-balance factor)	25'000.00 2500 FV= 2'500.00 200 i%= 200.00 n i% PV FV DB [F5]

1 (DB F5)
(RCL) (Y)

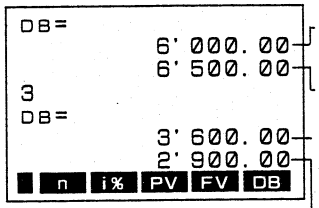


(Depreciation in first year) ($)
(Remaining depreciable value after first year) ($)

(F5)

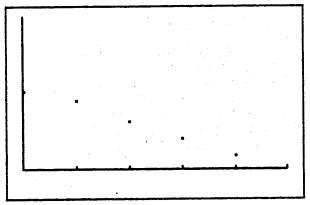
2 (DB F5)
(RCL) (Y)

3 (DB F5)
(RCL) (Y)

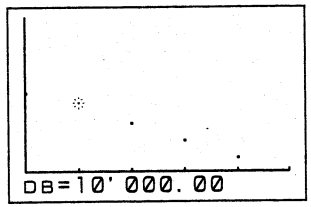


(Depreciation in second year) ($)
(Remaining depreciable value after second year) ($)
(Depreciation in third year) ($)
(Remaining depreciable value after third year)

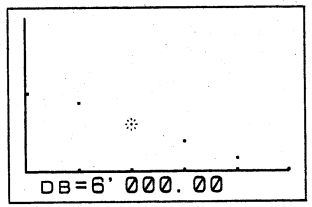
(Graph)



(Trace)



(Trace)



■ Conversion between percentage interest rate and effective interest rate

Press (SHIFT) (▶EFF) to convert to the effective interest rate, and (SHIFT) (▶APR) for the percentage interest rate.

•Converting percentage interest rate (APR) to effective interest rate (EFF)

1. Formula

$$EFF = \left[\left(1 + \frac{APR/100}{n}\right)^{n} - 1\right] \times 100$$

2. Operation

n (SHIFT) (▶EFF) percentage rate APR (EXE) (n = number of compound interest terms per year)

Example

To calculate the effective interest rate for an account yielding an annual percentage interest rate of 12%, compounded quarterly. Calculate the result to two decimal places.

Operation	Display
(AC) (MODE) (7) (2) (EXE) 4 (SHIFT) (▶EFF) 12 (EXE)	Fix 2 0.00 4▶EFF12 12.55 (%) SMP CMP MCI AMR DCF

•Converting effective interest rate (EFF) to percentage interest rate (APR)

1. Formula

$$APR = \left[\left(1 + \frac{EFF}{100}\right)^{1/n} - 1\right] \times n \times 100$$

2. Operation

n (SHIFT) (▶APR) effective interest rate EFF (EXE) (n = number of compound interest terms per year)

Example

To calculate the percentage interest rate for an account yielding an annual interest rate of 12.55%, compounded quarterly. Calculate the result to two decimal places.

Operation	Display
(AC) (MODE) (7) (2) (EXE) 4 (SHIFT) (▶APR) 12.55 (EXE)	Fix 2 0.00 4▶APR12.55 12.00 (%) SMP CMP MCI AMR DCF

■ Cost, selling price, margin calculations

Your calculator lets you calculate cost (CST), selling price (SEL), and margin (MAR). Simply enter two values to calculate the remaining value.

1. Formulas

$$CST = SEL\left(1 - \frac{MAR}{100}\right)$$

$$SEL = \frac{CST}{1 - \frac{MAR}{100}}$$

$$MAR(\%) = \left(1 - \frac{CST}{SEL}\right) \times 100$$

2. Selecting cost, selling price, margin calculations from the menu

Use the MENU key to display the FINANCE 2 menu, and then press F5 to select the CST.SEL.MAR screen.

3. Entering data

a. Before entering data you must first clear the applicable memories, but note that the following operation also clears all of the other financial memories. Press SHIFT AC EXE to clear the CST, SEL, and MAR memories.

b. Press function key F1, F2, or F3 * to input the currently displayed value for that key.
*MAR value is handled as a percent.

4. Editing data

After you have entered data, you can make any changes necessary by simply re-entering the correct data.

5. Displaying results

After entering two values, press COMP followed by the function key that corresponds to the value you want.

6. Checking data

You can check the value assigned to each key by pressing RCL, followed by the key you wish to check.

•Cost

Example

To calculate the cost at margins of 12%, 15%, and 18%, when the selling price is $20. Calculate to two decimal places.

Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (365) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	**** MODE **** sys mode :RUN cal mode :FIN display :Fix2 date mode :365 payment :END odd period :CMP
SHIFT AC EXE MENU (FINANCE 2 menu)	** FINANCE 2 ** F1 BOND F2 DEP SL F3 DEP SYD F4 DEP DB F5 CST. SEL. MAR. BND SL SYD DB CSM F5
F5	*CST. SEL. MAR. CST?0. 00 SEL?0. 00 MAR?0. 00 CST SEL MAR F1 F2 F3
20 F2	SEL= 20. 00
12 F3	12 MAR=
COMP F1	12. 00 CST= 17. 60 CST SEL MAR F1 F3
15 F3 COMP F1	CST= 17. 00
18 F3	18 MAR=
COMP F1	18. 00 CST= 16. 40 CST SEL MAR

(Cost when margin is 12%)

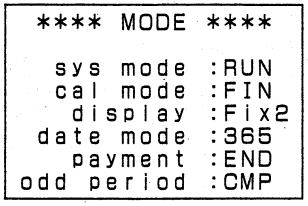
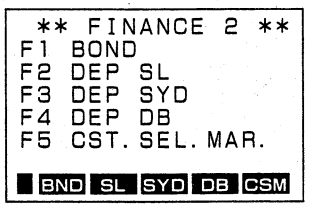
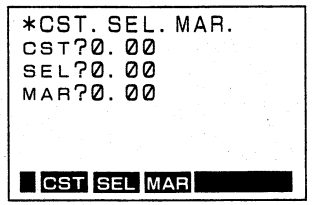
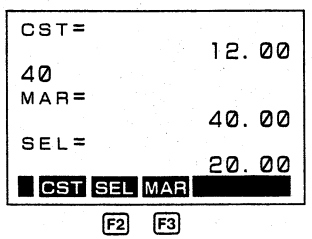
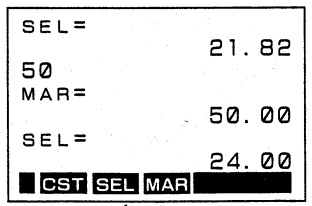
(Cost when margin is 15%)

(Cost when margin is 18%)

•Selling price

Example

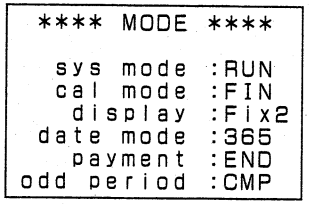
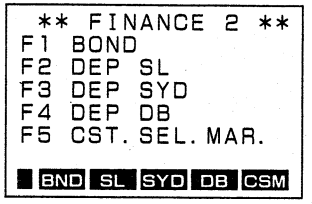
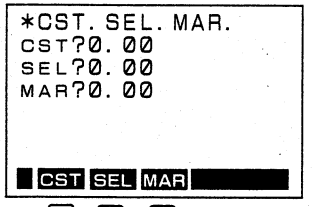
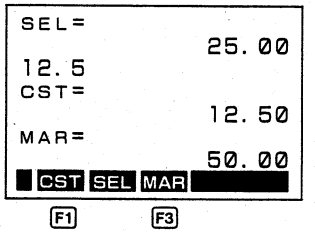
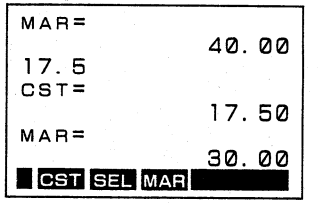
To calculate the selling price at margins of 40%, 45%, and 50% when the selling price is $12. Calculate to two decimal place.

Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (365) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	
SHIFT FCI AC EXE MENU (FINANCE 2 menu)	
	F5
CSM F5	
	F1 F2 F3
12 CST F1	
40 MAR F3	
COMP SEL F2	(Selling price when margin is 40%)
	F2 F3
45 MAR F3 COMP SEL F2	
	(Selling price when margin is 45%)
50 MAR F3	
COMP SEL F2	(Selling price when margin is 50%)

•Margin

Example

To calculate the margin at costs of $12.50, $15, and $17.50 when the selling price is $25. Calculate to two decimal places.

Operation	Display
MODE 4 (FIN) MODE 7 2 EXE (Fix 2) MODE 9 (365) SHIFT BGN (END) MODE 0 (CMP) MODE 1 (RUN)	
SHIFT FCI AC EXE MENU (FINANCE 2 menu)	
	F5
CSM F5	
	F1 F2 F3
25 SEL F2	
12.5 CST F1	
COMP MAR F3	(Margin when cost is $12.50)
	F1 F3
15 CST F1 COMP MAR F3	
	(Margin when cost is $15)
17.5 CST F1	
COMP MAR F3	(Margin when cost is $17.50)

Special Financial Functions

The following financial functions are available in the FIN mode.

Function	Key operation	Display	Formula	Application
$10^x - 1$	SHIFT 1	ALOGM1(	ALOGM1 (x)	Assures precision as x approaches zero.
$\log(1+x)$	SHIFT 2	LOG1P(	LOG1P (x)	Assures precision as x approaches zero.
$(1+i)^n$	SHIFT 3	FWF(	FWF(i%, n)	Final Worth Factor
$(1+i)^{-n}$	SHIFT 4	PWF(	PWF(i%, n)	Present Worth Factor
$\frac{(1+i)^n-1}{i}$	SHIFT 5	USFWF(	USFWF(i%, n)	Uniform Series Final Worth Factor
$\frac{1-(1+i)^{-n}}{i}$	SHIFT 6	USPWF(	USPWF(i%, n)	Uniform Series Present Worth Factor

$\left(\text{Here, } i = \frac{i\%}{100}\right)$

Error Conditions

The following conditions will cause errors to occur during financial calculations.

