FINANCIAL CONSULTANT

FC-200

OWNER'S MANUAL
MANUAL DEL PROPIETARIO

CASIO

FORWARD

Thank you for your purchase of the CASIO FC-200.
This unit is an advanced 12-digit financial calculator, which is equipped with features and functions allowing complex financial calculations including compound interest, amortization, interest rate conversion and investment appraisal, as well as standard deviation and regression analysis calculations.
Besides these, this unit is equipped with powerful programming capabilities.
This manual provides a basic explanation of unit operations and instructions on handling. Be sure to read it and gain a thorough understanding of this unit to assure proper operation and a long service life.
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 unit 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.

- 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.
- When the calculator is performing internal calculations, the display clears and key operation is impossible. Before entering data, check the display to confirm that the calculator is ready for further input.
- Never attempt your own maintenance or try to take the calculator apart.
- Never incinerate old batteries or the LCD panel.
- 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, benzine or other volatile agents for cleaning.
- The manufacturer assumes no responsibility for claims from third parties for loss or damages arising through the use of this calculator or examples in this manual.
- The manufacturer assumes no responsibility for any loss or damages arising from loss of data and/or programs incurred while using this calculator.
- If malfunction should occur, either bring or send the unit to your retailer or the nearest CASIO dealer. Be sure to clearly explain the problem in detail.
- Before assuming malfunction of the unit, be sure to carefully reread this manual and ensure that the problem is not due to insufficient battery power or operational errors.

About the Power Supply

- Your calculator is powered by two lithium batteries (CR2032). If the display becomes dim and difficult to read even if you adjust the contrast (see page 6), it probably means that your batteries are weak and should be replaced.
- To avoid damage caused by leaking batteries, be sure to replace them at least once every two years, regardless of how much you used the calculator during that time.
- Contents of the calculator's memory may be erased when you change batteries. Be sure to make a record of any data or program contained in memory before you replace batteries.

■ Replacing Batteries

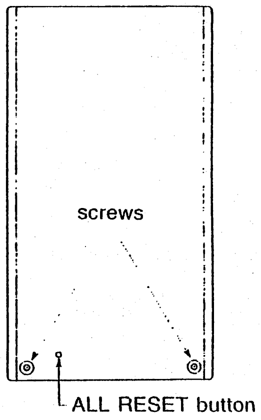
① Switch the power of the calculator OFF, and use a screwdriver to remove the two screws on the back. Remove the back cover of the calculator.

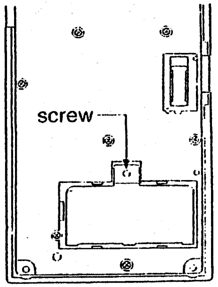
② Remove the screw fastening the battery holder in place, and remove the holder.

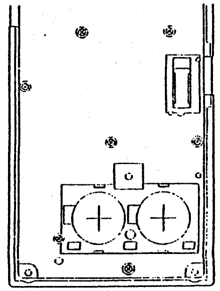
③ Remove both of the old batteries by turing the calculator so that the open battery compartment is facing downwards, and tapping gently on the calculator.

④ Wipe the surfaces of two new batteries with a soft cloth, and load them into the battery compartment ensuring that their positive ⊕ poles are facing up.

⑤ Replace the battery holder and its screw, followed by the back cover of the calculator and the two fastening screws.







Important:

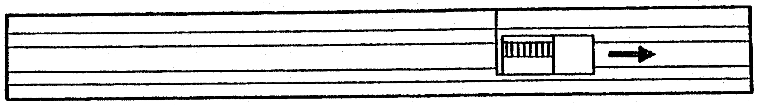
- Never expose batteries to extreme heat. Doing so can cause them to explode.
- If battery power becomes very low or if you remove batteries from the calculator for a very long time, memory contents may be erased or altered, or display and key operation may become abnormal. If you notice these symptoms, press the all reset button on the back of the calculator with a thin, pointed object. This will totally clear the memory of the calculator and make normal operation possible.
- It is possible to replace batteries quickly enough to retain the contents of the calculator's memory. Remember, though, it's always better to play it safe and write down important data and programs stored in memory before you change batteries.
- Keep batteries out of the reach of small children. If accidently swallowed, consult your physician immediately.

■ Auto Power OFF 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. 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.

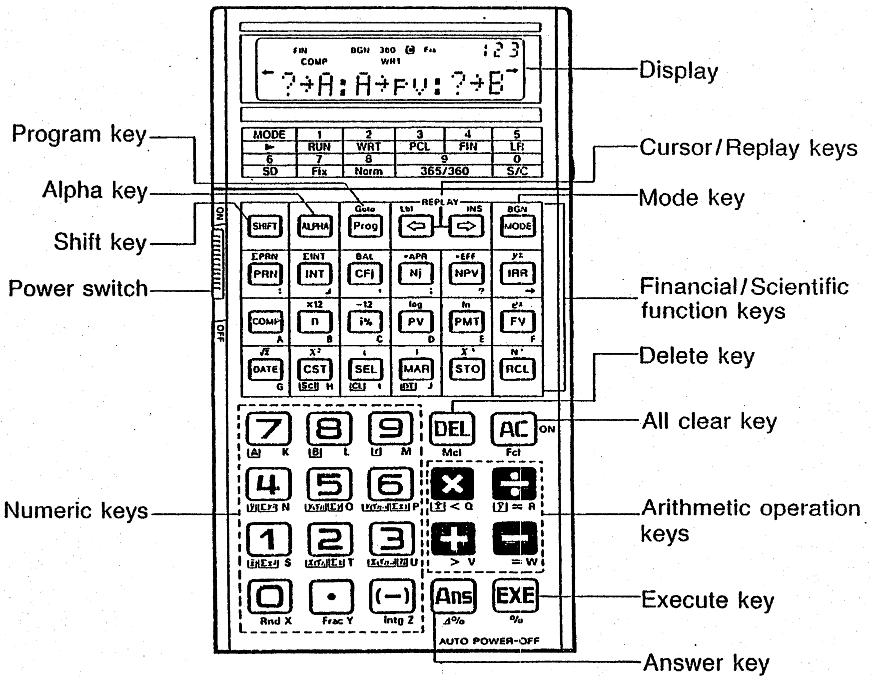
■ Contrast Adjustment

Rotate the dial on the right side of the calculator to adjust the contrast of the display.



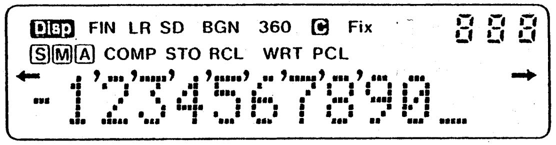
Rotating the dial in the direction indicated by the arrow makes the display darker, while rotating it in the opposite direction makes the display lighter. Whenever you find the display difficult to read, even after you adjust the contrast, replace the batteries of the calculator.

General Guide



Display

Symbols and indicators



Once you switch the power of the calculator on, a cursor, indicated by a blinking line, appears on the display. You will also notice various symbols and indicators at the top of the display. These appear when certain keys are pressed as explained for each key below.

ON OFF **Power switch**

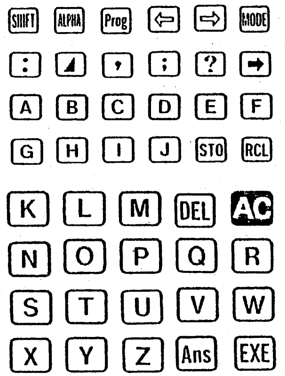
Slide up to switch power ON and down for OFF. Even when power is switched OFF, the calculator retains contents of the financial, statistical, variable, and program memories, as well as the mode settings.

[SHIFT] **Shift key**

- Press this key to perform any of the functions marked in orange on the key panel. When you press [SHIFT], the symbol [S] appears on the display to let you know that the functions marked in orange are now active. Pressing [SHIFT] again in this case clears [S] from the display and returns to a normal keyboard.

[ALPHA] **Alpha key**

- Press this key to enter any of the alphabetic characters (variable memories) or special characters marked in red on the key panel. When you press the [ALPHA] key, the symbol [A] appears on the display to let you know that the characters marked in red are now available. Pressing [ALPHA] again in this case clears [A] from the display and returns to a normal keyboard.



*In this manual, specification of a variable memory is indicated by such key sequences as [ALPHA] [A], [ALPHA] [X], etc.

Goto [Prog] **Program key**

- Use this key in the sequence [Prog] [0] ~ [9] [EXE] to execute a program stored in one of the calculator's program memories. Following [SHIFT], this key enters the "Goto" command to execute jumps (branching) within a program.

Lbl REPLAY INS [⇦] [⇨] **Cursor/Replay keys**

- These keys move the cursor to the left [⇦] and right [⇨] to position it for editing of calculations or values.
- Immediately following operation of the [EXE] key, these keys 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, edit it first and then execute it.
- Following [SHIFT], the [Lbl ⇦] key can be used to input labels into programs, while the [INS ⇨] key can be used to insert values into existing calculations.

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

- Your calculator can perform a wide variety of tasks, depending on its current mode. Specify the mode by pressing the [MODE] key followed by a numeric value from 0 through 9. See page 15 for details.
- 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, etc. The symbol "BGN" (beginning) is shown on the display when beginning of term payment is selected.

ΣPRN [PRN] : **Principal portion of loan repayment/Total principal key**

- Press to determine the amount of principal contained in any installment repaid on a loan.
- Following [SHIFT], this key returns the total principal repaid up to a certain point.
- Following [ALPHA], this key inputs a colon that acts as a delimiter for multistatements (see page 30 for details).

ΣINT [INT] ◢ **Interest portion of loan repayment/Total interest key**

- Press to determine the amount of interest contained in any installment repaid on a loan.
- Following [SHIFT], this key returns the total interest paid up to a certain point.
- Following [ALPHA], this key inputs " ◢ " that acts as a delimiter for multistatements (see page 30 for details).

BAL [CFj] , **Cash flow input/Principal balance key**

- Press to input cash flow (income/expenses) during investment appraisal (see page 61 for details).
- Following [SHIFT], this key returns the balance of the principal due on a loan.
- During paired-variable statistical calculations ([MODE] [5]), press this key after [ALPHA] to enter a delimiter for the X and Y data (see page 35 for details).

►APR [Ni] ;

Frequency/Percentage interest rate conversion key

- Press following input of a frequency when the same cash flow amount is to be used a number of times during investment appraisal (see page 61 for details).
- Following [SHIFT], this key converts an effective interest rate to its corresponding percentage interest rate (see page 59 for details).
- During statistical calculations ([MODE] [5] or [MODE] [6]), press this key after [ALPHA] to enter a frequency for data being input (see page 33 for details).

►EFF [NPV] ?

Net present value/Effective interest rate conversion key

- Press to determine the net present value during investment appraisal (see page 61 for details).
- Following [SHIFT], this key converts percentage interest rate to its corresponding effective interest rate see page 59 for details).
- When programming calculations or for repeat calculations, press this key after [ALPHA] when you want the calculator to request input of a value.

y^x [IRR] →

Internal rate of return/Power key

- Press to determine the internal rate of return during investment appraisal (see page 65 for details).
- This key is also used in combination with [SHIFT] when inputting values to calculate y to the xth power, as in: y [SHIFT] [y^x] x (see page 27 for details).
- When programming calculations, press this key after [ALPHA] to input a conditional jump.

[COMP] A

Compute key

- Press this key prior to pressing keys for the calculation of compound interest ([n], [i%], [PMT], [PV], [FV]), cost ([CST]), selling price ([SEL]), and margin ([MAR]). See page 43 for details.

×12 [n] B

Compound interest term/Term × 12 key

- Press to input the number of compound interest terms during compound interest calculations. Following [COMP], press this key to obtain the number of compound interest periods (see page 43 for details).
- Following [SHIFT], this key inputs 12 times the currently displayed value (see page 42 for details).

÷12 [i%] C

Interest rate/Interest rate ÷ 12 key

- Press to input the interest rate (as a percentage) in compound interest calculations, and when calculating the NPV during investment evaluation. Following [COMP] in compound interest calculations, press this key to obtain the interest rate (see page 42 for details).
- Following [SHIFT], this key inputs 1/12 of the displayed value (see page 42 for details).

log [PV] D

Present value (principal)/Common logarithm key

- Press to input the present value (principal) in compound interest calculations. Following [COMP] in compound interest calculations, press this key to obtain the present value (principal). See page 42 for details.
- Following [SHIFT], press this key to obtain the common logarithm (base 10) for the displayed value (see page 27 for details).

ln [PMT] E

Payment amount/Natural logarithm key

- Press to input the payment amount in compound interest calculations. Following [COMP] in compound interest calculations, press this key to obtain the payment amount (see page 42 for details).
- Following [SHIFT], press this key to obtain the natural logarithm (base e) for the displayed value (see page 27 for details).

e^x [FV] F

Future value (cumulative principal)/Natural antilogrithm key

- Press to input the future value (cumulative principal) in compound interest calculations. Following [COMP] in compound interest calculations, press this key to obtain the future value (cumulative principal). See page 42 for details.
- Following [SHIFT], press this key to obtain the natural antilogarithm (e to the power of x) for the displayed value (see page 27 for details).

$\sqrt{x}$ [DATE] G

Date input/Square root key

- Press during day/date calculations to input each element of date information, as in: month [DATE] day [DATE] year [DATE].
- Following [SHIFT], press this key to obtain the square root of the displayed value (see page 27 for details).

x^2 [CST] Scl H

Cost/Square key

- Press to input the cost in cost, selling price, and margin calculations ([MODE] [4]: FIN mode).
- Following [SHIFT], press this key to obtain the square of the displayed value (see page 27 for details).
- During statistical calculations ([MODE] [5], [MODE] [6]), press to clear the statistical memories (see page 33 for details).

([SEL] CL I

Selling price key

- Press to input the selling price in cost, selling price, and margin calculations ([MODE] [4]: FIN mode).
- Following [SHIFT], press this key to input an open parenthesis (see page 23 for details).
- During statistical calculations ([MODE] [5], [MODE] [6]), this key is used to edit data that has already been input (see page 35 for details).

) [MAR] DT J

Margin key

- Press to input the margin in cost, selling price, and margin calculations ([MODE][4]: FIN mode).
- Following [SHIFT], press this key to input a closed parenthesis (see page 23 for details).
- During statistical calculations ([MODE][5], [MODE][6]), press to input data (see page 33 for details).

x^{-1} [STO]

Store/Inverse number key

- Press to enter a value into a variable memory.
- Following [SHIFT], press this key to obtain the inverse number of the displayed value.

N! [RCL]

Data recall/Factorial key

- Press preceding the following keys to recall the data that corresponds to the respective key: [n], [i%], [PV], [PMT], [FV], [CST], [SEL], [MAR], [CFj], (j=0~19), [Nj] (j=0~99).
- Following [SHIFT], press this key to obtain the factorial of the displayed value (see page 27 for detalis).

[1]~[9], [0], [·] Numeric keys

- Press to enter numbers and the decimal point during arithmetic calculation.
- Following [SHIFT] or [ALPHA], the numeric keys perform the functions listed below.
  - [SHIFT][0] — Internal rounding
    The internal value (stored in the Y register) is cut off so as to be equal to the displayed value.
  - [SHIFT][·] — Fraction
    This operation eliminates the integer part of a value and returns its decimal part only.

  *Following operations are valid only in statistical calculations ([MODE][5] or [MODE][6]) see page 33 for details.
  - [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)

[(−)] Intg Z

Minus/Integer key

- Press immediately before inputting a value to specify that the value is negative, as in: −123 →[(−)][1][2][3].
- Following [SHIFT], press this key to obtain the integer part of the displayed value.

[DEL] Mcl

Delete key

- Press to delete the character or symbol at the current cursor location.
- The following operation clears all of the variable memories: [SHIFT][DEL][EXE]. See page 26 for details.

[AC] ON Fcl

All clear key

- Press to clear all displayed calculations or values.
- This key is also used to clear the "ERROR" display that appears when an error occurs.
- After operation of the Auto Power OFF function (see page 6 for details), press this key to restore power to the calculator.
- The following operation clears all of the financial memories: [SHIFT][AC][EXE].

[+], [−], [×], [÷] Arithmetic operation keys

- Enter arithmetic operations just as they are written, from left to right.
- Following [SHIFT], these keys can be used to enter relational operators into programs.
- In the LR mode ([MODE][5]), [×] and [÷] are used to calculate estimated values in regression calculations. Following [SHIFT], [×] obtains $\hat{x}$, while [SHIFT][÷] obtains $\hat{y}$.

[EXE]

Execute key

- Press to execute an operation and obtain its result.
- This key is also used during programmed calculations to enter values required by the program.
- Following [SHIFT], press this key to perform percent calculations (see page 25 for details).

[Ans]

Answer key

- Press to display the last result obtained by operation of the [EXE] key.
- After program execution, pressing this key obtains the last result obtained using the [EXE] key.
- Following [SHIFT], press this key to perform delta percent calculations (see page 25 for details).

Helpful Hints for Easier Calculations

The information given in this section should help you to understand the internal workings of the calculator, to help you enter data in the most efficient manner.

Order of Operations

Operations are performed in the following order of precedence:

① Financial: n, $i\%$, PV, PMT, FV, CST, SEL, MAR, NPV, IRR
② Type A functions*: x^2, x^{-1}, N!, STO IRR
③ Powers: y^x
④ Pi, memory, parenthetical operation preceded by a multiplication operation that does not use a multiplication symbol (including financial memories)
⑤ Type B functions*: $\sqrt{\ }$, log, ln, e^x, (−), Abs, Intg, Frac, PRN, INT, BAL, ΣPRN, ΣINT
⑥ Type B function* preceded by a multiplication operation that does not use a multiplication symbol
⑦ Interest 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.

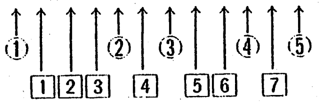
- In the case that the order of precedence is identical, the operation is performed from left to right.
- Complex functions are executed from left to right.
- All expressions contained in parentheses are performed first.

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 its 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 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:

2 × ((3 + 4 × (5 + 4) ÷ 3) ÷ 5) + 8 =



Numeric stack

①	2
②	3
③	4
④	5
⑤	4
⋮	

Command stack

$\boxed{1}$	×
$\boxed{2}$	(
$\boxed{3}$	(
$\boxed{4}$	+
$\boxed{5}$	×
$\boxed{6}$	(
$\boxed{7}$	+
⋮	

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

Understanding Modes

Before you start your calculations, you much first tell it how to handle the information you are about to input. The condition that the calculator goes into at this time is called a mode.

• Operation 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 run programs.
MODE 2 (WRT mode)	............Use this mode to create new programs and to edit existing programs (see page 77 for details). The symbol "WRT" is shown on the display when the calculator is in this mode.
MODE 3 (PCL mode)	............Use the PCL mode when you want to delete a program that is stored in the memory of the calculator (see page 81 for details. The symbol "PCL" is shown on the display when the calculator is in this mode.

- **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. The symbol "FIN" is shown on the display when the calculator is in this mode.

MODE 5 (LR mode) ....Use this mode for regression calculations (paired-variable statistics) and financial calculations (except CST, SEL, MAR). The symbol "LR" is shown on the display when the calculator is in this mode.

MODE 6 (SD mode) ....Use this mode for standard deviation and financial calculations (except CST, SEL, MAR). The symbol "SD" is shown on the display while the calculator is in this mode.

•Only one calculation mode can be in effect at any time — they cannot be used in combination.

- **Display modes**

MODE 7 (FIX mode) ....Use this mode to specify the number of decimal places for the fractional part of a value. The symbol "FIX" is shown on the display while the calculator is in this mode.

MODE 8 (NORM mode) ....Use this mode to cancel specifications made in the FIX mode. No symbol is shown on the display while the calculator is in this mode.

•The display modes are used in combination with the modes listed below.

Mode 3 — PCL (program clear)
Mode 4 — FIN (financial)
Mode 5 — LR (linear regression)
Mode 6 — SD (standard deviation)
Mode 9 — Number of days (360 or 365)
Mode 0 — Simple/Compound interest mode

*The current display mode specification is retained even when the power of the calculator is switched OFF.

- **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. The symbol "360" is shown on the display while 360-day year is specified.

- **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 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. The symbol "C" is shown on the display when the C mode is selected.

■ 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 N!.
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 79 steps for one calculation. After you input 73 steps the blinking "–" cursor changes to "▮" to indicate that you are reaching the limit. Calculations longer than 79 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: 1 2 3 5 → 1 2 3 4

Operation	Display
1 2 3 5	1235_
⇦	123$\underline{5}$
4	1234_

*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: 3 6 9 × × 2 → 3 6 9 × 2

Operation	Display
3 6 9 × × 2	369××2_
⇦ ⇦	$369\times\underline{\times}2$
DEL	$369\times\underline{2}$

- For insertion, use the ⇦ and ⇨ cursor keys to locate the cursor at the position of the insertion and press SHIFT ⇨. This will open up a space at the cursor's location, indicated by "[ ]". You can then insert a command or value inside of the "[ ]".

Example: 1 2 3 → 1 2 $\boxed{5}$ 3

Operation	Display
1 2 3	123_
⇦	$12\underline{3}$
SHIFT ⇨	12[ ]3
5	$125\underline{3}$

■ About Overflows and Errors

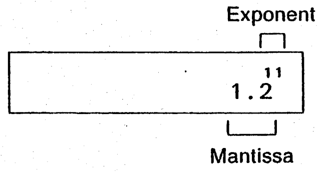
When predetermined calculation ranges are exceeded, the calculator will display "ERROR" at the bottom of the display and disable any further calculation. This will occur in the following cases:

1. If an intermediate result (general, financial, function, statistical calculations) or a value stored in a memory exceeds $\pm(9.999999999\times10^{99})$. Values stored in memory prior to the overflow are retained.
2. If a function calculation exceeds the input range shown on page 110.
3. If an error is made in operation during standard deviation or regression calculation (i.e. calculation of $\bar{x}$ or σ_n when $n=$ 0, or division by zero).

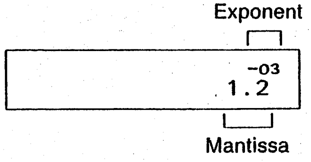
- When an error occurs, press the AC key to clear it and resume normal operation.

■ Reading the Display

Generally, values are displayed up to 12 digits long. When an intermediate or final result exceeds 12 digits, the calculator automatically switches over to exponential display. Values from 10-billion (10^{10}) through 0.1 (10^{-1}) are represented using exponential display.



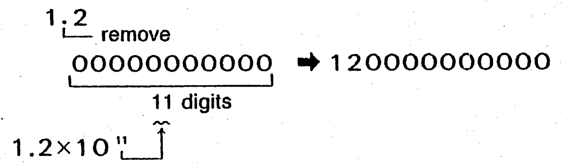
➡ 1.2×10^{11} ➡ 120,000,000,000 (120 billion)



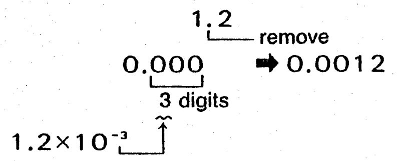
➡ 1.2×10^{-3} ➡ 0.0012

Notes on Exponential Notation

To convert a normal value from exponential notation, look at the exponent for the number 10 in the exponential notation. Then move the decimal place of the value to the right the same number of places as the exponent, adding zeros as needed. For example:



Negative values are handled the same way, except that you move the decimal place to the left instead of the right. For example:



■ Internal Rounding

Calculations are performed using a 12-digit mantissa, and results are rounded off to 10-digits. The original 12 digits, however, is retained internally. In the case of 10, 11, and 12-digit values, 001 ~ 007 is cut off, while 993 ~ 999 are rounded up, meaning that both cases result in 000.

■ 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 in Memory A.

Operation	Display
123 [STO] [ALPHA] [A]	133→A_
[EXE]	123.

- To store a value to a memory, press the [STO] key followed by the memory name.

Example: To add 74 to the contents of Memory A, and store the result in Memory B.

Operation	Display
[ALPHA] [A] [+] 74 [STO] [ALPHA] [B]	A+74→B_
[EXE]	197.

Example: To add 10 to the contents of Memory A and store the result in Memory A again.

Operation	Display
[ALPHA] [A] [+] 10 [STO] [ALPHA] [A]	A+10→A_
[EXE]	133.

- To check the contents of any memory, enter the memory name and then press [EXE].

Operation	Display
[ALPHA] [A] [EXE]	133.

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

Example: To clear Memory A

Operation	Display
0 [STO] [ALPHA] [A] [EXE]	0.

Example: To clear all variable memories.

Operation	Display
[SHIFT] [DEL Mcl]	Mcl_
[EXE]	0.

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

■ Answer (Ans) Function

The Answer function of this calculator automatically stores the last calculation result obtained by pressing [EXE]. You can recall this result by pressing [Ans] [EXE].

When [Ans] is pressed, Ans will appear on the display, and can be used in this form in subsequent calculations.

Example: 1 2 3 + 4 5 6 = $\underline{5\ 7\ 9}$

7 8 9 − $\underline{5\ 7\ 9}$ = 2 1 0

Operation	Display
[1] [2] [3] [+] [4] [5] [6]	123+456_
[EXE]	579.
[7] [8] [9] [−] [Ans]	789−Ans_
[EXE]	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.

Performing Fundamental Calculations

You can perform fundamental calculations in the RUN mode ([MODE] [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
$53+123-63=113$	53 [+] 123 [−] 63 [EXE]	113.
$0.456\times(-89)\div12=-3.382$	[•] 456 [×] [(−)] 89 [÷] 12 [EXE]	-3.382
$123456\times741852=9.158608051\times10^{10}$ (=91586080510)	123456 [×] 741852 [EXE]	9.158608051^{10}
$1.2\div(-963)=-1.246105919\times10^{-3}$ (=−0.001246105919)	1.2 [÷] [(−)] 963 [EXE]	-1.246105919^{-03}

- 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

- Enter parentheses using [SHIFT] [SEL] and [SHIFT] [MAR].

Example	Operation	Display
$100-(2+3)\times4=80$	100 [−] [SHIFT] [(] 2 [+] 3 [SHIFT] [)] [×] 4 [EXE]	80.
$2+3\times(4+5)=29$	2 [+] 3 [×] [SHIFT] [(] 4 [+] 5 [EXE]	29.
*You can omit any closed parenthesis immediately preceding the [EXE] key.		
$(7-2)\times(8+5)=65$	[SHIFT] [(] 7 [−] 2 [SHIFT] [)] [SHIFT] [(] 8 [+] 5 [EXE]	65.
*You can omit multiplication signs in front of open parentheses.		
$10-\{2+7\times(3+6)\}=-55$	10 [−] [SHIFT] [(] 2 [+] 7 [SHIFT] [(] 3 [+] 6 [EXE]	−55.
$\frac{2\times3+4}{5}=(2\times3+4)\div5=2$	[SHIFT] [(] 2 [×] 3 [+] 4 [SHIFT] [)] [÷] 5 [EXE]	2.
$\frac{5\times6+6\times8}{15\times4+12\times3}=0.8125$	[SHIFT] 5 [×] 6 [+] 6 [×] 8 [SHIFT] [)] [÷] [SHIFT] [(] 15 [×] 4 [+] 12 [×] 3 [SHIFT] [)] [EXE]	0.8125
$\frac{6}{4\times5}=0.3$	6 [÷] [SHIFT] [(] 4 [×] 5 [SHIFT] [)] [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 12-digit mantissa. To convert internal values to the displayed value, press SHIFT followed by Rnd. (Specifies 4 decimal places.)

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. 200 ÷ 7 EXE	28.571
	SHIFT Rnd EXE × 14 EXE	399.994
	(Clears the specification.) MODE 8 EXE	399.994

■ Performing Percent Calculations

Example	Operation	Display
•Percent To calculate 26% of 1,500	1500 × 26 SHIFT %	390.
•Add-on To calculate 3,620 increased by 15%.	3620 + 15 SHIFT %	4'163.
•Discount To calculate 4,750 decreased by 4%.	4750 − 4 SHIFT %	4'560.
•Ratio To calculate what percent of 250 is 75.	75 ÷ 250 SHIFT %	30. (%)
•Increase/decrease a. To calculate what percent of increase changes 120 to 141.	141 − 120 SHIFT Δ%	17.5 (%)
b. To calculate what percent of decrease changes 300 to 240.	240 − 300 SHIFT Δ%	−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.

■ Performing Memory Calculations

- Your financial calculator comes equipped with a total of 26 variable memories, "named" using the letters of the alphabet from A through Z.
- Variable memories can be used to hold data, constants and calculation results, as well as date data.
- The variable memories are non-volatile, which means that they retain their contents even when you switch the power of the calculator OFF.

To clear all variable memories, press SHIFT Mcl EXE.

Example	Operation	Display
$9.874\times7=69.118$	9.874 STO ALPHA A EXE	9.874
$9.874\times12=118.488$	ALPHA A × 7 EXE	69.118
$9.874\times26=256.724$	ALPHA A × 12 EXE	118.488
$9.874\times29=286.346$	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.		
$23+9=32$ $53-6=47$ $-)45\times2=90$ $99\div3=33$ 22	23 + 9 STO ALPHA B EXE	32.
	53 − 6 EXE	47.
	ALPHA B + Ans STO ALPHA B EXE	79.
	45 × 2 EXE	90.
	ALPHA B − Ans STO ALPHA B EXE	−11.
	99 ÷ 3 EXE	33.
	ALPHA B + Ans STO ALPHA B EXE	22.
$12\times(\underline{2.3+3.4})-5=63.4$	2.3 + 3.4 STO ALPHA G EXE	5.7
$30\times(\underline{2.3+3.4}+\underline{4.5})-15\times4.5=238.5$	12 × ALPHA G − 5 EXE	63.4
	4.5 STO ALPHA H EXE	4.5
	30 × (ALPHA G + ALPHA H) − 15 ALPHA H EXE	238.5
*The multiplication signs immediately before a memory name can be omitted.		

■ Performing Function Calculations
($\sqrt{x}$, x^2, x^{-1}, y^x, log, ln, e^x, N!, Intg, Frac)

Example	Operation	Display
$\sqrt{2}+\sqrt{5}=3.65028154$	SHIFT $\sqrt{x}$ 2 + SHIFT $\sqrt{x}$ 5 EXE	3.65028154
$2^2+3^2+4^2+5^2=54$	2 SHIFT x^2 + 3 SHIFT x^2 + 4 SHIFT x^2 + 5 SHIFT x^2 EXE	54.
$5.6^{2.3}=52.58143837$	5.6 SHIFT y^x 2.3 EXE	52.58143837
$\log1.23(=\log_{10}1.23)=0.089905111$	SHIFT log 1.23 EXE	−02 8.990511144
$\ln90(=\log e\ 90)=4.49980967$	SHIFT ln 90 EXE	4.49980967
$e^{4.5}=90.0171313$	SHIFT e^x 4.5 EXE	90.0171313
$\dfrac{1}{\dfrac{1}{3}-\dfrac{1}{4}}=12$	3 SHIFT x^{-1} − 4 SHIFT x^{-1} EXE SHIFT x^{-1} EXE	12.
$8!(=1\times2\times\cdots\cdots7\times8)=40320$	8 SHIFT N! EXE	40'320.
Intg $2.33333=2$	SHIFT Intg 2.33333 EXE	2.
Frac $2.33333=0.33333$	SHIFT Frac 2.33333 EXE	0.33333

Using Other 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 10 digits for the mantissa as in the displayed value.