■ Compound interest

〈When calculating n:〉
- $i\% \leqq -100$
- Calculated n is negative

} Ma ERROR

〈When calculating i%:〉
- Signs of PV, PMT, FV are identical
- $n \leqq 0$
- Calculated $i\% \leqq -100\%$

} Ma ERROR

〈When calculating PV:〉
- $i\% \leqq -100$ ..... Ma ERROR

〈When calculating PMT:〉
- $i\% \leqq -100$ ..... Ma ERROR

〈When calculating FV:〉
- $i\% \leqq -100$ ..... Ma ERROR

■ Loan amortization

When the number of terms for INT, PRN, BAL, ΣPRN, or ΣINT is not a natural number (1 ~ 9,999,999,999). ..... Arg ERROR

Example: INT 4.23 EXE → Arg ERROR

■ Investment appraisal

〈When entering CFj:〉
- Number of data items exceeds 61 ..... Mem ERROR

〈When entering Nj:〉
- Attempt to enter value outside of range of natural numbers 1 ~ 99 ..... Arg ERROR

〈When calculating NPV:〉
- $i\% \leqq -100$ ..... Ma ERROR

〈When calculating IRR:〉
- Calculated IRR $\leqq -100\%$
- Sign of all CFj values are identical
- Calculation too complex

} Ma ERROR

■ Bonds

〈When entering the date:〉
- Date outside range of January 1, 1901 ~ December 31, 2099
- $d_1 = d_2$ or d_2 is earlier than d_1

} Ma ERROR

〈When calculating PRC:〉
- When the conditions RDV $\geqq 0$ and CPN $\geqq 0$ are not satisfied ..... Ma ERROR

〈When calculating YLD:〉
- When the conditions CPN > 0, RDV $\geqq 0$ and PRC $\leqq 0$ are not satisfied
- When the conditions CPN $= 0$, RDV > 0 and PRC < 0 are not satisfied

} Ma ERROR

■ Depreciation

〈When calculating depreciation:〉
•j (number of years) is not natural number in range of 1 ~ 999 ..... Arg ERROR
Example: 1000 [DEG] → Arg ERROR

•n (useful life) is not natural number in range of 1 ~ 999 ..... Ma ERROR
Example: When $n = 1000 - 5$ [DEG] → Ma ERROR

•PV, FV, or i% is a negative value ..... Ma ERROR
Example: When PV = −1000 − 1 [DEG] → Ma ERROR

■ Graphing

〈When graphing simple interest:〉
•$n < 0$
•Error in SI or SFV calculation

〈When graphing compound interest:〉
•$n < 0$

〈When graphing amortization:〉
•$n \leqq 0$
•PV and PMT both have the same sign
•Error in INT calculation

〈When graphing bond calculations:〉
•$d_1 = d_2$ or d_2 is earlier than d_1

〈When graphing depreciation:〉
•$n \leqq 0$
•$n > 999$
•n is not an integer
•PV < 0
•FV < 0
•i% < 0 (for DB method only)

Practical Financial Calculation Examples

Example 1

Your child will be ready to go to college in seven years, so you calculate that you will need about $20,000 to cover educational expenses. If you start an installment plan at 4.5% annual interest, how much should you deposit each month in order to achieve your goal?

〈Solution〉
The amount you need to deposit monthly can be calculated using the following formula:

$$PMT = \frac{FV}{n \times 12 + \{m(m+1)/2\} \times (i/12)} \qquad m = n \times 12 \qquad i = i\%/100$$

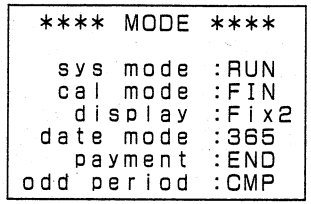
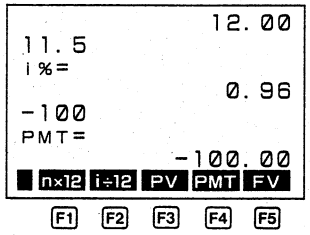
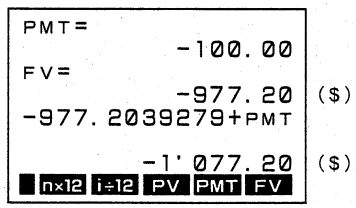
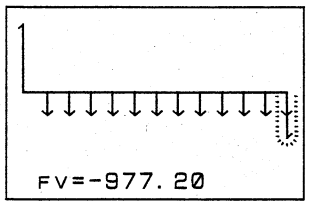
In this case, FV = $20,000, n = 7 years, m = 84 payments, and i = 4.5% per annum. This formula is not built into the calculator, so you will have to perform it manually.

Operation	Display
[MODE] [4] (FIN) [MODE] [7] [2] [EXE] (Fix 2) [MODE] [9] (365) [SHIFT] [BGN] (END) [MODE] [0] (CMP) [MODE] [1] (RUN)	**** MODE **** sys mode :RUN cal mode :FIN display :Fix2 date mode :365 payment :END odd period :CMP
20000 ÷ (7 × 12 + 84 × 85 ÷ 2 × 4.5 [10^x] (−) 2 ÷ 12) [EXE]	20000÷(7×12+84×85÷2×4.5$10^{-2}$÷12) 205.37 ($)

Example 2

You borrow a total of $2,000 at an annual rate of 11.5%. You arrange the loan so that you repay only $100 per month for 12 months, and the remaining balance of the loan along with the final payment. How much should you expect to pay for the final installment? Use end of term payment for this example.

〈**Solution**〉
Use the monthly $100 payment to calculate the total principal (FV). Since the final payment also includes a monthly payment, the solution of this example will be FV + $100.

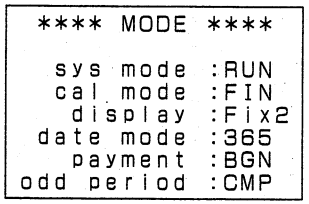
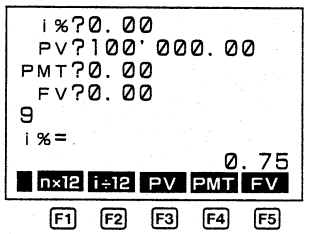
Operation	Display
[MODE] [4] (FIN) [MODE] [7] [2] [EXE] (Fix 2) [MODE] [9] (365) [SHIFT] [BGN] (END) [MODE] [O] (CMP) [MODE] [1] (RUN)	
[MENU] (FINANCE 1 menu) [MCI] [F3] [SHIFT] [Fel] [AC] [EXE] 2000 [PV] [F3] 1 [n×12] [F1] 11.5 [i÷12] [F2] [(−)] 100 [PMT] [F4]	
[COMP] [FV] [F5] [+] [RCL] [PMT] [F4] [EXE] (Final payment)	
[Graph] [Trace] [Trace] [Trace]	

Example 3

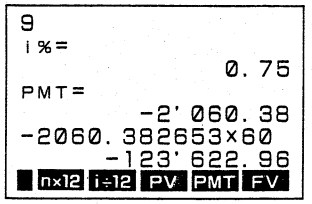
ABC incorporated has decided to automate its office by installing a computer. The actual cost of the computer, number of lease months, the fixed asset tax, and other conditions are listed below. Use this information to calculate the monthly lease charge.

Conditions
1. Actual cost: $100,000
2. Number of lease months (repayment term): 60
3. Annual interest: 9%
4. Fixed asset tax: 14/1000 of carrying price
   $\$304{,}900 \times \frac{14}{1000} = \text{approx } \$4{,}300$
5. Insurance: 3/1000 of carrying price
   $\$304{,}900 \times \frac{3}{1000} = \text{approx } \$900$
6. Sales promotion cost: 0.5% of actual cost
   $\$100{,}000 \times \frac{0.5}{100} = \$500$ ($2,500 in five years)
7. Profit: 0.5% of actual cost
   $\$100{,}000 \times \frac{0.5}{100} = \$500$ ($2,500 in five years)

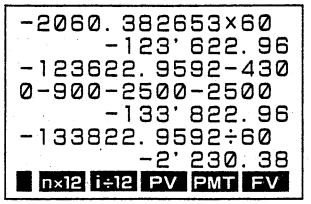
〈**Solution**〉
In the case of a lease, use the same operation as that for loan calculations, with payment at the beginning of the term. First, determine the lease charge for each month. Next, total all of the other charges applied over the five year period and divide by the number of payments.

Operation	Display
[MODE] [4] (FIN) [MODE] [7] [2] [EXE] (Fix 2) [MODE] [9] (365) [SHIFT] [BGN] (BGN) [MODE] [O] (CMP) [MODE] [1] (RUN)	
[MENU] (FINANCE 1 menu) [CMP] [F2] [SHIFT] [Fel] [AC] [EXE] 100000 [PV] [F3] 60 [n×12] [F1] [MENU] [MCI] [F3] 9 [i÷12] [F2]	

COMP PMT F4 (Monthly amount)
× 60 EXE (5-year net lease amount)

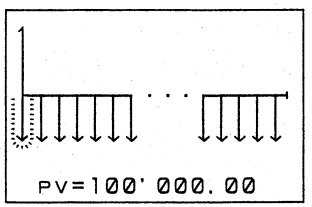


− 4300
− 900 − 2500 − 2500 EXE (Add tax, etc.)
÷ 60 EXE (Monthly lease charge)



($)

Graph Trace Trace



Using Programmed Calculations

To many, the word "programming" sounds rather overwhelming. Actually, however, the entire procedure can be broken down into a few simple steps.

① Decide what you wish the programmed calculation to do.
*What result are you trying to achieve?
*Good planning here makes your programmed calculation quick and efficient.

② Write the programmed calculation.
*Determine the formulas you need.
*Write the programmed calculation down.
*Put the programmed calculation in its proper format.

③ Input the programmed calculation into the calculator.
*Accurate input means less time spent tracking down problems later.

④ Test the programmed calculation.
*Use some common values and see what happens.

⑤ Store the programmed calculation for later use.

What is a Program?

Programs, whether for your calculator or a large main frame, are made up of *program statements*. Program statements are messages to a calculator or computer to perform certain tasks.

•Programming your calculator

With your financial calculator, program statements can contain variables, values, formulas, specification of conditions, function key operations, financial key operations, and commands.
Unlike other computers that require special languages, your financial calculator lets you enter statements from left to right, just as they are written.
Statements are entered one after another, and are separated by colons:

STATEMENT 1 : STATEMENT 2 : STATEMENT 3: ....

■ Using Commands and Symbols in Programed Calculations

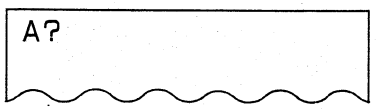
You can incorporate all of the functions available for manual calculations into programmed calculations.

•Using memories

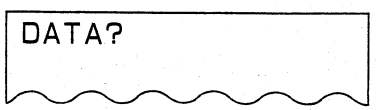
A ***variable*** is a place in the calculator's memory that you can use for the accumulation and storage of data, including numeric values and dates. In this manual we refer to variables as ***memories***. There are 26 memories available with your financial calculator, and they are identified by alphabetic names, ranging from A through Z. Specify that data should be assigned to a memory by pressing the STO key to input the symbol "→" into the programmed calculation.

Examples: 0→C, A→B, C+1→C, 1÷D→A

You can also tell the computer to ask for input of data for a specific memory, each time the programmed calculation is executed. Including the following statement within a programmed calculation causes the display to appear as illustrated: ?→A



With this display, the calculator is asking you to enter a value for Memory A.
You can also instruct the calculator to display a certain message on the display when asking for input of data. This makes it easier for the person using the calculator to understand the type of data needed. The following statement format results in the display shown when asking for input into Memory B: "DATA"?→B



•Using output functions

The computer will interrupt execution of a programmed calculation and display the result up to that point any time it comes to a "◢" symbol used in place of a colon (to separate statements). The —Disp— symbol is shown on the display while the calculator is displaying a value after it encounters "◢".