Example	Operation	Display
3×4=12 continuing to ÷3.14 =	3 × 4 EXE	12.
	(continuing) ÷ 3.14	Ans÷3.14_
	EXE	3.821656051
1÷3×3=	1 ÷ 3 × 3 EXE	1.
	1 ÷ 3 EXE	0.3333333333
	(continuing) × 3 EXE	1.

This function can also be used with memory, Type A functions (page 14), +, −, ×, ÷, y^x, ▶APR, ▶EFF.

Example	Operation	Display
To store the result of 12×45 to Memory	12 × 45 EXE	540.
	(continuing) STO ALPHA C	Ans→C_
	EXE	540.
To square the result of 78÷6 (see page 27)	78 ÷ 6 EXE	13.
	(continuing) SHIFT x^2	Ans^2_
	EXE	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 execute the original calculation again, edit it first and then execute it.

Example	Operation	Display
	123 × 456 EXE	56'088.
	⇨	123×456
	EXE	56'088.
	⇦	123×456_
4.12×3.58+6.4=21.1496	4.12 × 3.58 + 6.4 EXE	21.1496
4.12×3.58−7.1=7.6496	⇦	←12×3.58+6.4_
	⇦ ⇦ ⇦ ⇦	4.12×3.58±6.→
	− 7.1	←12×3.58−7.1_
	EXE	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 one of the replay keys, make the necessary changes, and then execute the new, correct calculation.

Example	Operation	Display
When 14÷0×2.3 is mistakenly entered for 14÷10×2.3:	14 ÷ 0 × 2.3 EXE	ERROR
	⇨ (or ⇦)	14÷0×2.3 Error caused here
	⇦ SHIFT INS 1	14÷10×2.3
	EXE	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 programs and in manual calculations to connect multiple formulas or statements into a single statement. Formulas and statements are separated by colons or the symbol " ◢ " ([ALPHA] [◢]).
- When a colon is used, the formulas and statements are executed in sequence from left to right without interruption.
- When program execution reaches a " ◢ " symbol, execution of the multistatement is interrupted and the intermediate result is displayed until the [EXE] key is pressed again.

Example	Operation	Display
6.9×123=848.7	123 [STO] [ALPHA] [A] [ALPHA] [:] 6.9 [×] [ALPHA] [A] [ALPHA] [◢] [ALPHA] [A] [÷] 3.2 [EXE]	Displayed when " ◢ " is reached Disp 848.7
123÷3.2=38.4375	[EXE]	38.4375

- The final result of the multistatement will be displayed if you don't put a " ◢ " symbol at the end.
- You cannot perform continuous calculations (see page 28) within multistatements.

123×456 :+5

↑Illegal

Number of Days and Date Calculations

You can perform number of day and date calculations in the 365-day mode (calculated according to 365 days in a year), and number of day 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 or end dates is not counted in number of days 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-mode. The 360-mode is indicated by the symbol "360" on the display.

•Calculation range

January 1, 1901 ~ December 31, 2099

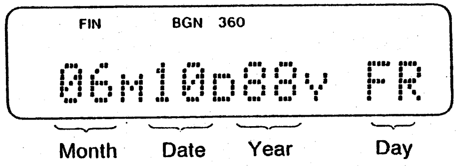
•Date input

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.

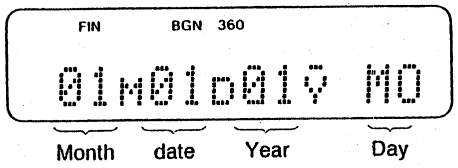
Example: To enter June 10, 1988
6 [DATE] 10 [DATE] (19) 88 [DATE]

•Reading the display

June 10, 1988 ➡



January 1, 2001 ➡



Days of week display
Sunday = SU
Monday = MO
Tuesday = TU
Wednesday = WE
Thursday = TH
Friday = FR
Saturday = SA

Y changes to Ȳ for years from 2000 ~ 2099.

•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 June 1, 1988 to January 1, 1992 (in 360-day mode).	MODE 9 6 DATE 1 DATE 88 DATE − 1 DATE 1 DATE 92 DATE EXE	360 6/1/88/- 360 1'290.
To calculate the number of days from June 1, 1988 to January 1, 1992 (in 365-day mode).	MODE 9 6 DATE 1 DATE 88 DATE − 1 DATE 1 DATE 92 DATE EXE	6/1/88/- 1'309.
To calculate the date that is 200 days from November 30, 2001 (365-day mode).	11 DATE 30 DATE 2001 DATE + 200 EXE	06M18D02$\overline{\text{Y}}$ TU
To calculate the dates 50 days, 100 days, and 150 days from May 20, 1988.	5 DATE 20 DATE 88 DATE STO ALPHA A EXE + 50 EXE ALPHA A + 100 EXE ALPHA A + 150 EXE	05M20D88Y FR 07M09D88Y SA 08M28D88Y SU 10M17D88Y MO

Performing Statistical Calculations

Before entering the statistical data, you should clear the statistical memories by pressing Scl EXE in the LR or SD mode. Remember, the memory is not cleared when you press the AC key or when you switch the power of the calculator OFF. Also keep in mind that statistical calculations utilize some of the variable memories (N, O, P, S, T, U).

■ Performing Standard Deviation Calculations

- Press MODE 6 and confirm that the "SD" indicator is shown on the display.
- Enter each data item, using the following operation:
  DATA DT. Enter negative values using (−).
  Example: (−) 50 DT (enters −50 as data)
- You can also enter identical data items by pressing the DT key repeatedly, or by using a frequency.

Example: Data: 41, 41
41 DT DT
Data: 57, 57, 57, 57, 57, 57, 57, 57
57 ALPHA : 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 population standard deviation using all data for a limited population.)

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

(For sample standard deviation using a sample from a population to estimate the standard deviation for the entire population.)

- Mean formula

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

Example	Operation	Display
Data: 55, 54, 51, 55, 53, 53, 54, 52 Press [MODE] followed by [6] to disply the SD symbol. *The same results can be obtained no matter in what sequence they are recalled.	[MODE] [6] ↓ "SD" [Scl] [EXE] 55 [DT] 54 [DT] 51 [DT] 55 [DT] 53 [DT] [DT] 54 [DT] 52 [DT]	52.
	(Standard deviation σ_n) [SHIFT] [2] [EXE]	1.316956719
	(Standard deviation σ_{n-1}) [SHIFT] [3] [EXE]	1.407885953
	(Mean $\bar{x}$) [SHIFT] [1] [EXE]	53.375
	(Number of data n) [ALPHA] [3] [EXE]	8.
	(Sum Σx) [ALPHA] [2] [EXE]	427.
	(Sum of squares Σx^2) [ALPHA] [1] [EXE]	22805.
	(Continuing) [SHIFT] [3] [SHIFT] [x^2] [EXE]	1.982142857 (Unbiased variance)

Example	Operation	Display
To calculate $\bar{x}$ and σ_{n-1} for the following table.	[Scl] [EXE] 110 [ALPHA] [;] 10 [DT]	110.
	130 [ALPHA] [;] 31 [DT]	130.
	150 [ALPHA] [;] 24 [DT]	150.
	170 [DT] [DT]	170.
	190 [DT] [DT] [DT]	190.
	[ALPHA] [3] [EXE]	70.
	[SHIFT] [1] [EXE]	137.7142857
	[SHIFT] [3] [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]
② To delete 49 [DT] which you previously entered: 49 [CL]
③ To delete 120 [ALPHA] [;], simply enter correct sequence without clearing.
④ To delete 120 [ALPHA] [;] 31 [DT] which you have just entered: [CL]
⑤ To delete 120 [ALPHA] [;] 30 [DT] which you have previously entered: 120 [ALPHA] [;] 30 [CL]

■ Regression Calculations

- Press [MODE] [5], and the indicator "LR" will appear on the display.
- Enter data using the sequence: x-DATA [ALPHA] [,] y-DATA [DT].
- You can also enter identical data items by pressing the [DT] key repeatedly.
- Use the following sequences for data entry when either the x or y-data only is identical:
  x-DATA 1 [ALPHA] [,] y-DATA 1 [DT] (inputs x-DATA 1 and y-DATA 1)
  [ALPHA] [,] y-DATA 2 [DT] (inputs x-DATA 1 and y-DATA 2)
  x-DATA 1 [ALPHA] [,] y-DATA 1 [DT] (inputs x-DATA 1 and y-DATA 1)
  x-DATA 2 [DT] (inputs x-DATA 2 and y-DATA 1)

•Performing Linear Regression Calculations

•The calculator uses the following regression formula:

$y = \mathrm{A} + \mathrm{B}x$

Coefficients A and B are calculated using the following formulas:

$$\mathrm{B} = \frac{n\cdot\Sigma xy - \Sigma x\cdot\Sigma y}{n\cdot\Sigma x^2 - (\Sigma x)^2} \qquad \mathrm{A} = \frac{\Sigma y - \mathrm{B}\cdot\Sigma x}{n}$$

•You can calculate estimated values $\hat{x}$ and $\hat{y}$ based on the regression formula. Press the $\hat{x}$ key for $\hat{x}$ and the $\hat{y}$ key for $\hat{y}$.

•The correlation coefficient for the input data is calculated according to the following formula:

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

<table>
<tr><th>Example</th><th>Operation</th><th>Display</th></tr>
<tr><td rowspan="12">•Length of a metal rod at various temperatures<table><tr><th>Temperature</th><th>Measured length</th></tr><tr><td>10℃</td><td>1003mm</td></tr><tr><td>15</td><td>1005</td></tr><tr><td>20</td><td>1010</td></tr><tr><td>25</td><td>1011</td></tr><tr><td>30</td><td>1014</td></tr></table>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).</td><td>MODE 5 Scl EXE
↓
"LR"</td><td>0.</td></tr>
<tr><td>10 ALPHA ,</td><td>10,</td></tr>
<tr><td>1003 DT</td><td>10.</td></tr>
<tr><td>15 ALPHA , 1005 DT</td><td>15.</td></tr>
<tr><td>20 ALPHA , 1010 DT</td><td>20.</td></tr>
<tr><td>25 ALPHA , 1011 DT</td><td>25.</td></tr>
<tr><td>30 ALPHA , 1014 DT</td><td>30.</td></tr>
<tr><td>(Regression formula constant term A) SHIFT 7 EXE</td><td>997.4</td></tr>
<tr><td>(Regression formula coefficient B) SHIFT 8 EXE</td><td>0.56</td></tr>
<tr><td>(Correlation coefficient r) SHIFT 9 EXE</td><td>0.9826073689</td></tr>
<tr><td>(Length at 18°C) 18 SHIFT $\hat{y}$ EXE</td><td>1'007.48</td></tr>
<tr><td>(Temperature for 1,000mm length) 1000 SHIFT $\hat{x}$ EXE</td><td>4.642857143</td></tr>
<tr><td></td><td>(Critical coefficient) SHIFT 9 SHIFT x^2 EXE</td><td>0.9655172414</td></tr>
</table>

★Correcting and Deleting Entered Data

① To delete 11 ALPHA ,, simply enter correct sequence without clearing.
② To delete 11 ALPHA , 1003 DT which you have just entered: CL
③ To clear 11 ALPHA , 1003 DT which you have previously entered: 11 ALPHA , 1003 CL

•Logarithmic Regression Calculations

•The calculator uses the following regression formula:

$y = \mathrm{A} + \mathrm{B}\cdot\ln x$

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 perform data editing using the same procedures as those described for linear regression. Other values are obtained as follows:

Estimated value $\hat{y}$ = SHIFT ln x SHIFT $\hat{y}$ EXE
Estimated value $\hat{x} = y$ SHIFT $\hat{x}$ EXE SHIFT e^x Ans EXE
$\Sigma x = \Sigma\ln x \quad \Sigma x^2 = \Sigma(\ln x)^2 \quad \Sigma xy = \Sigma\ln x\cdot y$

<table>
<tr><th>Example</th><th>Operation</th><th>Display</th></tr>
<tr><td rowspan="11"><table><tr><th>x_i</th><th>y_i</th></tr><tr><td>29</td><td>1.6</td></tr><tr><td>50</td><td>23.5</td></tr><tr><td>74</td><td>38.0</td></tr><tr><td>103</td><td>46.4</td></tr><tr><td>118</td><td>48.9</td></tr></table>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 $yi = 73$.</td><td>MODE 5 Scl EXE</td><td></td></tr>
<tr><td>SHIFT ln 29 ALPHA , 1.6 DT</td><td>3.36729583</td></tr>
<tr><td>SHIFT ln 50 ALPHA , 23.5 DT</td><td>3.912023005</td></tr>
<tr><td>SHIFT ln 74 ALPHA , 38.0 DT</td><td>4.304065093</td></tr>
<tr><td>SHIFT ln 103 ALPHA , 46.4 DT</td><td>4.634728988</td></tr>
<tr><td>SHIFT ln 118 ALPHA , 48.9 DT</td><td>4.770684624</td></tr>
<tr><td>(Constant term A) SHIFT 7 EXE</td><td>−111.1283976</td></tr>
<tr><td>(Coefficient B) SHIFT 8 EXE</td><td>34.02014749</td></tr>
<tr><td>(Correlation coefficient) SHIFT 9 EXE</td><td>0.9940139464</td></tr>
<tr><td>($\hat{y}$ when $xi = 80$)
SHIFT ln 80 SHIFT $\hat{y}$ EXE</td><td>37.94879482</td></tr>
<tr><td>($\hat{x}$ when $yi = 73$)
73 SHIFT $\hat{x}$ EXE SHIFT e^x Ans EXE</td><td>224.1541314</td></tr>
</table>

•Performing Exponential Regression Calculations

- The calculator uses the following regression formula:
  $y = A \cdot e^{B \cdot x}(\ln y = \ln A + Bx)$
  Enter the logarithm (ln) as the y data, and enter x data using the same sequence as that for linear regression.
- You can perform data editing using the same procedures as those described for linear regression. Other values are obtained as follows:
  Constant term A = [SHIFT] [e^x] [SHIFT] [7] [EXE]
  Estimated value $\hat{y} = x$ [SHIFT] [$\hat{y}$] [EXE] [SHIFT] [e^x] [Ans] [EXE]
  Estimated value $\hat{x} =$ [SHIFT] [ln] y [SHIFT] [$\hat{x}$] [EXE]
  $\Sigma y = \Sigma \ln y \quad \Sigma y^2 = \Sigma(\ln y)^2 \quad \Sigma xy = \Sigma x \ln y$

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

Example	Operation	Display
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 $yi = 20$.	[MODE] [5] [Scl] [EXE]	
	6.9 [ALPHA] [,] [SHIFT] [ln] 21.4 [DT]	6.9
	12.9 [ALPHA] [,] [SHIFT] [ln] 15.7 [DT]	12.9
	19.8 [ALPHA] [,] [SHIFT] [ln] 12.1 [DT]	19.8
	26.7 [ALPHA] [,] [SHIFT] [ln] 8.5 [DT]	26.7
	35.1 [ALPHA] [,] [SHIFT] [ln] 5.2 [DT]	35.1
	(Constant term A) [SHIFT] [e^x] [SHIFT] [7] [EXE]	30.49758742
	(Coefficient B) [SHIFT] [8] [EXE]	-4.920370831^{-02}
	(Correlation coefficient) [SHIFT] [9] [EXE]	−0.9972473519
	($\hat{y}$ when $xi = 16$) 16 [SHIFT] [$\hat{y}$] [EXE] [SHIFT] [e^x] [Ans] [EXE]	13.87915739
	($\hat{x}$ when $yi = 20$) [SHIFT] [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 perform data editing using the same procedures as those described for linear regression.
  Other values are obtained as follows:
  Constant term A = [SHIFT] [e^x] [SHIFT] [7] [EXE]
  Estimated value $\hat{y} =$ [SHIFT] [ln] x [SHIFT] [$\hat{y}$] [EXE] [SHIFT] [e^x] [Ans] [EXE]
  Estimated value $\hat{x} =$ [SHIFT] [ln] y [SHIFT] [$\hat{x}$] [EXE] [SHIFT] [e^x] [Ans] [EXE]
  $\Sigma x = \Sigma \ln x \quad \Sigma x^2 = \Sigma(\ln x)^2 \quad \Sigma y = \Sigma \ln y \quad \Sigma y^2 = \Sigma(\ln y)^2 \quad \Sigma xy = \Sigma \ln x \cdot \ln y$

x_i	y_i
28	2410
30	3033
33	3895
35	4491
38	5717

Example	Operation	Display
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 $yi = 1000$.	[MODE] [5] [Scl] [EXE]	
	[SHIFT] [ln] 28 [ALPHA] [,] [SHIFT] [ln] 2410 [DT]	3.33220451
	[SHIFT] [ln] 30 [ALPHA] [,] [SHIFT] [ln] 3033 [DT]	3.401197382
	[SHIFT] [ln] 33 [ALPHA] [,] [SHIFT] [ln] 3895 [DT]	3.496507561
	[SHIFT] [ln] 35 [ALPHA] [,] [SHIFT] [ln] 4491 [DT]	3.555348061
	[SHIFT] [ln] 38 [ALPHA] [,] [SHIFT] [ln] 5717 [DT]	3.66758616
	(Constant term A) [SHIFT] [e^x] [SHIFT] [7] [EXE]	0.2388010829
	(Coefficient B) [SHIFT] [8] [EXE]	2.771866148
	(Correlation coefficient) [SHIFT] [9] [EXE]	0.9989062562
	($\hat{y}$ when $xi = 40$) [SHIFT] [ln] 40 [SHIFT] [$\hat{y}$] [EXE] [SHIFT] [e^x] [Ans] [EXE]	6'587.674743
	($\hat{x}$ when $yi = 1000$) [SHIFT] [ln] 1000 [SHIFT] [$\hat{x}$] [EXE] [SHIFT] [e^x] [Ans] [EXE]	20.26225659

Performing Financial Calculations

Your calculator comes equipped with a wide variety of versatile financial functions that let you perform such complex calculations as compound interest, amortization of loans, conversion between percentage interest rates and effective interest rate, and investment appraisal.

■ Notes on Financial Calculations

- Use only the FIN mode (MODE 4) for financial calculations.
- Before beginning financial calculations, be sure to press SHIFT AC EXE to clear the financial memories. Be sure to press SHIFT. Pressing AC only does not clear the financial memories.
- The i% (periodic interest rate) key functions using percents.
- 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.

NOTES:

- The calculator may take some time to perform *i*% and IRR calculations. If you wish to interrupt such a calculation, press the AC key.
- *i*% and IRR calculations for which the result is less than −100% are impossible.

■ Using Financial Memories

Financial calculations n, *i*%, PMT, PV, and FV are performed using their own independent memories. 20 investment appraisal memories are also provided for CF*j* and N*j*. The contents of these memories are retained even when the power of the calculator is switched OFF.

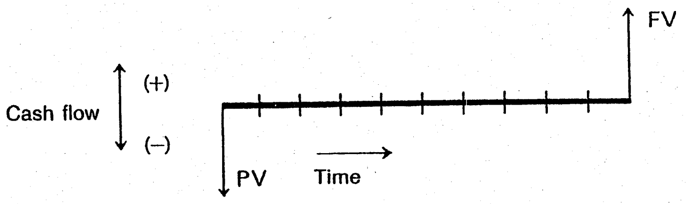
■ Entering Values

Enter cash outflows (credits) as negative values and inflows (debits) as positive values. Calculation results are also displayed using the same format.

■ Using a Cash Flow Diagram

Often, it is quite difficult to verbally express cash flows, so it becomes a better idea to use a cash flow diagram for a more graphic representation. The cash flow diagram shows time along a horizontal axis, running from left to right. At the left end we often have a vertical line marked PV for present value, while at the right end we have the FV or future value. The flow of cash is represented in the diagram by vertical lines above the time axis for inflows (debits) and below the time axis for outflows (credits).

Let's have a look at a cash flow diagram that represents principal and interest for basic compound interest.

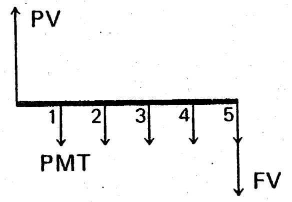


In this case the principal (PV) is remitted to a bank, out of your pocket, so it is represented as an outflow by a vertical line below the time axis. Later, the bank will return your principal with some interest, so this payment is plotted above the time axis as FV.

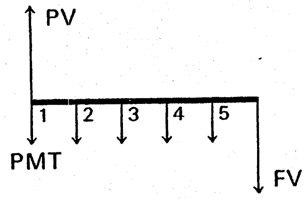
Cash flow diagrams will appear throughout this manual to help give you a better idea of examples presented here.

Note: The configuration of a cash flow diagram differs according to whether payment is made at the beginning of term or the end of term.

- End of term



- Beginning of term



■ Abbreviations Used In Financial Calculations

In the previous section, we introduced a few abbreviations that are commonly used in financial calculations. The following is a more complete list of such abbreviations:

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

■ Compound Interest Calculations

1) Formulas

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

- Calculation of odd periods using simple interest

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

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

- Calculation of odd periods using compound interest

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

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

- $i\% = 0 : PV + PMT \times Intg(n) + FV = 0$

Important

The above formulas and the internal rounding system used by the calculator may differ from those commonly acceptable by local standards in your area. In this case, you can manually enter the formulas used in your area.

2) Inputting data

Pressing [n], [i%], [PMT], [PV] or [FV] enters the currently displayed value. You can enter values for variables in any sequence. [n] and [i%] can also be used to convert values between months and years. [SHIFT] ×12[n] enters the display value time 12, while [SHIFT] ÷12[i%] enters 1/12 of the displayed value.

3) Editing data

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

4) 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 display. You can switch at any time, but doing so will only affect PMT calculations.

5) Outputting calculation results

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

[COMP] [n] [EXE] .... number of terms
[COMP] [PMT] [EXE] .... payment amount
[COMP] [PV] [EXE] .... present value
[COMP] [FV] [EXE] .... future value
[COMP] [i%] [EXE] .... periodic interest

*The calculator may take some time to perform i% calculations. If you wish to interrupt such a calculation, press the [AC] key.

*When an error occurs or calculation is interrupted by operation of the [AC] key during i% calculations, the i% memory retains the value before the error (or before operation of the [AC] key).

6) Checking entered data

You can check the values currently stored by pressing [n], [i%], [PMT], [PV], or [FV] followed by [EXE].

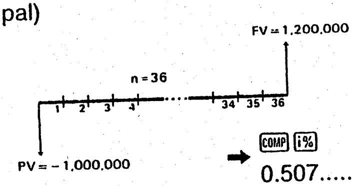
IMPORTANT

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

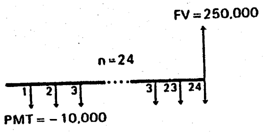
<Input Condition>

The term (n) is represented by a positive value, while either the present value (PV) and future value (FV) is positive and the corresponding other value (PV or FV) is negative.

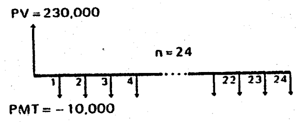
Savings (standard compound interest)

INPUT CONDITION	Future value is greater than present value.
FORMULA REPRESENTATION OF INPUT CONDITION	$PMT=0$ $\lvert PV\rvert < \lvert FV\rvert$
EXAMPLE	$PV=-1000000$ (Principal) $FV=1200000$ (Total of principal and interest) $n=36$ (Term)  $\lvert PV\rvert < \lvert FV\rvert$ → COMP i% 0.507.....

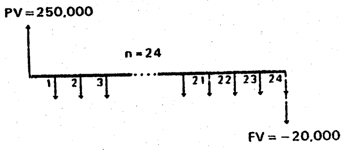
Installment savings, etc.

INPUT CONDITION	Future value is greater than total of payments.
FORMULA REPRESENTATION OF INPUT CONDITION	PMT and FV have different signs (negative/positive) when $PV=0$ $-FV<n\times PMT$ when $FV>0$ $-FV>n\times PMT$ when $FV<0$
EXAMPLE	$PMT=-10000$ (Installment amount) $FV=250000$ (Total of principal and interest) $n=24$ (Number of installments)  $-FV<n\times PMT$ $(-250000<24\times(-10000))$ → COMP i% 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 $FV=0$ $-PV>n\times PMT$ when $PV>0$ $-PV<n\times PMT$ when $PV<0$
EXAMPLE	$PV=230000$ (Amount borrowed) $PMT=-10000$ (Payment amount) $n=24$ (Number of payments)  $-PV>n\times PMT$ $(-230000>24\times(-10000))$ → COMP i% 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. $PV+FV>-n\times PMT$ when $FV>PV$ $PV+FV<-n\times PMT$ when $FV<PV$
EXAMPLE	$PV=250000$ (Amount borrowed) $FV=-20000$ (Final full payment) $PMT=-10000$ (Equal repayment) $n=24$ (Term)  $PV+FV<-n\times PMT$ $(250000-20000<(-24)\times(-10000))$ → COMP i% 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.

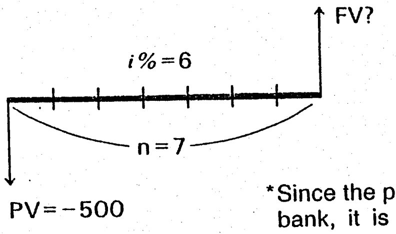
Therefore, it is suggested that PV (COMP PV), PMT (COMP PMT) or FV (COMP FV) be determined for comparison with input values to see if the calculated values fall within the allowable range.

Savings

•Total of principal and interest

Example 1

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

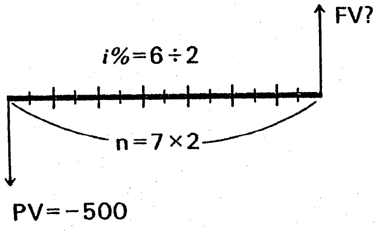


*Since the principal is remitted to a bank, it is treated as an outflow (negative value).

Operation	Display
MODE 7 2 EXE 0 EXE	0.00
SHIFT $\underset{Fcl}{AC}$ EXE	0.00
(Term) 7 n	7.00
(Interest rate) 6 i%	6.00
(Principal) (−) 500 PV	−500.00
(Total of principal and interest) COMP FV EXE	751.82 ($)

Example 2

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



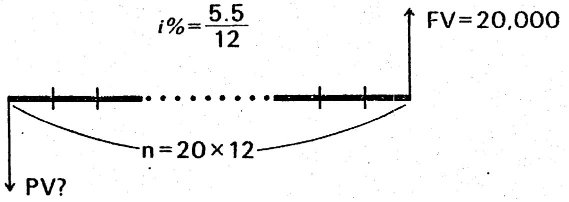
Operation	Display
(After completing the operation in example 1 ...)	
(Term) 7 × 2 n	14.00
(Interest rate) 6 ÷ 2 i%	3.00
COMP FV EXE	756.29 ($)

*For semiannual compounding, double the term and halve the interest rate.

•Compound interest principal

Example

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

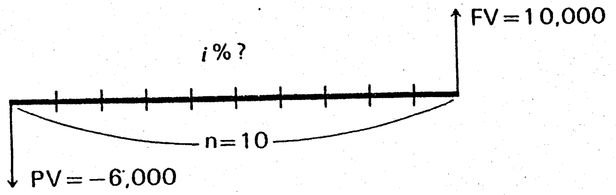


Operation	Display
MODE 7 2 EXE 0 EXE	0.00
SHIFT $\underset{Fcl}{AC}$ EXE	0.00
(Term) 20 SHIFT $\overset{\times 12}{n}$	240.00
(Interest rate) 5.5 SHIFT $\overset{\div 12}{i\%}$	0.46
(Total of principal and interest) 20000 FV	20'000.00
(Principal) COMP PV EXE	−6'674.17 ($)

•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.

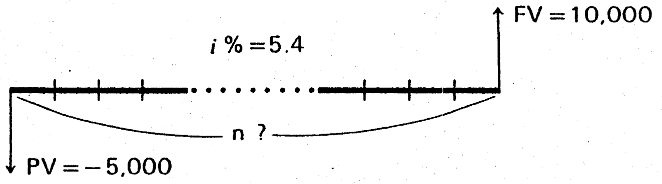


Operation	Display
$\boxed{\text{MODE}}\boxed{7}\boxed{2}\boxed{\text{EXE}}\boxed{0}\boxed{\text{EXE}}$	0.00
$\boxed{\text{SHIFT}}\boxed{\text{AC}}\boxed{\text{EXE}}$	0.00
(Term) 10$\boxed{n}$	10.00
(Total of principal and interest) 10000$\boxed{\text{FV}}$	10'000.00
(Principal) $\boxed{(-)}$6000$\boxed{\text{PV}}$	−6'000.00
(Interest rate) $\boxed{\text{COMP}}\boxed{i\%}\boxed{\text{EXE}}$	5.24 (%)
(Confirmation) $\boxed{\text{COMP}}\boxed{\text{FV}}\boxed{\text{EXE}}$	10'000.00

•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
$\boxed{\text{MODE}}\boxed{7}\boxed{2}\boxed{\text{EXE}}\boxed{0}\boxed{\text{EXE}}$	0.00
$\boxed{\text{SHIFT}}\boxed{\text{AC}}\boxed{\text{EXE}}$	0.00
(Interest rate) 5.4$\boxed{\text{SHIFT}}\boxed{i\%}$	0.45
(Principal) $\boxed{(-)}$5000$\boxed{\text{PV}}$	−5'000.00
(Total of principal and interest) 10000$\boxed{\text{FV}}$	10'000.00
(Term — number of months) $\boxed{\text{COMP}}\boxed{n}\boxed{\text{EXE}}$	155.00
(Term — number of years) $\boxed{\div}$12$\boxed{\text{EXE}}$	12.92

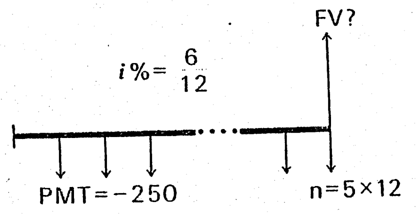
Installment savings

•Total of principal and interest

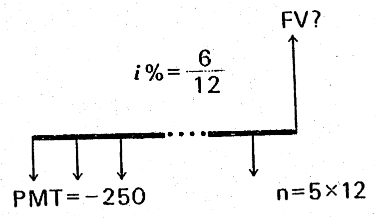
Example

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.