•About conditional and unconditional jumps

A ***jump*** tells the computer to go from one point of the programmed calculation to another. A ***conditional jump*** tells it to make the jump only if a certain preset condition is met. An ***unconditional jump***, on the other hand, tells the computer to make the jump no matter what.

•Specifying conditions

You specify conditions using the following symbols:
<: value on left of symbol is less than value on right
>: value on left of symbol is greater than value on right
=: value on left of symbol is equal to value on right
≠: value on left of symbol is not equal to value on right
≤: value on left of symbol is less than or equal to value on right
≥: value on left of symbol is greater than or equal to value on right

Note the following example: A<5 ⇨ 0→T

This can be read as: "if the value assigned to Memory A is less than 5, then store a zero in Memory T".

•Using jumps

The following is the format for the unconditional jump: Goto *n*
The letter "*n*" represents a number from 0 through 9. This number is a *label*. You can insert labels as statements anywhere in the programmed calculation, using the operation SHIFT Lbl, followed by a number from 0 through 9, as a type of reference points. Then, when you want execution of the program to jump from any point in the program to one of the labels, you use a Goto statement.

Note the following sample sequence: Lbl 1: statement: Goto 1

After the statement, execution jumps from Goto 1 to Lbl 1, and then executes the statement again. In fact, this example actually creates an endless loop.

The format for the conditional jump is: condition ⇨ Goto *n*

Again, the "*n*" represents a label number.
Note the following sample sequence:

Statement 1: Condition ⇨ Goto 1: Statement 2: Statement 3: Lbl 1:

If the condition is satisfied, execution jumps from Statement 1 to Lbl 1. If not, execution proceeds sequentially, from left to right.

•Using count jumps

Another type of jump is called a ***count jump***. A count jump tells the calculator to add or subtract one to a memory. Then if the value contained by the memory is not zero the calculator should proceed to the next sequential program statement. If the value contained by the memory is zero, then the calculator should skip the next statement. There are two types of count jumps:

Isz→increment and skip on zero

*This count jump increments the memory.

Dsz→decrement and skip on zero

*This count jump decrements the memory.

Note the following examples:

Statement 3: Isz X: Statement 4 : Statement 5

*In this case, Statement 3 is executed and then one is added to the contents of Memory X. Then if memory X contains zero, Statement 5 is executed, otherwise Statement 4 is executed.

Statement 6: Dsz Q : Statement 7 : Statement 8

*In this case, Statement 6 is executed and then one is subtracted from the contents of Memory Q. Then if memory Q contains zero, Statement 8 is executed, otherwise Statement 7 is executed.

Storing and Executing Programmed Calculations

■ Inputting Programmed Calculations

① Press [MODE] followed by a value to enter a calculation mode (FIN, SD, or LR).

[MODE] [4]

(FIN mode will be used as an example.)

```
**** MODE ****

 sys mode :RUN
 cal mode :FIN
  display :Nrml
date mode :365
  payment :BGN
odd period :SMP
```

•You cannot change the calculation mode once you being inputting a programmed calculation.

② Press [MODE] [2].

This selects the WRT (programmed calculation writing) mode.

[MODE] [2]

```
 sys mode :WRT
 cal mode :FIN
  display :Nrml
date mode :365
  payment :BGN
odd period :SMP
2470 Bytes Free
Prog 0123456789
```

③ Specify a program number.

Use the [◄][►] cursor keys to align the cursor with the program number you want to use.

[►] [►]

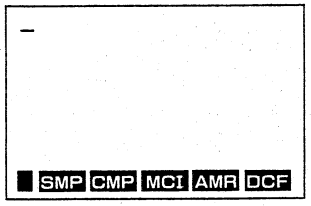
(Selects Program Number 2.)

```
 sys mode :WRT
 cal mode :FIN
  display :Nrml
date mode :365
  payment :BGN
odd period :SMP
2470 Bytes Free
Prog 0123456789
```

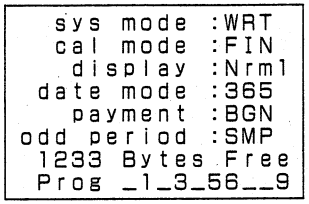
④ Enter the programmed calculation.

EXE

(This display shows when the calculator is ready for input.)



•Program numbers that already contain programmed calculations are replaced by a "_" on the display.



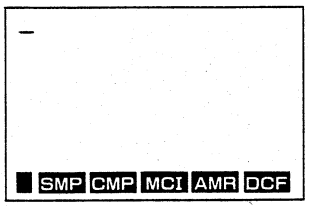
■ Entering Programmed Calculations

Enter programmed calculations by operating the keys of the calculator just as you do for manual calculations, except that you don't press the EXE key at the end.

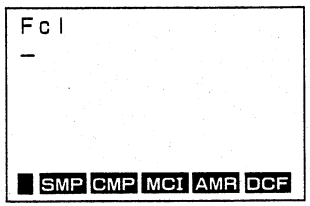
•Programming example

Enter a programmed calculation that calculates the amount of principal and interest due after three years on a 10-year saving for $10,000, compounded annually.

MODE 4 MODE 2 ▶ ▶
EXE (Selects Program Number 2.)

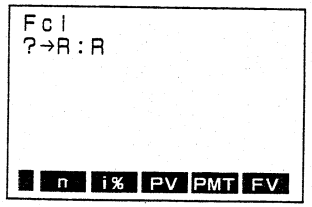


(MENU) SHIFT Fcl EXE



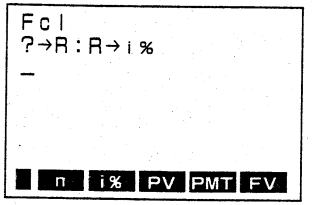
F2

CMP F2 SHIFT ? STO R : ALPHA R



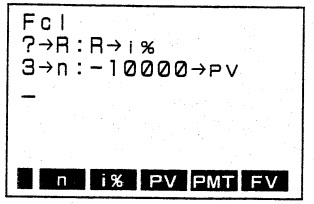
F2

STO i% F2 EXE



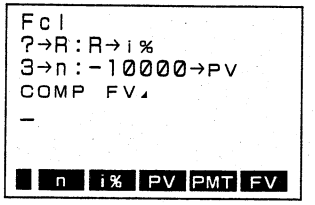
F1 F3

3 STO n F1 : (−) 10000
STO PV F3 EXE



F5

COMP FV F5 SHIFT ◢



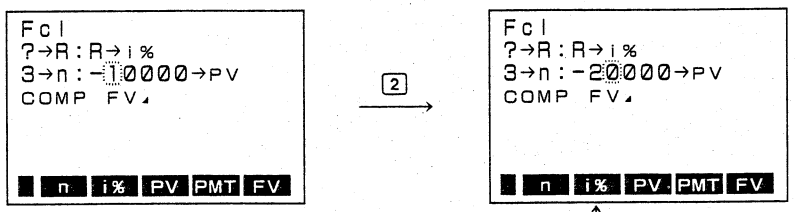
MODE 1
(Returns to the RUN mode.)

■ Editing Programmed Calculations

•To edit programmed calculations, first press [MODE][2] to enter the WRT mode, select the program number of the programmed calculation you want to edit, and press [EXE]. Then use the [◄], [►], [▲] and [▼] cursor keys to move the cursor to the place in the calculation that you wish to edit.

•Replace

After locating the cursor at the step to be replaced (see page 21 for an explanation of steps), simply enter the new step.

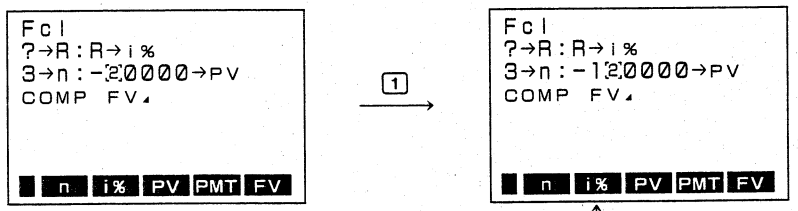


10,000 entered for 20,000

"1" changed to "2".

•Insert

After locating the cursor at the position of the insertion, press [INS]. This will open up a space indicated by [ ] on the display. Now, anything you enter will be inserted in the space.



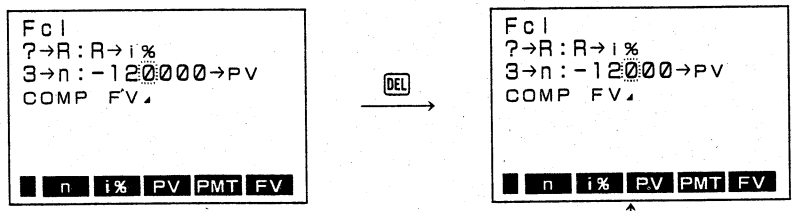
20,000 entered for 120,000

"1" inserted.

When you want to add something to the end of the calculation, just move the cursor to the end and make the addition. It is not necessary to press the [INS] key first when adding to the end of the calculation.

•Delete

After locating the cursor at the step to be deleted, press [DEL].



120,000 entered for 12,000

"0" deleted.

When you a delete a step, everything to the right of the deletion is shifted to the left to close the space created.

■ Executing Programmed Calculations and Interrupting Execution

•Executing a programmed calculation

① Press [MODE][1] to put the calculator into the RUN mode.
The RUN mode is used for programmed calculation execution.

② Press [Prog] followed by the program number of the programmed calculation you wish to execute. Then press [EXE] to execute the calculation.

•Interrupting programmed calculation execution

You can interrupt the execution of a programmed calculation by pressing [MODE][1] or by pressing the [AC] key. If the programmed calculation is waiting for input of a value, you must use the [MODE][1] method to interrupt execution.

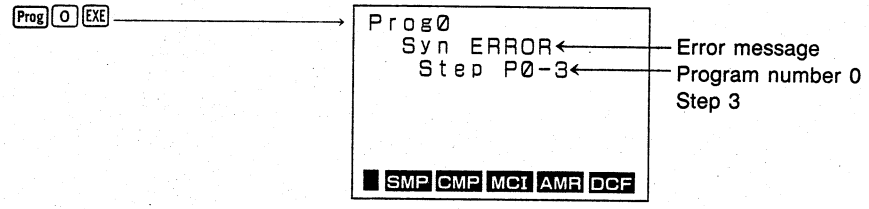
■ Debugging Programmed Calculations

Before actually using a program for calculations, it is always a good idea to try a few test runs to iron out any ***bugs*** (programming mistakes or problems). This process is commonly called ***debugging***.