•End of term payment



•Beginning of term payment



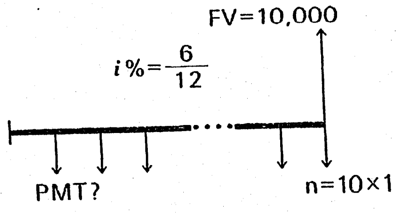
Operation	Display
[MODE] [7] [2] [EXE] [0] [EXE]	0.00
[SHIFT] [AC] [EXE]	0.00
(Term) 5 [SHIFT] [n]	60.00
(Interest rate) 6 [SHIFT] [i%]	0.50
(Installment amount) [(-)] 250 [PMT]	-250.00
(Principal calculation) [COMP] [FV] [EXE]	17'442.51 ($) (End of term payment)
[SHIFT] [BGN]	BGN 17'442.51
(Total of principal and interest) [COMP] [FV] [EXE]	BGN 17'529.72 ($) (Beginning of term payment)

•Installment amount

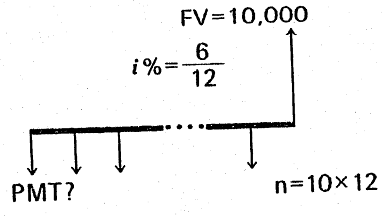
Example

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.

•End of term payment



•Beginning of term payment



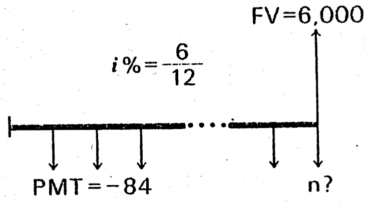
Operation	Display
[MODE] [7] [2] [EXE] [0] [EXE]	0.00
[SHIFT] [AC] [EXE]	0.00
(Term) 10 [SHIFT] [n]	120.00
(Interest rate) 6 [SHIFT] [i%]	0.50
(Total of principal and interest) 10000 [FV]	10'000.00
(Installment amount) [COMP] [PMT] [EXE]	-61.02 ($) (End of term payment)
[SHIFT] [BGN]	BGN -61.02
(Installment amount) [COMP] [PMT] [EXE]	BGN -60.72 ($) (Beginning of term payment)

•Number of installments

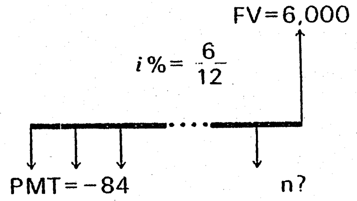
Example

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

•End of term payment



•Beginning of term payment



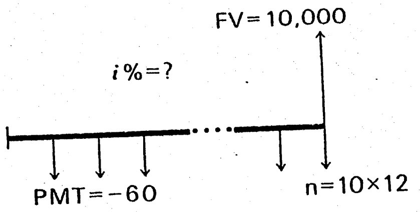
Operation	Display
[MODE] [7] [2] [EXE] [0] [EXE]	0.00
[SHIFT] [AC] [EXE]	0.00
(Interest rate) 6 [SHIFT] [i%]	0.50
(Installment amount) [(-)] 84 [PMT]	-84.00
(Total of principal and interest) 6000 [FV]	6'000.00
(Term — number of months) [COMP] [n] [EXE]	62.00 (End of term payment)
(Term — number of years) [÷] 12 [EXE]	5.17 (End of term payment)
[SHIFT] [BGN]	BGN 5.17
(Term — number of months) [COMP] [n] [EXE]	BGN 61.00 (Beginning of term payment)
(Term — number of years) [÷] 12 [EXE]	BGN 5.08 (Beginning of term payment)

•Interest rate

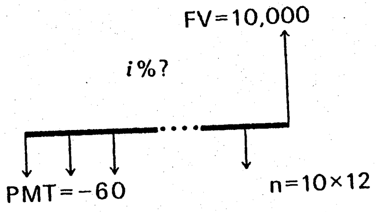
Example

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

•End of term payment



•Beginning of term payment

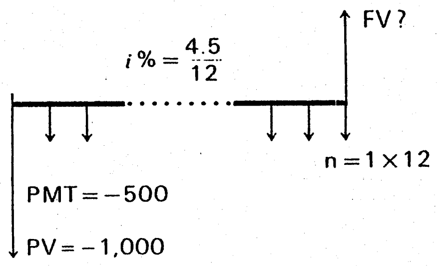


Operation	Display
MODE 7 2 EXE 0 EXE	0.00
SHIFT AC EXE	0.00
(Term) 10 SHIFT n	120.00
(Installment amount) (−) 60 PMT	-60.00
(Total of principal and interest) 10000 FV	10'000.00
(Interest rate — monthly) COMP i% EXE	0.53 (End of term payment)
(Interest rate — yearly) × 12 EXE	6.31 (End of term payment)
(Confirmation) COMP FV EXE	10'000.00
SHIFT BGN	BGN 10'000.00
(Interest rate — monthly) COMP i% EXE	BGN 0.52 (Beginning of term payment)
(Interest rate — yearly) × 12 EXE	BGN 6.22 (Beginning of term payment)
(Confirmation) COMP FV EXE	BGN 10'000.00

•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 7 2 EXE 0 EXE	0.00
SHIFT AC EXE	0.00
(Term) 12 n	12.00
(Interest rate) 4.5 SHIFT i%	0.38
(Principal) (−) 1000 PV	−1'000.00
(Installment amount) (−) 500 PMT	−500.00
(Total of principal and interest) COMP FV EXE	7'171.25 ($)

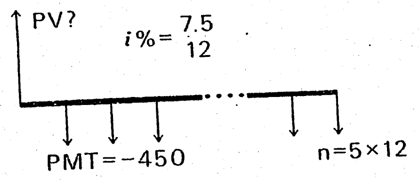
Loan (equal repayments of principal and interest)

•Borrowing power

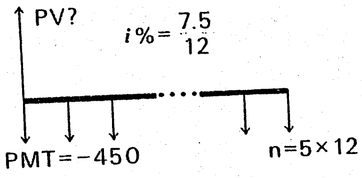
Example

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.

•End of term payment



•Beginning of term payment

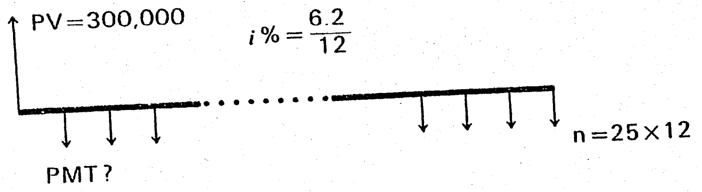


Operation	Display
MODE 7 2 EXE 0 EXE	0.00
SHIFT AC Fcl EXE	0.00
(Monthly payment) (−) 450 PMT	−450.00
(Interest rate) 7.5 SHIFT ÷12 i%	0.63
(Term) 15 SHIFT ×12 n	180.00
(Loan amount) COMP PV EXE	48'543.04 ($) (End of term payment)
SHIFT BGN	BGN 48'543.04
(Loan amount) COMP PV EXE	48'846.44 ($) (Beginning of term payment).

•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.



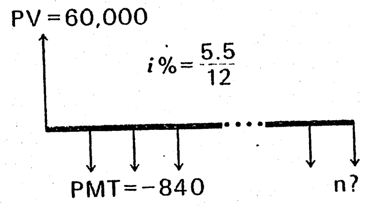
Operation	Display
MODE 7 2 EXE 0 EXE	0.00
SHIFT AC Fcl EXE	0.00
(Loan amount) 300000 PV	300'000.00
(Interest rate) 6.2 SHIFT ÷12 i%	0.52
(Term) 25 SHIFT ×12 n	300.00
(Monthly payment) COMP PMT EXE	−1'969.75 ($)

•Number of payments

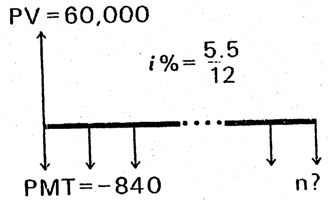
Example

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

•End of term payment



•Beginning of term payment



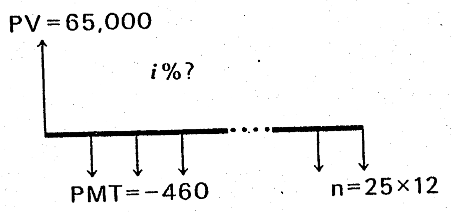
Operation	Display
MODE 7 2 EXE 0 EXE	0.00
SHIFT AC Fcl EXE	0.00
(Loan amount) 60000 PV	60'000.00
(Monthly payment) (−) 840 PMT	−840.00
(Interest rate) 5.5 SHIFT ÷12 i%	0.46
(Term — number of months) COMP n EXE	87.00 (End of term payment)
(Term — number of years) ÷ 12 EXE	7.25 (End of term payment)
SHIFT BGN	BGN 7.25
(Term — number of months) COMP n EXE	BGN 87.00 (Beginning of term payment)
(Term — number of years) ÷ 12 EXE	BGN 7.25 (Beginning of term payment).

•Effective interest rate

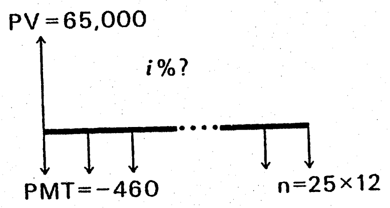
Example

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

•End of term payment



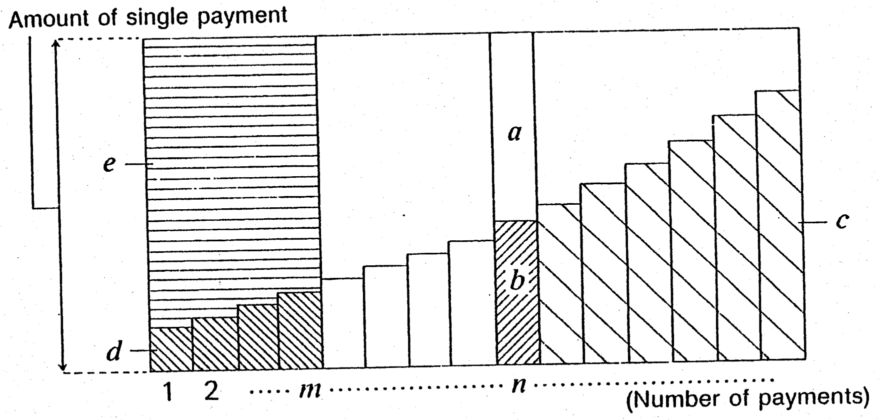
•Beginning of term payment



Operation	Display
MODE 7 2 EXE 0 EXE	0.00
SHIFT AC EXE	0.00
(Term) 25 SHIFT n	300.00
(Monthly payment) (−) 460 PMT	−460.00
(Loan amount) 65000 PV	65'000.00
(Interest rate — monthly) COMP i% EXE	0.58 (End of term payment)
(Interest rate — years) × 12 EXE	7.01 (End of term payment)
(Confirmation) COMP PV EXE	65'000.00
SHIFT BGN	BGN 65'000.00
(Interest rate — monthly) COMP i% EXE	0.59 (Beginning of term payment)
(Interest rate — years) × 12 EXE	7.08 (Beginning of term payment)
(Confirmation) COMP PV EXE	BGN 65'000.00

■ 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 of 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: $INT_n = |BAL_{n-1} \times i| \times$ (PMT sign)

b: $PRN_n = PMT + BAL_{n-1} \times i$

c: $BAL_n = BAL_{n-1} + PRN_n$

d: $\Sigma PRN_m = PRN_1 + PRN_2 + \cdots\cdots + PRN_m$

e: $\Sigma INT_m = INT_1 + INT_2 + \cdots\cdots + INT_m$ (INT1=0 and PMT1=0 for beginning of term payment)

2) 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.

3) Outputting results

To obtain the desired results, perform one of the following key operations:

[PRN]	[SHIFT] [ΣPRN]
[INT]	[SHIFT] [ΣINT]
[SHIFT] [BAL]	

Next, enter the number of the payment up to which you want the result calculated, and then press [EXE]. Note that you cannot use exponential data for the number of payment entry.

*In the above operation, you can enter natural numbers up to 10 digits long. Any other type of value will result in an error.

4) Checking entered data

- After pressing [RCL], you can check the values currently stored by pressing [PV], [i%], [n] or [PMT] followed by [EXE].
- The values for PRN and ΣPRN are stored in the X-memory, INT and ΣINT in the Y-memory, and the resulting BAL is stored in the Z-memory. You can check the contents of each memory by performing the one of the following key sequences:

[ALPHA] [X] [EXE]	X-memory
[ALPHA] [Y] [EXE]	Y-memory
[ALPHA] [Z] [EXE]	Z-memory

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).

Operation	Display
[MODE] [7] [2] [EXE] [0] [EXE]	0.00
[SHIFT] [AC] [EXE]	0.00
(Mortgage amount) 140000 [PV]	140'000.00
(Term) 15 [SHIFT] [n]	180.00
(Interest rate) 6.5 [SHIFT] [i%]	0.54
(Installment amount) [COMP] [PMT] [EXE]	−1219.55
[PRN] 49 [EXE]	−597.75 ($) (PRN at 49th payment)
[INT] 49 [EXE]	−621.80 ($) (INT at 49th payment)
[SHIFT] [BAL] 49 [EXE]	114'196.78 ($) (BAL at 49th payment)
[SHIFT] [ΣPRN] 24 [EXE]	−11'786.91 ($) (ΣPRN at 24th payment)
[SHIFT] [ΣINT] 24 [EXE]	17'482.30 ($) (ΣINT at 24th payment)

■ 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

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

2) Operation

n [SHIFT] [▸EFF] APR [EXE] (n = number of compound interest terms per year)

Example

To calculate the effective interest rate for an account yielding a percentage interest rate of 12%, compounded quarterly.

Operation	Display
[MODE] [7] [2] [EXE] [0] [EXE]	0.00
[SHIFT] [AC] [EXE]	0.00
4 [SHIFT] [▸EFF] 12 [EXE]	12.55

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

1) Formula

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

2) Operation

n [SHIFT] [▸APR] 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.

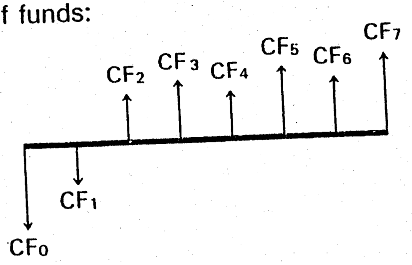
Operation	Display
MODE 7 2 EXE 0 EXE	0.00
SHIFT $\underset{\text{Fcl}}{\text{AC}}$ EXE	0.00
4 SHIFT ▸APR 12.55 EXE	12.00

■ Investment Appraisal

Your financial calculator applies the Discount Cash Flow (DCF) Method to let you perform two 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. Internal Rate of Return (IRR)

Again, 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.

•Net Present Value (NPV)

1) Formula

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

2) Entering data

a) Before entering data, you should clear the i%, CFj, and Nj memories. But note that this operation will also clear the financial, cost, selling price, and margin memories. To clear the memories, press SHIFT $\underset{\text{Fcl}}{\text{AC}}$ EXE.

b) Use the i%, CFj, and Nj keys to enter data. 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.

c) Each time you press CFj, the currently displayed value is entered as CF_0 through CF_{19}. This means that you can enter up to 20 cash flow values.

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

Example: To enter two consecutive $3200 inflows.
3200 CFj CFj
To enter four consecutive $3500 inflows.
3500 CFj 4 Nj

•Be sure to enter the Nj value immediately following the corresponding CFj key operation.

*Up to 99 Nj entry may be made per CFj.

•The value entered using Nj must be a natural number. Entering any other value will cause an error. When an error occurs, press the AC key and restart data entry.

3) Calculating NPV

Press NPV EXE to display the result of the NPV calculation.

Result	Meaning	
Positive	Revenue target exceeded	Effective investment
0	Revenue target met	
Negative	Revenue target not attained	— Ineffective investment

4) Checking entered data

a) CFj
Press RCL CFj, enter the number of the cash flow to be recalled, and press EXE.

b) Nj
Press RCL Nj, enter the number of the cash flow to be recalled, and press EXE.

c) i%
Press RCL i% EXE.

<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

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

5) Editing data

a) [CFj]
<new CFj data> [STO] [CFj] <cash flow number> [EXE]

b) [Nj]
<new Nj data> [STO] [Nj] <cash flow number> [EXE]

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

	CFj	Nj
CF_0	−1000	1
CF_1	2000	1
CF_2	3000	3
CF_3	4000	1

Operation:

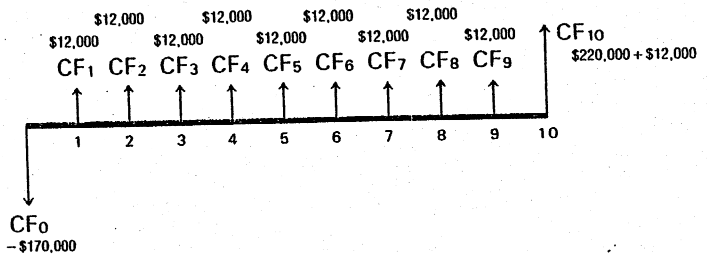
2500 [STO] [CFj] 1 [EXE]

New value   Cash flow number

*Continuing from the above example, if you now enter another value, it is entered as the next cash flow (CF_2 in this case).

Example 1

To evaluate investment in a condominium. According to your projection you can rent the condo 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 ($12,000 per year), and the future selling price is $220,000?



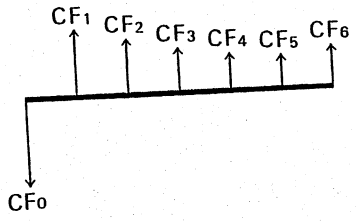
Operation		Display
	0 [EXE] [SHIFT] [AC/Fcl] [EXE]	0.
(Initial investment: CF_0)	[(−)] 170000 [CFj]	−170'000.
(CF_1 ~ CF_9)	12000 [CFj] 9 [Nj]	9.
(CF_{10})	12000 [+] 220000 [CFj]	232'000.
(Yield)	8 [i%]	8.
(NPV)	[NPV] [EXE]	12'423.54417($)

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

Example 2

To evaluate investment in machinery. If you invest $86,000 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 six years is $14,000, and the capital cost is 11%?

Year	Income
1	52000
2	31000
3	27000
4	24000
5	23000
6	12000+14000



Operation		Display
	0 EXE SHIFT AC EXE	0.
(CF_0)	(−) 86000 CFj	-86'000.
(CF_1)	52000 CFj	52'000.
(CF_2)	31000 CFj	31'000.
(CF_3)	27000 CFj	27'000.
(CF_4)	24000 CFj	24'000.
(CF_5)	23000 CFj	23'000.
(CF_6)	12000+14000 CFj	26'000.
(Capital cost)	11 i%	11.
(NPV)	NPV EXE	49'108.89524($)

•Internal Rate of Return (IRR)

1) Formula

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

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.

2) Entering data

a) Before entering data, you should clear the CFj, and Nj memories. But note that this operation will also clear the financial, cost, selling price, and margin memories. To clear the memories, press SHIFT AC EXE.

b) Use the CFj, and Nj keys to enter data. 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.

c) Each time you press CFj, the currently displayed value is entered as CF_0 through CF_{19}. This means that you can enter up to 20 cash flow values.

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

Examples: To enter two consecutive $3200 inflows.
3200 CFj CFj
To enter four consecutive $3500 inflows.
3500 CFj 4 Nj

- Be sure to enter the Nj value immediately following the corresponding CFj key operation.

*Up to 99 Nj may be made per CFj.

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

3) Calculating IRR

Press IRR EXE to display the result of the IRR calculation. 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% EXE.

4) Calculating IRR by inputting a estimated value

Since IRR calculations are rather complex, the calculator may not be able to produce a result for the data entered (in this case an error occurs), or multiple results are obtained. In such an instance, enter an estimated value and calculate IRR.

(Estimated value) STO IRR EXE

Performing this operation causes the calculator to begin calculations using the entered estimated value, producing a result in the vincinity of the estimated value. When multiple results are obtained, it is impossible to tell how many there are, so it is necessary to repeatedly input the estimated values and perform the IRR calculation sequence.

*When an error occurs or calculation is interrupted by operation of the AC key during IRR calculation, the IRR memory retains the value before the error (or before operation of the AC key).

5) Checking entered data

a) CFj

Press RCL CFj, enter the number of the cash flow to be recalled, and press EXE.

b) Nj

Press RCL Nj, enter the number of the cash flow to be recalled, and press EXE.

<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

Example: To recall data for CF_{11} ➡ RCL CFj 1 1 EXE

6) Editing data

a) CFj

<new CF*j* data> STO CFj <cash flow number> EXE

b) Nj

<new N*j* data> STO Nj <cash flow number> EXE

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

	CFj	Nj
CF_0	−1000	1
CF_1	2000	1
CF_2	3000	3
CF_3	4000	1

Operation:

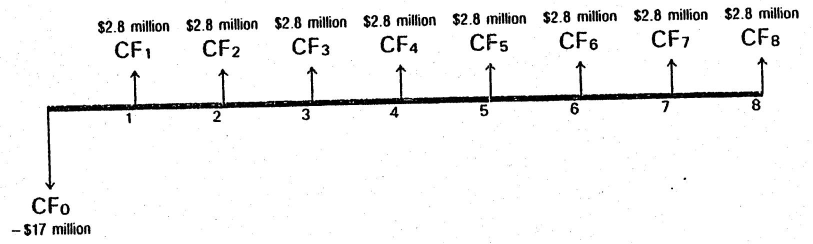
$\underbrace{2500}_{\text{New value}}$ STO CFj $\underbrace{1}_{\text{Cash flow number}}$ EXE

*Continuing from the above example, if you now enter another value, it is entered as the next cash flow (CF_2 in this case).

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



Operation	Display
MODE 7 2 EXE 0 EXE	0.00
SHIFT AC EXE	0.00
(−) 17 CFj	−17.00
2.8 CFj 8 Nj	8.00
IRR EXE	6.57 (%)

■ 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

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

<When calculating PV:>
- $i\% \leqq -100$

<When calculating PMT:>
- $i\% \leqq -100$

<When calculating FV:>
- $i\% \leqq -100$

•Loan amortization

When the number of terms for INT, PRN, BAL, ΣPRN, or ΣINT is not a natural number.

Example: INT 4.23 EXE → ERROR

•Investment appraisal

<When entering CFj:>
- Number of data items exceeds 20

<When entering Nj:>
- Attempt to enter value outside of range of natural numbers 1～99

<When calculating NPV:>
- $i\% \leqq -100$

<When calculating IRR:>
- Calculated IRR $\leqq -100\%$
- The signs of all CFj values are identical

■ 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:

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

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.

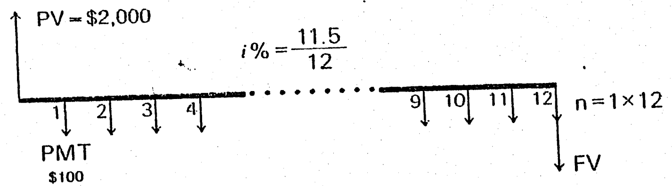
Operation	Display
MODE 7 2 EXE 0 EXE	0.00
(Calculation) 20000 ÷ SHIFT (7 × 12 + 84 × 85 ÷ 2 × 4.5 ÷ 100 ÷ 12 SHIFT) EXE	205.37 ($)

Example 2

You borrow a total of $2,000 at an annual interest 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 7 2 EXE 0 EXE	0.00
(Memory clear)	SHIFT AC EXE	0.00
(Loan amount)	2000 PV	2'000.00
(Term)	1 SHIFT n	12.00
(Annual interest)	11.5 SHIFT i%	0.96
(Monthly payment)	(−) 100 PMT	−100.00
(Amount due)	COMP FV EXE	−977.20
(Final payment)	+ RCL PMT EXE	−1'077.20 ($)

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 months
3. Annual interest: 9%
4. Fixed asset tax: 14/1000 of carrying price

   $\$304,900 \times \frac{14}{1000} =$ approx $4300
5. Insurance: 3/1000 of carrying price

   $\$304,900 \times \frac{3}{1000} =$ 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 7 2 EXE 0 EXE	0.00
(Memory clear)	SHIFT AC EXE	0.00
(Beginning of term payment)	SHIFT BGN	BGN 0.00
	100000 PV	BGN 100'000.00
(Number of terms)	60 n	BGN 6.00
(Interest rate)	9 SHIFT i%	BGN 0.75
(Monthly payment)	COMP PMT EXE	BGN −2'060.38
(5-year net lease amount)	× 60 EXE	BGN −123'622.96
(Add tax, etc.)	− 4300 − 900	
	− 2500 − 2500 EXE	BGN −133'822.96
(Monthly lease charge)	÷ 60 EXE	BGN −2'230.38 ($)

Cost, Selling Price, Margin Calculations

You 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) Entering data

Enter a value and press the key that identifies the value (CST, SEL, MAR*). Values are retained even when calculator power is switched off.

*MAR value is handled as a percent.

3) Outputting results

After entering two values, press COMP followed by the key that corresponds to the third value, and then press EXE.

4) Checking data

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

5) Clearing data

You can clear the value assigned to each key by the following operation, but you should remember that this operation also clears all of the other financial memories: SHIFT AC EXE.

■ 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 7 2 EXE 0 EXE	0.00
SHIFT AC EXE	0.00
20 SEL	20.00
12 MAR	12.00
COMP CST EXE	17.60
15 MAR	15.00
COMP CST EXE	17.00
18 MAR	18.00
COMP CST EXE	16.40

■ Selling Price

Example

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

Operation	Display
MODE 7 2 EXE 0 EXE	0.00
SHIFT AC EXE	0.00
12 CST	12.00
40 MAR	40.00
COMP SEL EXE	20.00
45 MAR	45.00
COMP SEL EXE	21.82
50 MAR	50.00
COMP SEL EXE	24.00

■ 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] [7] [2] [EXE] [0] [EXE]	0.00
[SHIFT] [AC] [EXE]	0.00
25 [SEL]	25.00
12.5 [CST]	12.50
[COMP] [MAR] [EXE]	50.00
15 [CST]	15.00
[COMP] [MAR] [EXE]	40.00
17.5 [CST]	17.50
[COMP] [MAR] [EXE]	30.00

Performing Programmed Calculations

With your financial calculator you can store formulas and calculations that you often need as programs. Then you can call them up and run them at the touch of a key.

■ 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 program to do.
    - What result are you trying to achieve?
    - Good planning here makes your program quick and efficient.
2. Write the program.
    - Determine the formulas you need.
    - Write the program down.
    - Put the program in its proper format.
3. Input the program into the calculator.
    - Accurate input means less time spent tracking down problems later.
4. Test the program.
    - Use some common values and see what happens.
5. Store the program 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 Programs

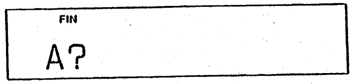
You can incorporate all of the functions available in manual calculations into programs.

•Using variables

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. There are 26 variables 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 variable by pressing the [STO] key, to input the symbol "→" into the program.

Examples: 0→C, A→C, C+1→C, 1÷D→A

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


FIN
A?

With this display, the calculator is asking you to enter a value for variable A.

•Using output functions

The computer will interrupt execution of a program 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 calculator to go from one point of the program 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 calculator 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

Note the following example:
A<5⇒0→T

This can be read as:
"if the value assigned to Variable A is less than 5, then the value of Variable T is 0".

•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.

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

After execution of statement, execution jumps from Goto 1 to Lbl 1.

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

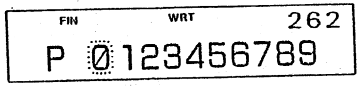
Again, the "*n*" represents a label number.
Note the following sample sequence:
statement 1: condition⇒Goto 1: statement 2: statement 3: Lbl 1

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

■ Storing and Executing Programs

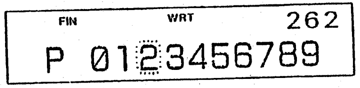
■ Setting modes

① Press [MODE][2] to enter the WRT mode (program writing mode).

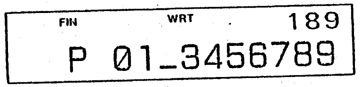

FIN WRT 262
P 0123456789

② Specify a program number.
Use the [⇦][⇨] cursor keys to align the cursor with the program number you want to use.

[⇨][⇨]
(Selects Program Number 2.)

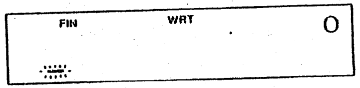

FIN WRT 262
P 0123456789

- Program numbers that already contain programs are not shown on the display.


FIN WRT 189
P 01_3456789

③ Specify a calculation mode (FIN, SD, or LR).
Press [MODE] followed by the number key that indicates the mode you need. Then press the [EXE] key to begin program input.

[MODE][4][EXE]
(Specifies the FIN mode.)


FIN WRT 0

- You can't change the calculation mode part way through a program.

④ Enter the program.

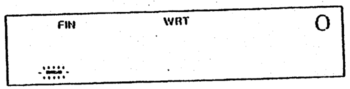
Entering programs

Programs are entered 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.

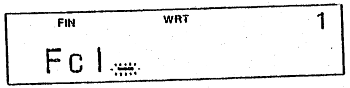
•Programming example

Enter a program that calculates the amount of principal and interest due after three years for $10,000, compounded annually. Write the program so that an interest rate must be entered for each execution.

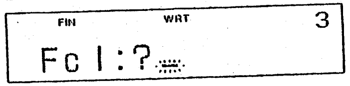
[MODE] [2] [⇨] [⇨] [MODE] [4] [EXE]
(Selects Program Number 2.)


FIN WRT 0

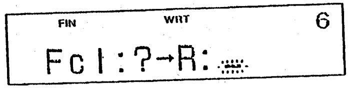
[SHIFT] [AC] (Fcl)


FIN WRT 1
Fcl

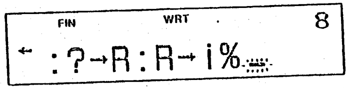
[ALPHA] [:] [ALPHA] [?]


FIN WRT 3
Fcl:?

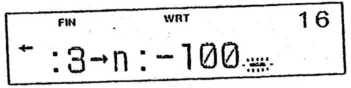
[STO] [ALPHA] [R] [ALPHA] [:]


FIN WRT 6
Fcl:?→R:

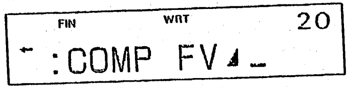
[ALPHA] [R] [STO] [i%]


FIN WRT 8
← :?→R:R→i%

[ALPHA] [:] [3] [STO] [n] [ALPHA] [:] [(−)] [1] [0] [0]


FIN WRT 16
← :3→n:-100

[STO] [PV] [ALPHA] [:] [COMP] [FV] [ALPHA] [◢]


FIN WRT 20
← :COMP FV◢_

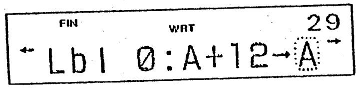
([MODE] [1] returns to the RUN mode.)