•Locating bugs

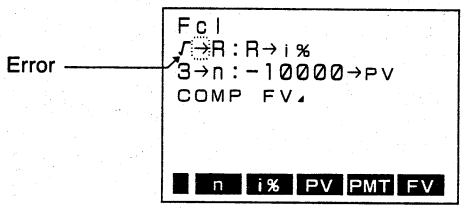
If the calculator finds incorrect programmed calculation input or data during execution, it goes into an error handling routine that stops the execution. This routine also displays an error message that describes the type of error found, as well as the number of the step and program where the error is located.

Example:



① Press either [◄][►] cursor key and the calculator will automatically enter the WRT mode and display the place in the programmed calculation where it found the error. The cursor will be blinking at the exact location of the error.

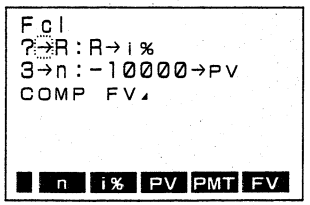
Example:



② Use the editing functions (see page 118) to correct the error.

Example:

◀ SHIFT ?



③ Press MODE 1 to enter the RUN mode and re-execute the programmed calculation. Repeat this process as many times as necessary to eliminate all of the bugs.

•Correcting data input

Some programmed calculations require that you enter data during execution. If you make a mistake that causes an error, press the AC key to clear the error and execute the programmed calculation again.

■ Entering Programmed Financial Calculations

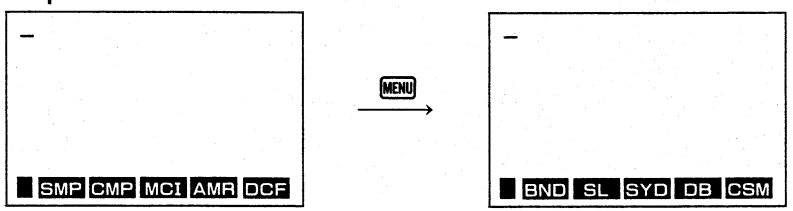
•Entering financial commands

Financial commands can be entered into programmed calculations using the following procedure.

① Enter the WRT mode.
This is done by pressing MODE 2, selecting a program number, and then pressing EXE.

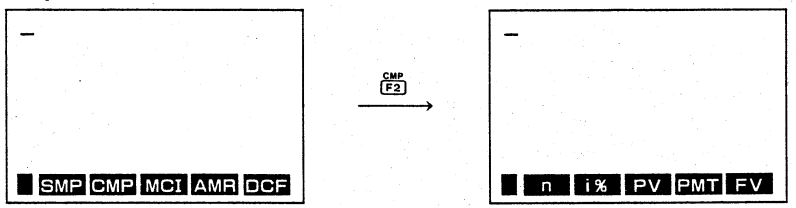
② The financial command function key indicators are shown on the bottom line of the display. Switch between the two sets of function keys by pressing the MENU key. The display changes as shown below:

Example:



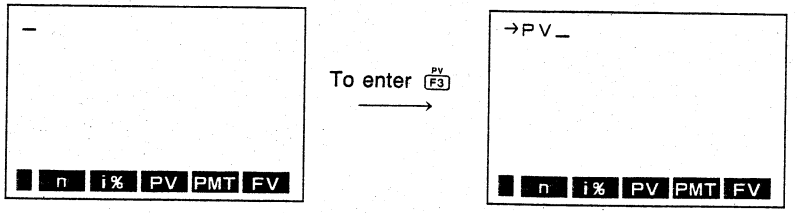
③ Press the MENU key until you find the function key for the screen that you need. Here we will use CMP as an example, so press function key CMP F2.

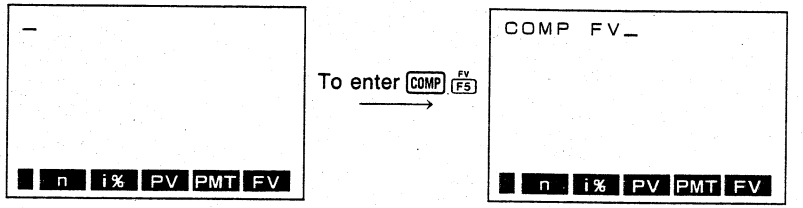
Example:



④ Now the function keys show the operations for the CMP screen. Press the key for the command that you wish to enter.

Example:





•You can also enter data directly into the financial memories.

Example: ?→PV, ?÷12→*i*%, ?→CF*j*, ?→N*j*, ?→IRR

•For the FIN mode, you can also use the special financial functions inside of programmed calculations (see page 104).

•Financial command table

	Key operation	Display
1. Simple interest	n	→n
	i%	→i%
	PV	→PV
	sINT	sINT
	sFV	sFV
	RCL n	n
	RCL i%	i%
	RCL PV	PV
	RCL X	X
	RCL Y	Y
2. Compound interest	n	→n
	i%	→i%
	PV	→PV
	PMT	→PMT
	FV	→FV
	n×12	×12→n
	i%÷12	÷12→i%
	COMP n	COMP n
	COMP i%	COMP i%
	COMP PV	COMP PV
	COMP PMT	COMP PMT
	COMP FV	COMP FV
	PCL n (n×12)	n
	RCL i% (i%÷12)	i%
	RCL PV	PV
	RCL PMT	PMT
	RCL FV	FV
3. Amortization	PRN	PRN
	INT	INT
	BAL	BAL
	~	~
	RCL X	X
	RCL Y	Y
	RCL Z	Z
4. Investment appraisal	CFj	→CFj
	Nj	→Nj
	i%	→i%
	NPV	NPV
	NFV	NFV
	PBP	PBP
	IRR	IRR
	STO IRR	→IRR
	RCL CFj	CF(
	RCL Nj	N(
	RCL i%	i%
	RCL X	X
	RCL Y	Y
	RCL Z	Z
	STO CFj	→CF(
	STO Nj	→N(

	Key operation	Display
5. Bonds	YLD	→YLD
	CPN	→CPN
	PRC	→PRC
	RDV	→RDV
	d_1	→d_1
	d_2	→d_2
	COMP YLD	COMP YLD
	COMP PRC	COMP PRC
	RCL YLD	YLD
	RCL CPN	CPN
	RCL PRC	PRC
	RCL RDV	RDV
	RCL d_1	d_1
	RCL d_2	d_2
	RCL X	X
	RCL Y	Y
6. Depreciation	PV	→PV
	FV	→FV
	n	→n
	SL	SL
	SOYD	SOYD
	i%	→i%
	DB	DB
	RCL PV	PV
	RCL FV	FV
	RCL n	n
	RCL X	X
	RCL Y	Y
	RCL i%	i%
7.Cost, Selling Price, Margin	CST	→CST
	SEL	→SEL
	MAR	→MAR
	COMP CST	COMP CST
	COMP SEL	COMP SEL
	COMP MAR	COMP MAR
	RCL CST	CST
	RCL SEL	SEL
	RCL MAR	MAR

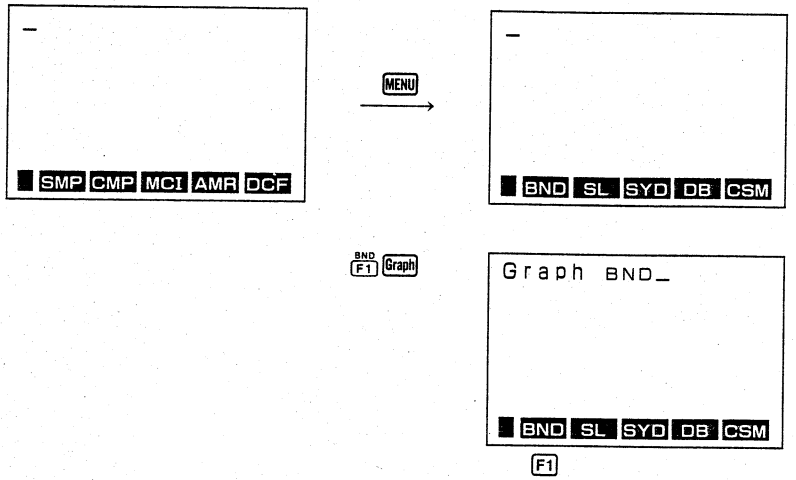
•Entering financial graph commands

You can use the following procedure to tell the calculator to produce a graph at any point during a programmed calculation.

① While you are entering a programmed calculation, press the MENU key until the function key indicator for the graph that you want to draw is shown on the bottom line of the display.

② Press the Graph key followed by the function key for the graph you wish to produce.

Example: To produce a BND graph.



•Financial graph command table

Screen	Key operation	Display
SMP	Graph	Graph SMP
CMP	Graph	Graph CMP
AMR	Graph	Graph AMR
DCF	Graph	Graph DCF
BND	Graph	Graph BND
SL	Graph	Graph SL
SYD	Graph	Graph SYD
DB	Graph	Graph DB

■ What are Branches and Subroutines?

A common technique when programming a calculator is known as ***branching***. With branching, you instruct the calculator to go (branch off) from one programmed calculation to another. The original programmed calculation from which you branched is called the *main routine*, while the destination is called the ***subroutine***.
Generally, processes (routines) that are repeated often are put into subroutines and branched to when they are necessary. This means that if a certain process must be performed ten times by Program A, it is more economical to program it once, as say Program B. Then you simply branch from Program A to Program B ten times, rather than repeating the same programming sequence ten times in Program A.
Another possible application would be to store a subroutine that is often used is various different calculations that you need to perform. Then when you program such calculations, you only need to program a branch to the subroutine, rather than the entire sequence.

Note the following samples:

•No branching used

Program A
A=1+1 E=Q+R
B=A+1 C=Z+X
C=Z+X E=Q+R
E=Q+R C=Z+X
C=Z+X E=Q+R

•With branching

Program 1
A=1+1
B=A+1
PROG 2

Program 2
C=Z+X
E=Q+R
PROG 2

PROG 2 PROG 2 PROG 2

As you can see, the branching technique does the same job using less memory.

•Branching from one program to another

You specify a branch to another programmed calculation as follows:

Statement 1 : Prog 5 : Statement 2 : .....

Here, Statement 1 is executed followed by a branch to Program Number 5. Once the contents of Program Number 5 (the subroutine) are executed, the calculator returns to Statement 2 in the main routing above. In place of the 5 in Prog 5 above, you can use any value from 0 through 9.

•Note that an error (Go ERROR), occurs when you specify a program number to branch to and there is no subroutine located there.

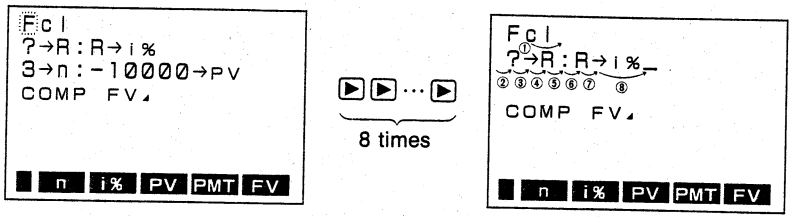
•Using multiple jumps

You can also branches from one subroutine to another and then another if required. Such a technique is called ***nesting***. You are restricted, however, to ten nested branches. If you try to exceed this number an error (Ne ERROR) will occur.

Note:
A Goto *n* jumps to the corresponding Lbl *n* in the same program area. Goto *n* cannot be used to jump from one program area to another.

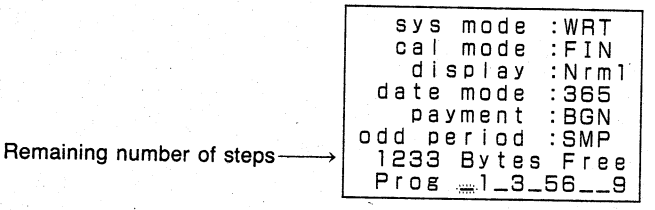
■ Understanding Steps

The size of a calculation is measured in ***steps***, with each step representing a value or calculation command. Your financial calculator has a capacity of 2,470 steps. In some cases, one step is the same as one value or one key operation as in the case of arithmetic operators such as [+], [−], [×] and [÷]. In other cases, two key operations represent a single function, and, therefore, one step, such as [SHIFT] [Goto].
If you ever have a doubt about what makes up a step, press the [◄] or [►] cursor key. Each press will cause the cursor to move the equivalent of one step on the display.



•Finding out the remaining number of steps

The program number screen of the WRT mode shows the remaining number of free (unused) steps on the second line from the bottom.



•The cursor changes to ■ during program input when there are six free steps remaining.

■ Deleting Programs

You can delete programs in the PCL mode, entered by the operation [MODE] [3].

•Deleting a specific programmed calculation

Enter the PCL mode and then position the cursor at the program number of the program you wish to delete. Then press the [AC] key. When you a delete a program its the program number reappears on the display to indicate that the program area is free.

```
  sys mode :PCL
  cal mode :FIN
   display :Nrml
 date mode :365
   payment :BGN
odd period :SMP
 1233 Bytes Free
 Prog _1_3_56__9
```

[AC] →

```
  sys mode :PCL
  cal mode :FIN
   display :Nrml
 date mode :365
   payment :BGN
odd period :SMP
 1388 Bytes Free
 Prog _1_3_56__9
```

•Deleting all programs

Enter the PCL mode and press [SHIFT] [Mcl]. This operation will cause all program numbers (0 ~ 9) to reappear on the display.

```
  sys mode :PCL
  cal mode :FIN
   display :Nrml
 date mode :365
   payment :BGN
odd period :SMP
 2470 Bytes Free
 Prog 0123456789
```

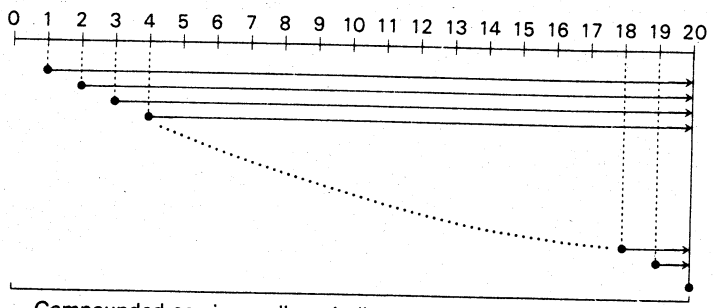

Programmed Calculation Examples

Example 1

You've just had your first child and decide to buy a $10,000 government bond for the child's future. What will the yield of the bond be (principal and interest) in 10 years if the 5% interest earned on the bond is deposited semiannually in your bank account, which pays 4% annual interest, compounded semiannually.

〈**Solution**〉

You will receive a total of $250 twice a year ($10,000 × (5% ÷ 2)). Since this is a 10-year bond, you will receive a total of 20 payments. Now just determine the principal and interest on your compound interest account.

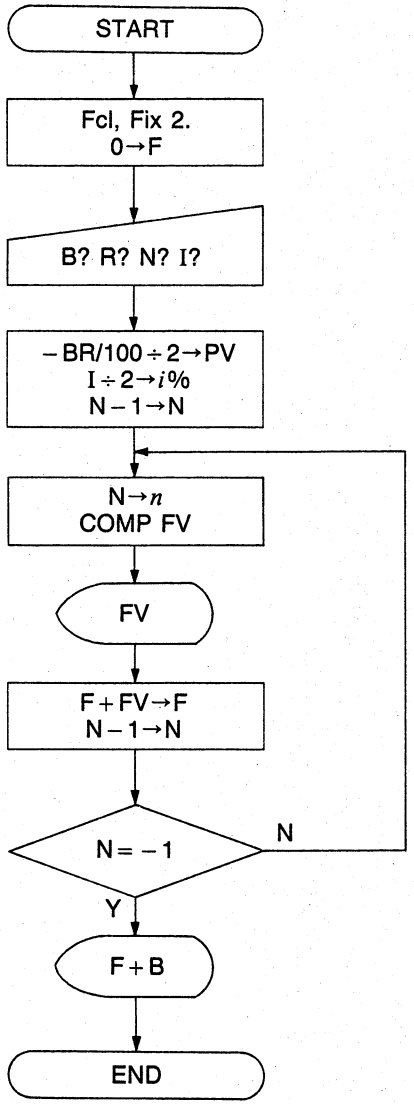


Compounded semiannually •indicates interest received ($250)

•Worksheet

Objective	Formula	Required data (variables)
① Single bond interest payment	Bond amount × (Bond interest ÷ 2)	Bond value (B) Bond interest rate (R)
② Bank account interest	Bank account interest rate ÷ 2	Annual interest rate of bank account (I)
③ Total of principal and interest for bond interest payment	Use financial keys ①→PV ②→i% N→n } COMP FV	Number of bond interest payments (N)
④ Total interest and principal	Total of FV values calculated in ③. $FV_1 + FV_2 + \ldots FV_N$	
⑤ Total of principal and interest, including bond amount	Bond amount + interest portion Total principal and interest (④)	

•Flow chart



Flow chart symbols

Terminal

Processing

Key input

Display

•Coding

	(MODE 2)	Program														Step
1	Fcl	:	Fix	2	↵											5
2	0	→	F	↵												9
3	"	B	O	N	D		A	M	O	U	N	T	"	?	→	24
4	B	↵														26
5	"	B	O	N	D		I	.	R	.	"	?	→	R	↵	41
6	"	T	E	R	M	"	?	→	N	↵						51
7	"	B	A	N	K		I	.	R	.	"	?	→	I	↵	66
8	(−)	B	R	÷	2	0	0	→PV	↵							75
9	I	÷	2	→i%	↵											80
10	N	−	1	→	N	↵										86
11	Lbl	0	↵													89
12	N	−n	↵													92
13	COMP FV	◢														94
14	F	+	COMP FV	→	F	↵										100
15	Dsz	N	↵													103
16	N	=	(−)	1	⇒	Goto	1	:	Goto	0	↵					114
17	Lbl	1	↵													117
18	F	+	B	◢												121
19	Norm															122
20																
21																
22																
23																
24																
25																
26																
27																
28																

Variables

A		J		S	
B	Bond amount	K		T	
C		L		U	
D		M		V	
E		N	Number of bond interest payments	W	
F		O		X	
G		P		Y	
H		Q		Z	
I	Bank interest rate	R	Bond interest rate		

•Sample execution

[MODE] [1] [AC]
[Prog] [0] [EXE] (Recall program)
10000 [EXE] (Bond amount)
5 [EXE] (Bond interest rate)

```
Prog0
BOND  AMOUNT?
10000
BOND  I. R. ?
5
TERM?

■ SMP CMP MCI AMR DCF
```

(Number of bond interest payments)
20 [EXE]

4 [EXE] (Bank account interest rate)

```
TERM?
20
BANK  I. R. ?
4
FV=
              364. 20
          - Disp -
■ SMP CMP MCI AMR DCF
```

(Principal and interest calculation of first interest portion)

[EXE]

```
BANK  I. R. ?
4
FV=
              364. 20
FV=
              357. 06
          - Disp -
■ SMP CMP MCI AMR DCF
```

(Principal and interest calculation of second interest portion)

⋮

Continues sequentially and displays total

[EXE]

```
              260. 10
FV=
              255. 00
FV=
              250. 00
           16' 074. 34
          - Disp -
■ SMP CMP MCI AMR DCF
```

(18th)
(19th)
(20th)
(Cumulative total)

Example 2

This example compares fixed rate and floating rate plans for home mortgages.

a. Fixed rate

What will be the total amount paid for $100,000 home loan at a fixed rate of 6.6% per year over 25 years (end of term payment).

〈**Solution**〉

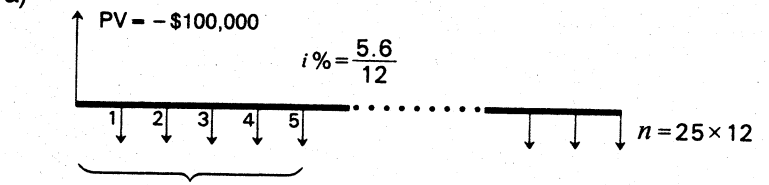
Calculate the monthly payment and multiply by the number of payments.

b. Floating rate

What will be the total principal and interest for the same loan as above if the interest is 5.6% for the first five years, 6% for the next five years, 7% for the next five years, and 6% for the final ten years (end of term payment).