Editing Programs

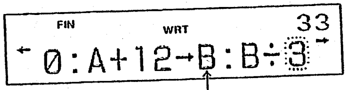
- To edit programs, first press [MODE] [2] to enter the WRT mode, and select the program number of the program you want to edit, followed by [EXE]. Then use the [⇨] and [⇦] cursor keys to move the cursor to the place in the program that you wish to edit.

•Replace

After locating the cursor at the step to be replaced (see page 17 for an explanation of step), simply enter the new step.


FIN WRT 29
← Lbl 0:A+12→A →

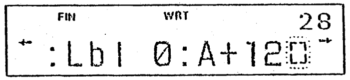
[ALPHA] [B] →


FIN WRT 33
← 0:A+12→B:B÷3 →

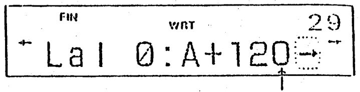
"A" changed to "B".

•Insert

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


FIN WRT 28
← :Lbl 0:A+12[ ] →

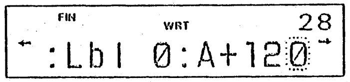
[0] →


FIN WRT 29
← Lal 0:A+120[→] →

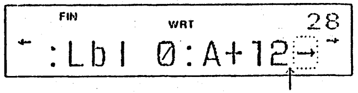
"0" inserted.

•Delete

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


FIN WRT 28
← :Lbl 0:A+120 →

[DEL] →


FIN WRT 28
← :Lbl 0:A+12→ →

"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 by the deletion.

Executing programs and interrupting execution

•Executing a program

① Press [MODE] [1] to put the calculator into the RUN mode.
② Press [Prog] followed by the program number of the program you wish to execute. Then press [EXE] to execute the program.

•Interrupting program execution

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

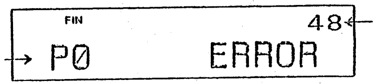
Debugging programs

Before actually using a program for calculations, it is always a good idea to try a few test runs to iron out any bugs. In fact, this process is commonly called debugging.

•Locating errors

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

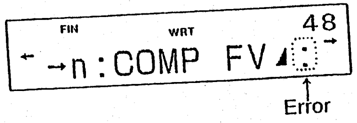
Example:


FIN 48
P0 ERROR

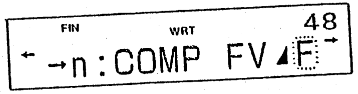
Program number →
← Step number (error in step number 48)

① Press either ⇨ or ⇦ cursor key and the calculator will automatically enter the WRT mode and display the place in the program where it encountered the error. The cursor will be blinking at the exact location of the error.

Example:



② Use the editing functions (see page 78) to correct the error. In this example, you would press DEL to delete it.



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

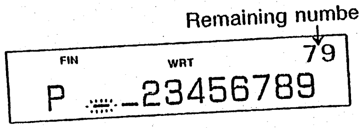
•Correcting data input

Some programs 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 program again.

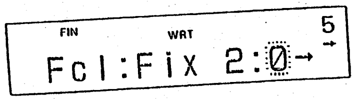
■ About steps

The total of the steps contained in all ten program areas cannot exceed 262. The shape of the cursor will change to "▓" when there are six or fewer free steps remaining. See page 17 for information on what constitutes a step and how steps are counted.

To help you keep track of steps while you are programming, the calculator displays the number of open steps remaining in memory in the upper right hand corner of the program number display in the WRT mode.



When you are inside a program, the number in the upper right tells you the cursor location inside that program. This value shows the number of steps from the beginning of the program up to the step immediately to the left of the cursor location.

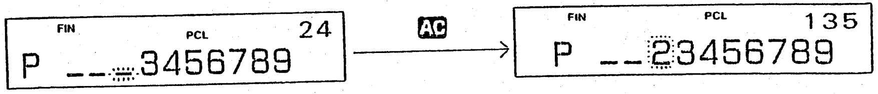


■ Deleting programs

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

•Deleting a specific program

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 delete a program its program number reappears on the display to indicate that the program area is free.



•Deleting all programs

Enter the PCL mode and press SHIFT McI. This operation will cause all program numbers to reappear on the display.

■ Programming for financial, percent, number of day and date functions

1) Basically, financial, percent, number of day and date functions are entered the as they are for manual calculations, except for the displayed characters as noted below:

Key	WRT mode display
n (×12)	→n (×12→n)
i% (÷12)	→*i*% (÷12→*i*%)
PV	→PV
PMT	→PMT
FV	→FV
CST	→CST
SEL	→SEL
MAR	→MAR
CF*j*	→CF*j*
N*j*	→N*j*

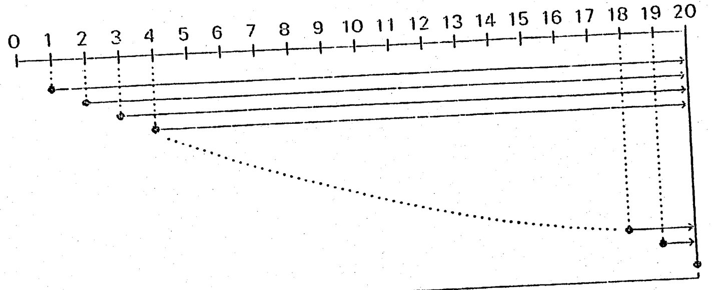
Programmed Calculation Examples

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.

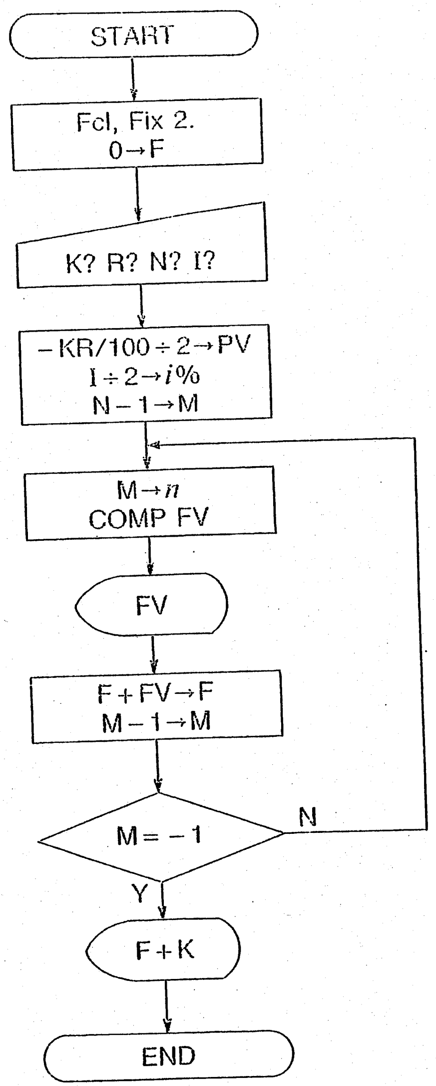


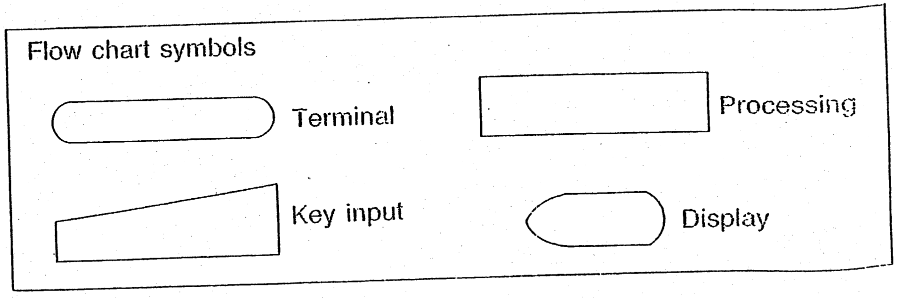
Compounded semiannually •indicates interest received ($250)

•Arrangement

Objective	Formula	Required data (variables)
① Single bond interest payment	Bond amount × (Bond interest ÷ 2)	Bond value (K) 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 a principal of 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	Bond amount + interest portion Total principal and interest (④)	

•Flow chart





Program

	Program															Step
1	Fcl	:	Fix	2	:	0	→	F	:	?	→	K	:	?	→	15
2	R	:	?	→	N	:	?	→	I	:	(–)	K	R	÷	2	30
3	0	0	→PV	:	I	÷	2	→i%	:	N	−	1	→	M	:	45
4	Lbl	0	:	M	→n	:	COMP	FV	◢	F	+	COMP	FV	→	F	60
5	:	M	−	1	→	M	:	M	=	(–)	1	⇒	Goto	1	:	75
6	Goto	0	:	Lbl	1	:	F	+	K	◢	Norm					86
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																

Variables

A		J		S	
B		K	Bond amount	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 account annual interest rate	R	Bond interest rate		

•Sample execution

MODE 1 Prog 0
(Recall program)

FIN
Prog 0_

EXE
(Execute program)

FIN Fix
K?

10000 EXE
(Bond amount)

FIN Fix
R?

5 EXE
(Bond interest rate)

FIN Fix
N?

20 EXE
(Number of bond interest payments)

FIN Fix
I?

4 EXE
(Bank account interest rate)

FIN Fix
364.20 ($)
(Principal and interest of first interest portion)

EXE

FIN Fix
357.06 ($)
(Principal and interest of second interest portion)

Continues sequentially and displays principal and interest

EXE

FIN Fix
255.00 ($)
(Principal and interest of 19th interest portion)

EXE

FIN Fix
250.00 ($)
(Principal and interest of 20th interest portion)

EXE

FIN Fix
16'074.34 ($)
(Cumulative total)

Example 2

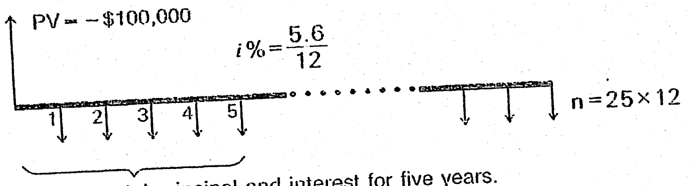
This example compares fixed rate and floating rate plans for home mortgages.

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.

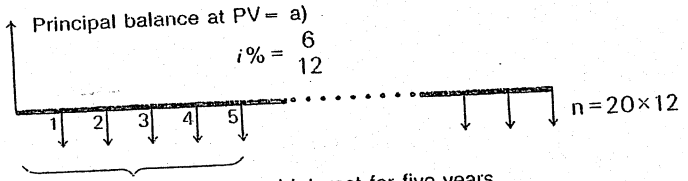
b. Floating rate
What will be the total principal and interest for the same loan as above if the interest is 5.6% for the first five, 6% for the next five years, 7% for the next five years, and 6% for the final ten years (end of term payment).

a)



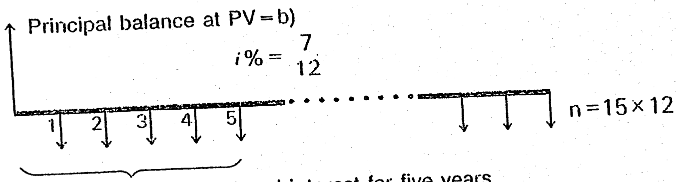
Determine the total principal and interest for five years.

b)



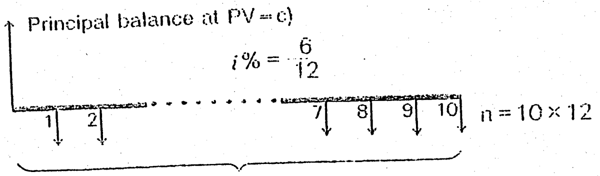
Determine the total principal and interest for five years.

c)



Determine the total principal and interest for five years.

d)



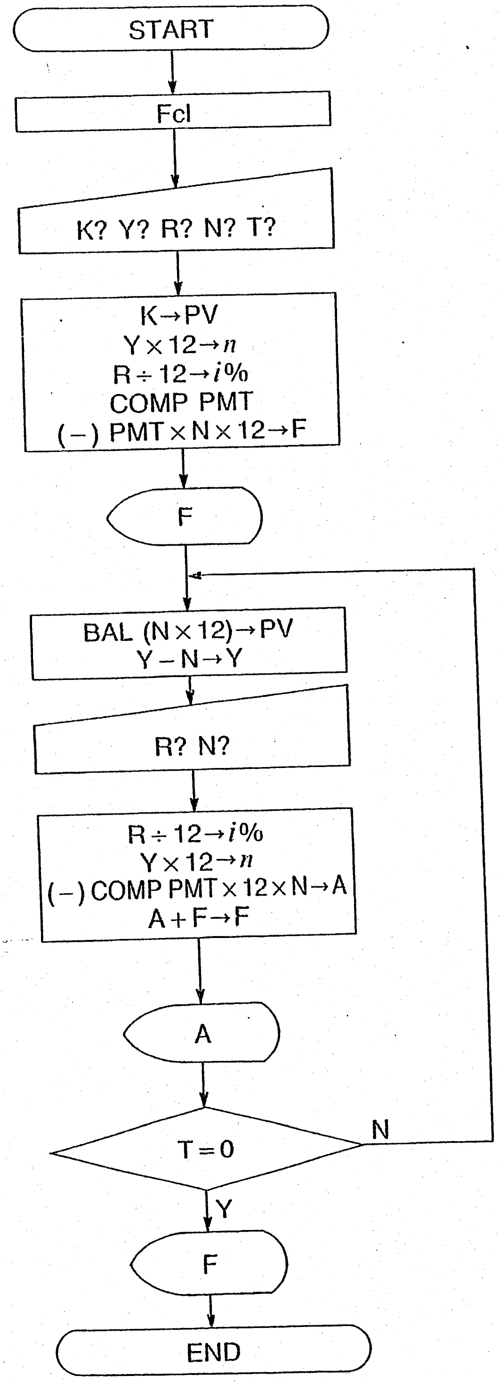
Determine the total principal and interest for ten years.

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

• Arrangement

Objective	Formula	Required data (variables)
① Amount of principal repaid by first n-year period	Monthly payment (PMT) × Number of repayments (12×n) ↳Use financial keys Amount of loan (K)→PV Number of years (Y)×12→n Initial interest rate (R)÷12→i% COMP PMT	Amount of loan (K) Number of years (Y) Initial interest rate (R) Number of years repaid at R (N) Number of interest rate changes (T)
①' Principal remaining after ① payment.	Use financial keys BAL (N×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×n) ↳Use financial keys ①'→PV ①''×12→n Initial interest rate (R)÷12→i% COMP PMT	New interest rate (R) Number of years repaid at R (N)
②' Principal remaining after ② payment.	Use financial keys BAL (N×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



Program

	Program															Step
1	Fcl	:	?	→	K	:	?	→	Y	:	?	→	R	:	?	15
2	→	N	:	?	→	T	:	K	→PV	:	Y	×12→n	:	R	÷12→i%	30
3	:	(−)	1	2	COMP	PMT	N	→	F	◢	Lbl	0	:	BAL	(	45
4	1	2	N	)	→PV	:	Y	−	N	→	Y	:	?	→	R	60
5	:	?	→	N	:	R	÷12→i%	:	Y	×12→n	:	(−)	1	2	COMP	75
6	PMT	N	→	A	◢	A	+	F	→	F	:	T	−	1	→	90
7	T	:	T	=	0	⇒	Goto	1	:	Goto	0	:	Lbl	1	:	105
8	F															106
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																

Variables

A		J		S	
B		K	Amount of loan	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		R	Interest rate		

•Sample execution

Specify end of term payment.