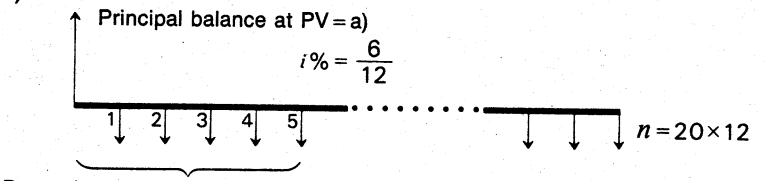
〈**Solution**〉

a)



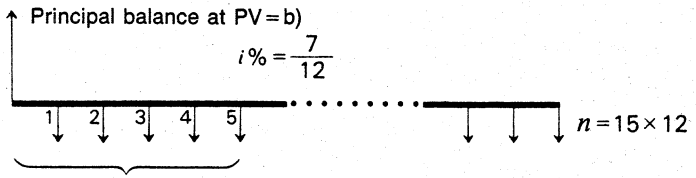
Determine the total principal and interest for five years.

b)



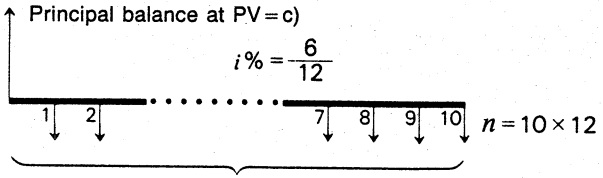
Determine the total principal and interest for five years.

c)



Determine the total principal and interest for five years.

d)



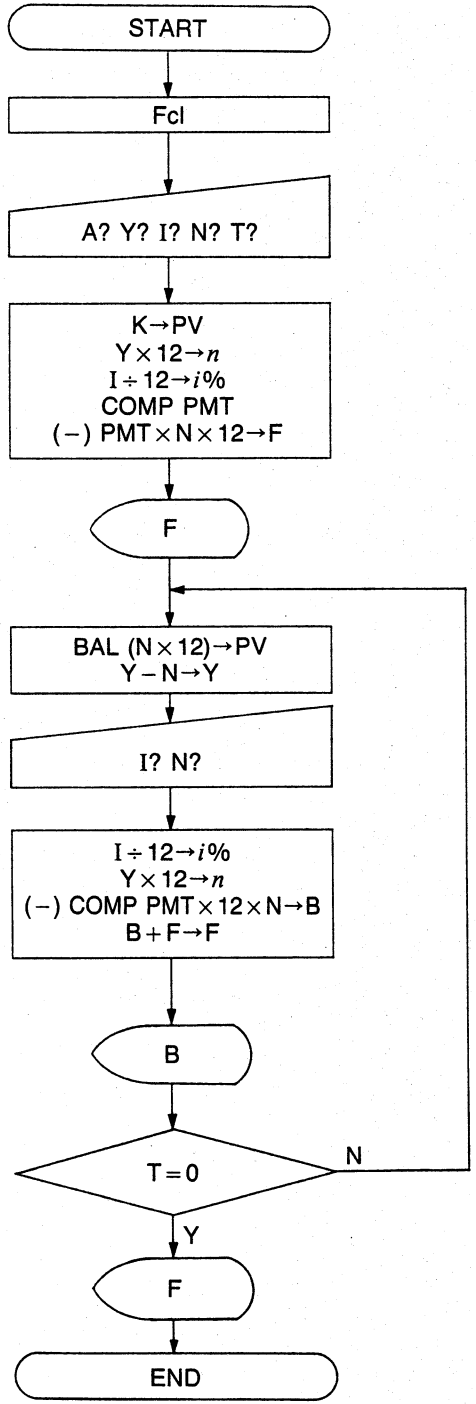
Determine the total principal and interest for ten years.

The sum of the first 5-year interest/principal totals for cash flow diagrams a) through c) and the interest/principal total of d) provides the answer to this equation.

•Worksheet

Objective	Formula	Required data (variables)
① Amount of principal repaid by first n-year period	Monthly payment (PMT) × Number of repayments ($12 \times n$) ↳Use financial keys Amount of loan (A)→PV Number of years (Y) × 12→n Initial interest rate (I) ÷ 12→i% COMP PMT	Amount of loan (A) Number of years (Y) Initial interest rate (I) Number of years repaid at R (N) Number of interest rate changes (T)
①' Principal remaining after ① payment.	Use financial keys BAL ($N \times 12$)	
①'' Remaining number of years after ① payment.	Number of years in first interest period (Y) − Number of years (N)	
② Amount of principal repaid for n years after first interest rate change	Monthly payment (PMT) × Number of repayments ($12 \times n$) ↳Use financial keys ①'→PV ①'' × 12→n Initial interest rate (I) ÷ 12→i% COMP PMT	New interest rate (I) Number of years repaid at R (N)
②' Principal remaining after ② payment.	Use financial keys BAL ($N \times 12$)	
②'' Remaining number of years after ② payment.	①''— number of years (N)	
Continue until the Tth interest change.		
③ Total principal and interest	① + ② + ... (Totalize amount of principal and interest repaid at each interest rate.)	

•Flow chart



•Coding

	(MODE 2) Program															Step
1	Fcl	:	Norm	↵												4
2	"	A	M	O	U	N	T	"	?	→	A	↵				16
3	"	T	O	T	A	L		Y	E	A	R	S	"	?	→	31
4	Y	↵														33
5	"	I	N	T	E	R	E	S	T		R	A	T	E	"	48
6	?	→	I	↵												52
7	"	Y	E	A	R	S	"	?	→	N	↵					63
8	"	C	H	A	N	G	E	"	?	→	T	↵				75
9	A	→PV	:	Y	×12→n	:	I	÷12→i%	↵							84
10	(−)	1	2	COMP PMT	N	→	F	◢								92
11	Lbl	∅	↵													95
12	COMP PMT	:	1	2	N	BAL	:	Z	→PV	↵						105
13	Y	−	N	→	Y	↵										111
14	"	I	N	T	E	R	E	S	T		R	A	T	E	"	126
15	?	→	I	↵												130
16	"	Y	E	A	R	S	"	?	→	N	↵					141
17	Y	×12→n	:	I	÷12→i%	↵										147
18	(−)	1	2	COMP PMT	N	→	B	◢								155
19	B	+	F	→	F	↵										161
20	Dsz	T	:	Goto	∅	:	F									168
21																
22																
23																
24																
25																
26																
27																
28																

Variables

A	Amount of loan	J		S	
B		K		T	Number of interest rate changes
C		L		U	
D		M		V	
E		N	Number of years	W	
F		O		X	
G		P		Y	Total number of years
H		Q		Z	
I	Interest rate	R			

•Sample execution

[MODE] [1] [AC]
[Prog] [0] [EXE] (Recall program)
100000[EXE] (Amount of loan)
25[EXE] (Total number of years)

```
Prog0
AMOUNT?
100000
TOTAL YEARS?
25
INTEREST RATE?
■ SMP CMP MCI AMR DCF
```

(Interest rate for
5.6[EXE] first period)
5[EXE] (Number of repayments at 5.6%)
3[EXE] (Number of interest rate changes. Enter 0 for fixed rate)

```
5.6
YEARS?
5
CHANGE?
3
     37'204.42376
          - Disp -
■ SMP CMP MCI AMR DCF
```

(Total principal and interest repaid during first five years)

[EXE]
6[EXE] (Interest rate for first change)
5[EXE] (Number of payments at 6%)

```
     37'204.42376
INTEREST RATE?
6
YEARS?
5
     38'431.98065
          - Disp -
■ SMP CMP MCI AMR DCF
```

(Total principal and interest repaid during second five years)

[EXE]
7[EXE] (Interest rate for second change)
5[EXE] (Number of payments at 7%)

```
     38'431.98065
INTEREST RATE?
7
YEARS?
5
     40'935.5587
          - Disp -
■ SMP CMP MCI AMR DCF
```

(Total principal and interest repaid during third five years)

[EXE]
6[EXE] (Interest rate for third change)
10[EXE] (Number of payments at 6%)
[EXE]

```
     40'935.5587
INTEREST RATE?
6
YEARS?
10
     78'283.45189
    194'855.415
■ SMP CMP MCI AMR DCF
```

(Total principal and interest repaid during final ten years)
(Accumulated total)

Application Library

•In some cases, symbols shown in the program list may differ from those used in actual key operation. Refer to the chart shown below when making actual key entries.

Symbols on program list	Actual key operation
→	[STO] (Displayed simultaneously with variable when variable is input after pressing [STO].)
÷12 → *i* %	[i÷12] (F2)
→ PV	[PV] (F3)
×12 → *n*	[n×12] (F1)

1 Final worth factor

Formula

Total of principal and interest = principal (1 + interest rate)^{Term}

Example

Determine the final worth factor at an interest rate of 4.40%.

Operation example

Key operation	Display	
MODE 1 AC Prog 0 EXE (Recall program) 4.4 EXE (Interest rate) EXE	Prog0 INTEREST RATE? 4.4 1. 1.044 - Disp -	(Initial term) (Final worth factor after initial term)
EXE EXE	INTEREST RATE? 4.4 1. 1.044 2. 1.089936 - Disp -	(Second term) (Final worth factor after second term)

(Press AC key to end program after you have derived the appropriate final worth factor.)

	(MODE 2) Program															Step
1	Fcl	:	Norm	↵												4
2	"	I	N	T	E	R	E	S	T		R	A	T	E	"	19
3	?	→	I	:	1	→	N	↵								27
4	Lbl	0	↵													30
5	N	◢														32
6	FWF(	I	,	N	)	◢										38
7	Isz	N	:	Goto	0											43
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
26																
27																
28																

Variables

A		J		S	
B		K		T	
C		L		U	
D		M		V	
E		N	Number of terms	W	
F		O		X	
G		P		Y	
H		Q		Z	
I	Interest rate	R			

*Enter FWF(using SHIFT 3 (see page 104).

2 Duration of allotment for progressive private annuities

Formula

$$\text{Possible duration of payments from an annuity} = \frac{\left\{1 - \frac{\text{amount of deposit} \times \left(\text{interest rate on deposit} - \text{progressive rate of annuity}\right)}{\text{Amount of annuity for initial year}}\right\} \text{(common logarithm)}}{\left(\frac{1 + \text{progressive rate of annuity}}{1 + \text{interest rate on deposit}}\right) \text{(common logarithm)}}$$

Example

The annual rate of interest on deposit is 6.25%. Determine the number of years you will receive allotments from your annuity with an initial-year annuity of $18,000 and a progressive rate of 5% on a deposit of $250,000.

Operation example

Key operation	Display
MODE 1 AC Prog 0 EXE (Recall program) 6.25 EXE (Interest rate) 18000 EXE (Annuity for initial year)	Prog0 INTEREST RATE? 6.25 ANNUITY? 18000 PROGRESSIVE R.? ■ SMP CMP MCI AMR DCF
5 EXE (Progressive rate) 250000 EXE (Value of deposit)	18000 PROGRESSIVE R.? 5 DEPOSIT? 250000 16.11 - Disp - ■ SMP CMP MCI AMR DCF

	(MODE 2) Program															Step
1	Fix	2	↵													3
2	"	I	N	T	E	R	E	S	T		R	A	T	E	"	18
3	?	→	I	↵												22
4	"	A	N	N	U	I	T	Y	"	?	→	A	↵			35
5	"	P	R	O	G	R	E	S	S	I	V	E		R	.	50
6	"	?	→	P	↵											55
7	"	D	E	P	O	S	I	T	"	?	→	D	↵			68
8	log	(	1	−	.	0	1	D	(	I	−	P	)	÷	A	83
9	)	÷	log	(	(	1	+	.	0	1	P	)	÷	(	1	98
10	+	.	0	1	I	◢										104
11	Norm															105
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
26																
27																
28																

Variables

A	Amount of annuity for initial year	J		S	
B		K		T	
C		L		U	
D	Amount of deposit	M		V	
E		N		W	
F		O		X	
G		P		Y	
H		Q		Z	
I	Annual interest rate on deposit	R	Progressive rate of annuity		

3 Conversion of effective interest rate to add-on interest rate

Formula

$$\text{Add-on interest rate} = \frac{\text{Effective interest rate}}{1-\left(1+\text{effective interest rate}\right)^{-\text{(Number of monthly installments)}}} - \frac{1}{\text{Number of monthly installments}}$$

Example

Determine the annual add-on interest rate in order to acquire a 20-month add-on loan, with a real interest rate of 12%.