MODE 1 Prog 0 (Recall program)	FIN Prog 0_
EXE (Execute program)	FIN K?
100000 EXE (Amount of loan)	FIN Y?
25 EXE (Total number of years)	FIN R?
5.6 EXE (Interest rate for first period)	FIN N?
5 EXE (Number of repayments at 5.6%)	FIN T?
3 EXE (Number of interest rate changes. Enter 0 for fixed rate)	Disp FIN 37'204.42376 ($) (Total principal and interest repaid during first five years)
EXE	FIN R?
6 EXE (Interest rate for first change)	FIN N?
5 EXE (Number of payments at 6%)	Disp FIN 38'431.98065 ($) (Total principal and interest repaid during second five years)
EXE	FIN R?
7 EXE (Interest rate for second change)	FIN N?
5 EXE (Number of payments at 7%)	Disp FIN 40'935.55869 ($) (Total principal and interest repaid during third five years)
EXE	FIN R?
6 EXE (Interest rate for third change)	FIN N?
10 EXE (Number of payments at 6%)	Disp FIN 78'283.45188 (Total principal and interest repaid during final ten years)
EXE	FIN 194'855.415 ($) (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
⇒	ALPHA →
→	STO (Displayed simultaneously with variable when variable is input after pressing STO.)
→ *i* %	i%
→ PV	PV
→ *n*	n

1 Depreciation (fixed rate method)

Formula

$$\text{Yearly depreciation} = \text{Purchase price} \times \text{Depreciation rate as determined by fixed rate method}$$

(Predetermined depreciation educated from 2nd year)

- The depreciation rate calculation is often difficult to perform accurately, and often discrepancies occur when the applicable number of years is input to calculate depreciation. As a result, this manual uses a method wherein the depreciation rate is input.

Example

Determine the amount of yearly depreciation for an asset purchased at $20,000 with a remaining value ratio of 10%, at a depreciation rate of 0.280 using a fixed rate calculation method.

Operation example

Key operation	Display	Key operation	Display
Prog 0 EXE (Recall program)	FIN Fix K?	EXE	FIN Fix 2'006.12 (Remaining book value for seventh year)
20000EXE (Input purchase price)	FIN Fix F?	EXE	FIN Fix 6.12 (Depreciation for eighth year)
10EXE (Input remaining value ratio)	FIN Fix R?	EXE	FIN Fix 2'000.00 (Remaining book value for eighth year)
.280EXE (Input depreciation rate)	FIN Fix 5'600.00 (Depreciation for first year)	EXE	FIN Fix 0.00 (End of depreciation)
EXE	FIN Fix 14'400.00 (Remaining book value for first year)		
EXE ⋮ Display of data from second year on. EXE.	FIN Fix 780.16 (Depreciation for seventh year)		

Program

	Program															Step
1	Fix	2	:	?	→	K	:	?	→	F	:	?	→	R	:	15
2	.	0	1	F	K	→	D	:	K	R	→	A	◢	K	−	30
3	A	→	C	◢	Lbl	1	:	C	R	→	A	:	C	−	A	45
4	→	C	:	C	>	D	⇒	Goto	2	:	Goto	3	:	Lbl	2	60
5	:	A	◢	C	◢	Goto	1	:	Lbl	3	:	C	+	A	−	75
6	D	→	A	◢	D	◢	0	◢	Norm							84
7																
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9																
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14																
15																
16																
17																
18																

Variables

A	Yearly depreciation	J		S	
B		K	Purchase price	T	
C	Book balance	L		U	
D	Remaining value	M		V	
E		N		W	
F	Remaining value ratio	O		X	
G		P		Y	
H		Q		Z	
I		R	Depreciation rate		

2 Final worth factor

Formula

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

Example

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

Operation example

Key operation	Display
[Prog] [0] [EXE] (Recall program)	FIN I?
4.4 [EXE] (Input interest rate)	FIN 1. (Initial term)
[EXE]	FIN 1.044 (Final worth factor after initial term)
[EXE]	FIN 2. (Second term)
[EXE]	FIN 1.089936 (Final worth factor after second term)
⋮	⋮

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

Program

	Program															Step
1	Fcl	:	?	→	I	:	I	→i%	:	1	→	N	:	Lbl	1	15
2	:	N	→n	:	(−)	1	→PV	:	N	◢	COMP	FV	◢	N	+	30
3	1	→	N	:	Goto	1										36
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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			

3 Duration of allotment for progressive private annuities

Formula

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

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
Prog 0 EXE (Recall program)	FIN Fix I?
6.25 EXE (Input interest rate)	FIN Fix M?
18000 EXE (Input annuity for initial year)	FIN Fix R?
5 EXE (Input progressive rate)	FIN Fix K?
250000 EXE (Input value of deposit)	Disp FIN Fix 16.11

Program

	Program															Step
1	Fix	2	:	?	→	I	:	?	→	M	:	?	→	R	:	15
2	?	→	K	:	log	(	1	−	.	0	1	K	(	I	−	30
3	R	)	÷	M	)	÷	log	(	(	1	+	.	0	1	R	45
4	)	÷	(	1	+	.	0	1	I	)	)	◢	Norm			58
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15																
16																
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18																

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

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

Formula

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

Example

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

Operation example

Key operation	Display
Prog 0 EXE (Recall program)	Fix R?
12 EXE (Input effective interest rate)	Fix N?
20 EXE (Input number of monthly installments)	Fix 6.49837787 (Annual add-on interest rate)

Program

	Program															Step
1	?	→	R	:	.	0	1	R	÷	1	2	→	R	:	?	15
2	→	N	:	R	÷	(	1	−	(	1	+	R	)	x^y	(−)	30
3	N	)	−	N	x^{-1}	→	A	:	1	2	0	0	A			43
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18																

Variables

A	Monthly add-on interest rate	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		R	Annual effective interest rate		

5 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 approximate calculations.
- Due to the repetitive calculation required in approximate calculation, some time is required for completion of the calculation.
- Used the succeeding program when the ratio of effective interest to the displayed add-on interest rate is 1.48 or over. If this ratio is lower, adjust the corresponding value appropriately in the program.

Example

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

Operation example

Key operation	Display
Prog 0 EXE (Recall program)	FIN A?
9.6 EXE (Input annual add-on interest rate)	FIN N?
15 EXE (Input number of installments)	Disp FIN Fix 17.41 (Annual effective interest rate)

Program

	Program															Step
1	?	→	A	:	A	÷	1	2	0	0	→	A	:	?	→	15
2	N	:	1	.	4	8	A	→	R	:	A	+	N	x^{-1}	→	30
3	A	:	Lbl	0	:	R	+	.	0	0	0	1	→	R	:	45
4	R	÷	(	1	−	(	1	+	R	)	y^x	(−)	N	)	→	60
5	B	:	A	>	B	⇒	Goto	0	:	Fix	2	:	R	−	.	75
6	0	0	0	1	→	S	:	S	÷	(	1	−	(	1	+	90
7	S	)	y^x	(−)	N	)	→	C	:	S	+	.	0	0	0	105
8	1	(	A	−	C	)	÷	(	B	−	C	)	→	T	:	120
9	1	2	0	0	T	→	T	◢	Norm							129
10																
11																
12																
13																
14																
15																
16																
17																
18																

Variables

A	Add-on interest rate	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		R	Approximation of effective interest rate (high)		

6 Loans featuring uniform repayment of principal

Formula

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

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
Prog 0 EXE (Recall program)	Fin Fix K?
120000 EXE (Input amount borrowed)	Fin Fix N?
10 EXE (Input number of installments)	Fin Fix R?
9 EXE (Input annual interest rate)	Fin Fix 10'800.00 (Initial interest installment)
EXE	Fin Fix 22'800.00 (Amount of initial principal/interest installment)
EXE	Fin Fix 9'720.00 (Second interest installment)
EXE	Fin Fix 21'720.00 (Amount of second principal/interest installment) : Displayed consecutively
⋮ EXE	Fin Fix 13'080.00 (Amount of tenth principal/interest installment)
EXE	Fin 11. (End of repayment)

Program

	Program															Step
1	Fix	2	:	?	→	K	:	?	→	N	:	?	→	R	:	15
2	.	0	1	R	→	R	:	1	→	A	:	Lbl	1	:	K	30
3	÷	N	×	(	1	+	(	N	−	A	+	1	)	R	)	45
4	→	B	:	B	−	K	÷	N	◢	B	◢	A	+	1	→	60
5	A	:	A	<	N	+	1	⇒	Goto	1	:	Norm				72
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14																
15																
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17																
18																

Variables

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

7 Interest on lease installments

Formula

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

(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.

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

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
Prog 0 EXE (Recall program)	FIN Fix K?
75000 EXE (Input price of leased item)	FIN Fix T?
24 EXE (Input number of installments)	FIN Fix N?
3 EXE (Input number of installments made in advance)	FIN Fix R?
8 EXE (Input annual interest rate)	FIN Fix 3'328.06 ($) (Amount of monthly installment)

Program

	Program															Step
1	Fix	2	:	?	→	K	:	?	→	T	:	?	→	N	:	15
2	T	−	N	—	T	:	?	→	R	:	.	0	1	R	÷	30
3	1	2	→	R	:	K	R	÷	(	1	−	(	1	+	R	45
4	)	y^x	(−)	T	+	N	R	)	◢	Norm						55
5																
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9																
10																
11																
12																
13																
14																
15																
16																
17																
18																

Variables					
A		J		S	
B		K	Price of leased item	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		Y	
H		Q		Z	
I		R	Annual interest rate		

8 Breakeven point calculation

Formula

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

$$\text{Profit} = \text{Sales} - \text{Variable costs} \times \text{Number of units sold} - \text{Fixed expenses}$$

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	Key operation	Display
Prog 0 EXE (Recall program)	F?	400 EXE (Input number of unit sold)	2'600.00 (Gross profit)
17000 EXE (Input fixed costs)	V?	EXE	T?
16 EXE (Input variable costs)	T?	3 EXE (Derive unit selling price : T = 3)	G?
1 EXE (Derive necessary unit sales : T = 1)	P?	2600 EXE (Input gross profit)	U?
60 EXE (Input selling price)	386.36 (Necessary unit sales)	370 EXE (Input unit sales)	68.97 (Unit selling price)
EXE	T?		
2 EXE (Derive gross profit : T = 2)	P?	EXE	T?
65 EXE (Input selling price)	U?	4 EXE (End program : T = 4)	4.

Program

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

	Program															Step
1	Fix	2	:	?	→	F	:	?	→	V	:	Lbl	1	:	?	15
2	→	T	:	T	=	1	⇒	Goto	2	:	T	=	2	⇒	Goto	30
3	3	:	T	=	3	⇒	Goto	4	:	T	=	4	⇒	Goto	5	45
4	:	Goto	1	:	Lbl	2	:	?	→	P	:	F	÷	(	P	60
5	−	V	)	◢	Goto	1	:	Lbl	3	:	?	→	P	:	?	75
6	→	U	:	(	P	−	V	)	U	−	F	◢	Goto	1	:	90
7	Lbl	4	:	?	→	G	:	?	→	U	:	(	G	+	F	105
8	+	V	U	)	÷	U	◢	Goto	1	:	Lbl	5	:	Norm		119
9																
10																
11																
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13																
14																
15																
16																
17																
18																

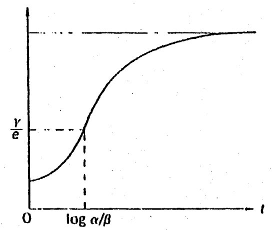
Variables

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 expenses	O		X	
G	Gross profit	P	Per unit sales price	Y	
H		Q		Z	
I		R			

9 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 saturated 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	Key operation	Display
Prog 0 EXE	FIN Fix N?	100 EXE (Input number of years far into future — 100 for example. Population calculation will not change very much even if a value over 100 is input.)	FIN Fix 220'212.93 (Saturated of population)
3 EXE (Input number of data for 1 group)*	FIN Fix A?	EXE 21 EXE (Calculate for 21st year)	FIN Fix 216'983.30 (Estimated population for 1990)
146583 EXE (Input value for $t = 1$)	FIN Fix A?		
⋮ Input succeeding values for t ⋮			
195687 EXE (Input value for $t = 9$)	FIN Fix T?	EXE 0 EXE (End program)	FIN -1.

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

Program

	Program															Step
1	Fix	2	:	0	→	L	:	?	→	N	:	Lbl	0	:	L	15
2	+	1	→	L	:	L	>	3	⇒	Goto	3	:	0	→	M	30
3	:	0	→	S	:	Lbl	1	:	M	+	1	→	M	:	M	45
4	>	N	⇒	Goto	2	:	?	→	A	:	S	+	ln	A	→	60
5	S	:	Goto	1	:	Lbl	2	:	L	=	1	⇒	S	→	H	75
6	:	L	=	2	⇒	S	→	I	:	L	=	3	⇒	S	→	90
7	J	:	Goto	0	:	Lbl	3	:	?	→	T	:	T	−	1	105
8	→	T	:	T	<	0	⇒	Goto	4	:	(	J	−	I	)	120
9	÷	(	I	−	H	)	→	C	:	C	y^x	N	x^{-1}	→	B	135
10	:	(	H	−	I	)	(	B	−	1	)	÷	(	C	−	150
11	1	)	x^2	→	D	:	N	x^{-1}	(	H	J	−	I	x^2	)	165
12	÷	(	H	−	2	I	+	J	)	→	K	:	e^x	K	→	180
13	K	:	K	(	e^x	(−)	D	)	y^x	(	B	y^x	T	)	◢	195
14	Goto	3	:	Lbl	4	:	Norm									202
15																
16																
17																
18																

Variables

A	Data	J	Partial sum of Group 3	S	
B		K		T	Number of years
C		L		U	
D		M		V	
E		N	Number 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			

•Input range of functions (general rules)

Function name	Input range	Accuracy of results
$\log x$、$\ln x$	$10^{99} \leqq x < 10^{100}$	±1 in the 10th digit
e^x	$-10^{100} < x \leqq 230.2585092$	—〃—
$\sqrt{x}$	$0 \leqq x < 10^{100}$	—〃—
x^2	$\|x\| < 10^{50}$	—〃—
x^{-1}	$\|x\| < 10^{100}$、$x \fallingdotseq 0$	—〃—
N!	$0 \leqq N \leqq 69$ (N is an integer)	—〃—
y^x	$y > 0 : -1 \times 10^{100} < {}^1\!/\!{}_x \log y < 100 \quad x \fallingdotseq 0$ $y = 0 : x > 0$ $y < 0 : x = n$、$1/(2n+1)$ *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 : $n \fallingdotseq 0$ $x\sigma_{n-1}$、$y\sigma_{n-1}$: $n \fallingdotseq 1, 0$	—〃—

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

Specifications

Model:	FC-200
Basic calculation functions:	Addition/subtraction/multiplication/division, constant calculations, 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
Financial functions:	Compound interest (savings, installment savings, loan), amortization, reciprocal conversion of percentage interest rate and effective interest rate, investment appraisal (net present value, internal rate of return), and cost, selling price, margin calculations
Statistical functions:	Standard deviation, linear regression, logarithmic regression, exponential regression, power regression
Memory:	26 variable memories
Display/digits:	12-digit dot display, 10-digit mantissa plus 2-digit exponent, date display, symbol display
Decimal point:	Full floating with underflow
Error check:	Indicated by "ERROR" message, locking operation
Power source:	Two lithium batteries (CR2032)
Auto power off:	After approximately 6 minutes
Power consumption:	0.01W
Battery life:	Approximately 450 hours (continuous operation)
Ambient temperature range:	0°C ~ 40°C (32°F ~ 104°F)
Dimensions:	9.5mmH × 71.5mmW × 132.5mmD (3/8"H × 2 3/4"W × 5 3/16"D)
Weight:	87g (3.1 oz) including batteries.