Operation example

Key operation	Display
MODE 1 AC	
Prog 0 EXE (Recall program)	
12 EXE (Effective interest rate)	
20 EXE (Number of monthly installments)	
	Prog0 INTEREST RATE? 12. TERM 20. 6.50 (Annual add-on interest rate) - Disp - SMP CMP MCI AMR DCF

	(MODE 2, MODE 4) Program															Step
1	Fcl	:	Fix	2	↵											5
2	"	I	N	T	E	R	E	S	T		R	A	T	E	"	20
3	?	→	I	:	I	÷	1	2	−	I	↵					31
4	"	T	E	R	M	"	?	→	N	↵						41
5	USPWF(	I	,	N	)	→	A	↵								49
6	1	2	Ø	Ø	(	A	x^{-1}	−	N	x^{-1}	◢					60
7	Norm															61
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
26																
27																
28																

Variables

A		J		S	
B		K		T	
C		L		U	
D		M		V	
E		N	Number of monthly installments	W	
F		O		X	
G		P		Y	
H		Q		Z	
I	Annual effective interest rate	R			

*Enter USPWF(using SHIFT 6 (see page 104).

4 Conversion of add-on interest rate to effective interest rate

Formula

$$\text{Interest rate according to add-on method} + \frac{1}{\text{Number of monthly installments}} = \frac{\text{Effective interest rate}}{1-\left\{1+\text{Effective interest rate}\right\}^{-(\text{Number of monthly installments})}}$$

- The formula listed above is a high-power equation for effective interest rate, which cannot easily be solved. Because of this, effective interest rate wherein both sides of the formula are equal is derived using approximation.
- Due to the repetitive calculation required in approximation, some time is required for completion of the calculation.
- Use the succeeding program when the ratio of effective interest to the displayed add-on interest is 1.48 or over. If this ratio is lower, adjust the corresponding value appropriately in the program.

Example

Derive the annual rate of real interest to which a 15-month add-on loan with monthly installments at 9.6% annual interest corresponds.

Operation example

Key operation	Display
MODE 1 AC Prog 0 EXE (Recall program) 9.6 EXE (Annual add-on interest rate) 15 EXE (Number of installments)	Prog0 INTEREST RATE? 9.6 TERM? 15 17.41 - Disp - ■ SMP CMP MCI AMR DCF (Annual effective interest rate)

	(MODE 2) Program															Step
1	"	I	N	T	E	R	E	S	T		R	A	T	E	"	15
2	?	→	I	↵												19
3	"	T	E	R	M	"	?	→	N	↵						29
4	I	÷	1	2	Ø	Ø	→	I	:	1	.	4	8	I	→	44
5	R	:	I	+	N	x^{-1}	→	I	↵							53
6	Lbl	Ø	↵													56
7	R	+	10^x	(−)	4	→	R	↵								64
8	R	÷	(	1	−	(	1	+	R	)	y^x	(−)	N	→	B	79
9	:	I	>	B	⇒	Goto	Ø	:	Fix	2	:	R	−	10^x	(−)	94
10	4	→	S	↵												98
11	S	÷	(	1	−	(	1	+	S	)	y^x	(−)	N	→	C	113
12	:	S	+	10^x	(−)	4	(	I	−	C	)	÷	(	B	−	128
13	C	)	→	T	↵											133
14	1	2	Ø	Ø	T	◢										139
15	Norm															140
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
26																
27																
28																

Variables

A		J		S	Approximation of effective interest rate (low)
B	Right side of the formula when interest rate is R	K		T	Effective interest rate
C	Right side of the formula when interest rate is S	L		U	
D		M		V	
E		N	Number of monthly installments	W	
F		O		X	
G		P		Y	
H		Q		Z	
I	Add-on interest rate	R	Approximation of effective interest rate (high)		

5 Loans featuring uniform depreciation of principal

Formula

$$\text{Total principal/interest repay amount of each installment number} = \frac{\text{Amount borrowed}}{\text{Total number of installments}} \times \left\{1 + \left(\text{Total number of installments} - \text{Corresponding installment number} + 1\right) \times \text{Interest rate}\right\}$$

Example

Determine the total interest amount and repayment amount you will pay during a 1-year period on a 10-year $120,000 loan with an annual interest rate of 9%.

Operation example

Key operation	Display
MODE 1 AC Prog 0 EXE (Recall program) 120000 EXE (Amount borrowed) 10 EXE (Number of installments)	Prog0 BORROWED? 120000 TERM? 10 INTEREST RATE? SMP CMP MCI AMR DCF
9 EXE (Annual interest rate) EXE	TERM? 10 INTEREST RATE? 9 10'800.00 → (Initial interest installment) 22'800.00 → (Initial principal/interest installment) - Disp - SMP CMP MCI AMR DCF
EXE EXE ⋮	INTEREST RATE? 9 10'800.00 22'800.00 9'720.00 → (Second interest installment) 21'720.00 → (Second principal/interest installment) - Disp - SMP CMP MCI AMR DCF
	Displayed consecutively
EXE	3'240.00 15'240.00 2'160.00 14'160.00 1'080.00 13'080.00 → (Tenth principal/interest installment) 11. → (End of repayment) SMP CMP MCI AMR DCF

	(MODE 2) Program															Step
1	Fix	2	↵													3
2	"	B	O	R	R	O	W	E	D	"	?	→	B	↵		17
3	"	T	E	R	M	"	?	→	N	↵						27
4	"	I	N	T	E	R	E	S	T		R	A	T	E	"	42
5	?	→	I	↵												46
6	1	→	A	↵												50
7	Lbl	ø	↵													53
8	B	÷	N	×	(	1	+	.	ø	1	I	(	N	−	A	68
9	+	1	)	)	→	C	↵									75
10	C	−	B	÷	N	◢										81
11	C	◢														83
12	Isz	A	↵													86
13	A	<	N	+	1	⇒	Goto	ø	↵							95
14	Norm															96
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
26																
27																
28																

Variables

A	Corresponding installment number	J		S	
B	Amount borrowed	K		T	
C	Amount of corresponding installment	L		U	
D		M		V	
E		N	Total number of installments	W	
F		O		X	
G		P		Y	
H		Q		Z	
I	Annual interest rate	R			

6 Interest on lease installments

Formula

$$\text{Amount of 1 (1-month) installment} = \frac{\text{Price of leased item} \times \text{Monthly interest rate}}{1 - \left(\frac{1}{1 + \text{Monthly interest rate}}\right)^{\text{(Lease period)}} + \text{Number of installments paid in advance} \times \text{Monthly interest rate}}$$

(Lease period : Number of applicable months)

- Lease agreements generally contain some elements in addition to interest, however this formula is used only to determine the affect of interest on the overall calculation.
- The above formula is a derivative of the following formula.

$$\text{Amount of 1 (1-month) installment} = \left(\text{Price of leased item} - \text{Number of installments paid in advance} \times \text{Amount of 1 (1-month) installment}\right) \times \frac{\text{Monthly interest rate}}{1 - \left(\frac{1}{1 + \text{Monthly interest rate}}\right)^{\text{(Lease period)}}}$$

Example

You've arranged to lease out a car with a sticker price of $75,000 for 24 months. At the end of the lease term, the customer will owe nothing on the car. According to the agreement, the last three installments will be paid in advance. How much should the monthly installments be in order to earn an annual yield of 8%?

Operation example

Key operation	Display
[MODE] [1] [AC]	
[Prog] [0] [EXE] (Recall program)	Prog0 PRICE? 75000 TOTAL NUMBER? 24 ADVANCE ■ SMP CMP MCI AMR DCF
75000 [EXE] (Price of leased item)	
24 [EXE] (Number of installments)	
3 [EXE] (Number of installments made in advance)	24 ADVANCE? 3 INTEREST RATE? 8 3'328.06 - Disp - ■ SMP CMP MCI AMR DCF (Amount of monthly installment)
8 [EXE] (Annual interest rate)	

	([MODE] [2]) Program															Step
1	Fix	2	↵													3
2	"	P	R	I	C	E	"	?	→	P	↵					14
3	"	T	O	T	A	L		N	U	M	B	E	R	"	?	29
4	→	T	↵													32
5	"	A	D	V	A	N	C	E	"	?	→	N	↵			45
6	T	−	N	→	T	↵										51
7	"	I	N	T	E	R	E	S	T		R	A	T	E	"	66
8	?	→	I	↵												70
9	.	0	1	I	÷	1	2	→	I	↵						80
10	P	I	÷	(	1	−	(	1	+	I	)	y^x	(−)	T	+	95
11	N	I	)	◢												99
12	Norm															100
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
26																
27																
28																

Variables

A		J		S	
B		K		T	Total number of installments
C		L		U	
D		M		V	
E		N	Number of installments paid in advance	W	
F		O		X	
G		P	Price of leased item	Y	
H		Q		Z	
I	Annual interest rate	R			

7 Breakeven point calculation

Formula

$$\text{Number of units to sell to reach breakeven point} = \frac{\text{Fixed costs}}{\text{Selling price} - \text{Variable costs (Per unit)}}$$

Profit = Sales − Variable costs × Number of units sold − Fixed expenses

Example

(1) The fixed costs incurred in producing a certain product total $17,000 per month, with variable costs per unit of $16. If the selling price is $60 per unit, how many units must you sell to reach the breakeven point?
(2) What would your profit be if you sold 400 units at a price of $65?
(3) If you can sell only 370 units per month, what unit price must be set to earn gross profits of $2,600?

Operation example

Key operation	Display
MODE 1 AC Prog 0 EXE (Recall program) 17000 EXE (Fixed costs) 16 EXE (Variable costs)	Prog0 FIXED COSTS? 17000 VARIABLE COSTS? 16 T? SMP CMP MCI AMR DCF
1 EXE (Necessary unit sales: T=1) 60 EXE (Selling price)	16 T? 1 PRICE? 60 386.36 (Necessary unit sales) - Disp - SMP CMP MCI AMR DCF
EXE 2 EXE (Gross profit: T=2) 65 EXE (Selling price) 400 EXE (Unit sales)	2 PRICE? 65 UNIT? 400 2'600.00 (Gross profit) - Disp - SMP CMP MCI AMR DCF
EXE 3 EXE (Unit selling price: T=3) 2600 EXE (Gross profit) 370 EXE (Unit sales)	3 GROSS PROFIT? 2600 UNIT? 370 68.97 (Unit selling price) - Disp - SMP CMP MCI AMR DCF
EXE 4 EXE (End program: T=4)	2600 UNIT? 370 68.97 T? 4 4. SMP CMP MCI AMR DCF

When "T" is input. T=1 : Number of units which must be sold T=2 : Gross profits T=3 : Unit price T=4 : End

	(MODE 2) Program															Step
1	Fix	2	↵													3
2	"	F	I	X	E	D		C	O	S	T	S	"	?	→	18
3	F	:	"	V	A	R	I	A	B	L	E		C	O	S	33
4	T	S	"	?	→	V	↵									40
5	Lbl	0	↵													43
6	?	→	T	↵												47
7	T	=	1	⇒	Goto	1	↵									54
8	T	=	2	⇒	Goto	2	↵									61
9	T	=	3	⇒	Goto	3	↵									68
10	T	=	4	⇒	Goto	4	↵									75
11	Lbl	1	↵													78
12	"	P	R	I	C	E	"	?	→	P	↵					89
13	F	÷	(	P	−	V	)	◢								97
14	Goto	0	↵													100
15	Lbl	2	↵													103
16	"	P	R	I	C	E	"	?	→	P	↵					114
17	"	U	N	I	T	"	?	→	U	↵						124
18	(	P	−	V	)	U	−	F	◢							133
19	Goto	0	↵													136
20	Lbl	3	↵													139
21	"	G	R	O	S	S		P	R	O	F	I	T	"	?	154
22	→	G	↵													157
23	"	U	N	I	T	"	?	→	U	↵						167
24	(	G	+	F	+	U	V	)	÷	U	◢					178
25	Goto	0	↵													181
26	Lbl	4	↵													184
27	Norm															185
28																

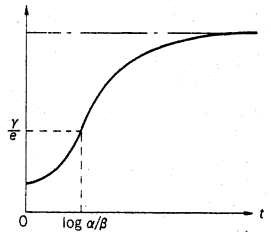
Variables

A		J		S	
B		K		T	Specify operation
C		L		U	Units sold
D		M		V	Variable costs per unit
E		N		W	
F	Fixed exprenses	O		X	
G	Gross profit	P	Per unit sales price	Y	
H		Q		Z	
I		R			

8 Gompertz curve

Formula $y_t = \gamma a^{b^t}$ $(e^{-\alpha} = a,\ e^{-\beta} = b)$

•Gompertz curve



$\alpha>1,\ 0<\beta<1,\ \gamma>0$
$y_t = \gamma \exp(-\alpha e^{-\beta t})$
(exp = exponential)

•3-point estimation method used to derive estimated α, β, and γ parameters.

Example

The following chart lists the population fluctuation for a certain city, for the nine years beginning 1970 and ending in 1978. Using Gompertz curve, determine this city's saturation population. Also, predict the city's population level for the year 1990 (21st year, $t = 21$).

Year (t)	Population (A)
1970 (1)	146583
1971 (2)	150203
1972 (3)	161475
1973 (4)	169182
1974 (5)	177619
1975 (6)	183054
1976 (7)	189431
1977 (8)	193082
1978 (9)	195687

Operation example

Key operation	Display
MODE 1 AC	
Prog 0 EXE (Recall program)	Prog0 NUMBER? 3 DATA? 146583 DATA?
3 EXE (Number of data for 1 group)	
146583 EXE (Value for $t=1$)	
⋮ Succeeding values for t ⋮	
195687 EXE (Value for $t=9$)	193082 DATA? 195687 YEARS? 100
100 EXE (Number of years far into future — 100 for example. Population calculation will not change very much even if a value over 100 is input.)	220' 212. 90 - Disp - (Saturation population)
EXE 21 EXE (Calculate for 21st year)	220' 212. 90 YEARS? 21
EXE 0 EXE	216' 983. 27 (Estimated population for 1990) YEARS? 0 -1.

*Number of data for 1 group is obtained by dividing the total number of data by 3 according to 3-point estimation method.

	(MODE 2)	Program													Step
1	Fix	2	:	O	→	L	↵								7
2	"	N	U	M	B	E	R	"	?	→	N	↵			19
3	Lbl	∅	↵												22
4	Isz	L	:	L	>	3	⇒	Goto	3	↵					32
5	O	→	M	:	O	→	S	↵							40
6	Lbl	1	↵												43
7	Isz	M	:	M	>	N	⇒	Goto	2	↵					53
8	"	D	A	T	A	"	?	→	A	↵					63
9	S	+	ln	A	→	S	:	Goto	1	↵					73
10	Lbl	2	↵												76
11	L	=	1	⇒	S	→	H	:	L	=	2	⇒	S	→	I	91
12	:	L	=	3	⇒	S	→	J	:	Goto	∅	↵				103
13	Lbl	3	↵													106
14	"	Y	E	A	R	S	"	?	→	T	↵					117
15	Dsz	T	:	T	<	∅	⇒	Goto	4	↵						127
16	(	J	−	I	)	÷	(	I	−	H	)	→	C	:	C	142
17	y^x	N	x^{-1}	→	B	:	(	H	−	I	)	(	B	−	1	157
18	)	÷	(	C	−	1	)	x^2	→	D	↵					168
19	N	x^{-1}	(	H	J	−	I	x^2	)	÷	(	H	−	2	I	183
20	+	J	)	→	K	:	e^x	K	→	K	↵					194
21	K	(	e^x	(−)	D	)	y^x	(	B	y^x	T	)	◢			207
22	Goto	3	↵													210
23	Lbl	4	↵													213
24	Norm															214
25																
26																
27																
28																

Variables

A	Data	J	Partial sum of Group 3	S	
B		K		T	Amount of years
C		L		U	
D		M		V	
E		N	Amount of data for 1 group	W	
F		O		X	
G		P		Y	
H	Partial sum of Group 1	Q		Z	
I	Partial sum of Group 2	R			

Error Message Table

Message	Meaning	Action
Syn ERROR	① Incorrect formula format ② Incorrect formula in programmed calculation.	① Press ◄ or ► to locate error and correct. ② Press ◄ or ► to locate error and correct.
Ma ERROR	① Calculation result out of range. ② Calculation performed outside input range of function. ③ Illegal mathematical operation (i.e. division by zero). ④ Financial conditions insufficient for financial calculations or graphs.	① ② ③ ④ Check entered values to ensure they are within range. Be sure to check values in memory.
Go ERROR	① No label (Lbl *n*) matches that specified by Goto. ② No programmed calculation contained in area specified by Prog.	① Match Goto with label or delete Goto. ② Match Prog with program number or delete Prog.
Ne ERROR	•Nesting of subroutines by Prog *n* exceeds 10 levels.	•Check whether Prog *n* is used for return from subroutine Eliminate unnecessary Prog *n* branches. •Check for meaningless branches (i.e. branching to current program area).

Message	Meaning	Action
Stk ERROR	•Capacity of numeric stack or command stack exceeded.	•Simplify calculation to keep it within the 8-step limitation of the numeric stack and 20-step limitation of the command stack. •Break down formula into multiple pieces.
Mem ERROR	•Memory error caused when number of CF*j*'s exceeds 61.	•Keep memory usage within specified range (61 CF*j*'s).
Arg ERROR	•Illegal argument.	•Use correct arguments: Sci *n*, Fix *n* = natural number 0 ~ 9 Goto *n*, Lbl *n*, Prog *n* = natural number 0 ~ 9 •Check for correct arguments for PRN, INT, BAL, N*j*, DB, SYD, SYL
Uns ERROR	*i*%, IRR, or YLD calculation too complex to solve.	•Re-input and check. •For IRR, input initial value and calculate.

Input Range of Functions (general rules)

Function name	Input range	Accuracy of results
$\log x$, $\ln x$	$10^{-99} \leqq x \leqq 10^{100}$	±1 in the 10th digit
e^x	$-10^{100} < x \leqq 230.2585092$	—"—
10^x	$-10^{100} < x < 100$	—"—
$\sqrt{x}$	$0 \leqq x < 10^{100}$	—"—
x^2	$\|x\| < 10^{50}$	—"—
x^{-1}	$\|x\| < 10^{100}$, $x \neq 0$	—"—
$N!$	$0 \leqq N \leqq 69$ (N is an integer)	—"—
y^x	$y>0$: $-1 \times 10^{100} < {}^1/_x \log y < 100$ $x \neq 0$ $y=0$: $x>0$ $y<0$: $x=n$, $1/(2n+1)$ *n is an integer	—"—
Statistical calculation	$\|x\| < 10^{50}$, $\|y\| < 10^{50}$, $\|n\| < 10^{100}$ $x\sigma n$, $y\sigma n$, $\bar{x}$, $\bar{y}$, a, b, r: $n \neq 0$ $x\sigma n-1$, $y\sigma n-1$: $n \neq 1, 0$	—"—

*Internal continuous calculations such as are used in y^x, $N!$, etc. may cause cumulative errors which affect accuracy.

Specifications

Model: FC-1000

Calculation function

Basic calculations: Addition/subtraction/multiplication/ division, percent calculations including mark-up/mark-down, and various types of practical calculations.

Built-in functions: Square roots, squares, exponential functions, logarithmic functions, powers, reciprocals, factorials, integer part subtraction, decimal part subtraction, internal value rounding, random number generation, absolute values

Financial functions: Simple interest, compound interest (savings, installment, loan), amortization, reciprocal conversion of percentage interest rate and effective interest rate, investment appraisal (net present value, internal rate of return, net future value, pay-back period), cost, selling price, margin calculations, bond calculations, and depreciation calculations (straight-line, sum-of-the-year's digits, declining balance)

Statistical functions: Standard deviation, linear regression, logarithmic regression, exponential regression, power regression

Memory: 26 variable memories

Programming

Number of steps: 2,470

Jump function: Unconditional jump (10 maximum), conditional jump, count jump, subroutines (9 groups up to 10 levels)

Program areas: 10 (P0 ~ P9)

Editing: Program check, debugging, delete, insert

Graph function

Graph commands: Graph, Trace

Types of graphs: Financial — simple interest, compound interest, amortization, investment appraisal, bond, depreciation (straight-line, sum-of-the-years' digits, declining balance)

General

Display/digits: 16-column × 8-line dot display, 10-digit mantissa plus 2-digit exponent, date display, symbol display

Decimal point: Nrm 1 — fixed in range of $10^{-2} \leqq |x| < 1 \times 10^{10}$, otherwise full floating
Nrm 2 — fixed in range of $10^{-9} \leqq |x| < 1 \times 10^{10}$, otherwise full floating

Error check: Indicated by "ERROR" message, locking operation

Power source: Three lithium batteries (CR2025)

Power consumption: 0.06W

Auto power off: After approximately 6 minutes

Battery life: Approximately 70 hours (continuous operation)

Ambient temperature range: 0°C ~ 40°C (32°F ~ 104°F)

Dimensions: Folded — 14(H) × 126(W) × 74(D)mm
($^1/_2$"(H) × 5"(W) × $2^7/_8$"(D))
Unfolded — 7(H) × 126(W) × 145(D)mm
($^1/_4$"(H) × 5"(W) × $5^3/_4$"(D))

Weight: 140g (4.9 oz.) including batteries

MEMO