FC-100

OWNER'S MANUAL

MANUAL DEL PROPIETARIO

FINANCIAL CONSULTANT

CASIO

英西B

FORWARD

Thank you for your purchase of the CASIO FC-100.
This unit is an advanced 10-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.
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

HANDLING PRECAUTIONS

- This unit is composed of precision electronic components, and should never be dissasembled. Do not drop it or otherwise subject it to sudden impacts, or sudden temperature changes. Be especially careful to avoid storing the unit or leaving it in areas exposed to high temperature, humidity, or large amounts of dust. When exposed to low temperatures, the unit will require more time to display answers and may even fail to operate. The display will return to normal once normal temperature is attained.
- The display is blank while the unit is performing calculations. At this time, keys are inoperative. Therefore, keys should normally be used while confirming proper operation by checking the display.
- Remove batteries if this unit is not to be used for an extended period. Never leave dead batteries in the battery compartment as leakage may cause damage to the unit.
- The manufacturer does not assume responsibility for losses or damages incurred through the use of this product or formulas listed in this manual, or through the alteration or loss of data due to malfunction, repair, weak batteries or other causes.
- Avoid using volatile liquids such as thinner or benzine to clean the unit. Wipe the unit with a soft, dry cloth or a cloth that has been dipped in a neutral detergent solution and wrung out.
- 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.

BATTERY REPLACEMENT

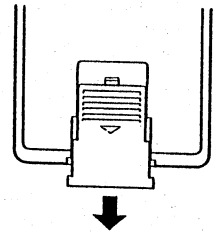
Power is supplied to this unit by one lithium battery (CR2025C). If the power of the battery should diminish, the display will weaken and become difficult to read. In this case, battery should be replaced as shown below.

*If the battery is used for longer than two years, there is the danger leakage. Be sure to replace batteries at least once every two years — even if the unit is not used during that period.

*Stored data are erased when the battery is replaced.

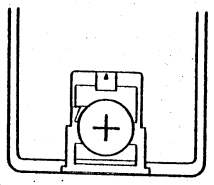
■ Procedure

① Slide the power switch to the OFF position and remove the back cover.



② Remove the old battery from the unit. (It can be removed easily by turning the unit upside down and tapping lightly on the battery box.)

③ Wipe the surface of the new battery with a soft, dry cloth and load it into the unit, making sure that the positive (+) side is facing up.



④ While holding the battery in with the cover, slide the cover back into place.

IMPORTANT:
Never dispose of old batteries in such a way that they will be incinerated. Batteries may explode if exposed to fire.
Keep batteries out of the reach of small children. If a battery should be inadvertently swallowed, contact your physician immediately.

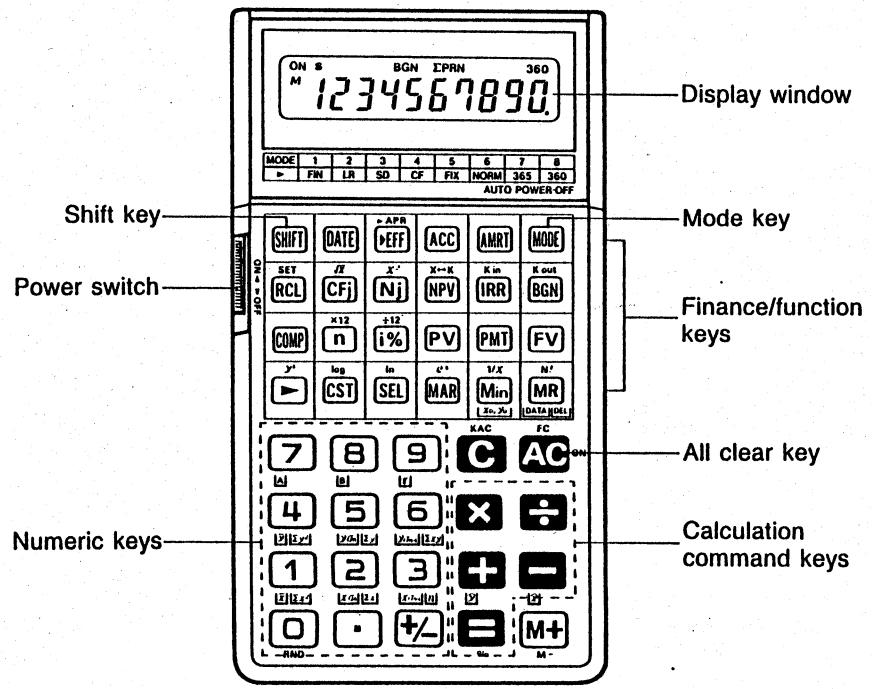
NOTE: Perform the following key operations each time battery is replaced.

[MODE] [1]	[SHIFT] [AC] (FC)	[SHIFT] [C] (KAC)	[AC] [Min]	[MODE] [6]	[MODE] [7]
Set FIN mode	Clear financial memories	Clear constant memories	Clear independent memory	Specify NORM	Specify 365-day mode

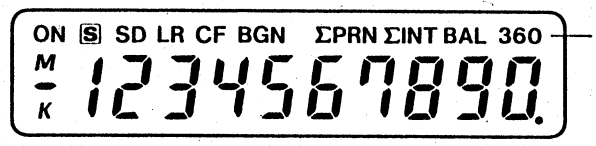
■ Auto Power Off Function

The power of the unit is automatically switched OFF approximately 6 minutes after the last key operation. Once this occurs, power can be restored either by switching the power of the unit OFF and then ON again, or by pressing the [AC] key. (Numeric values in the memories and specified modes are unaffected when power is switched OFF.)

GENERAL GUIDE

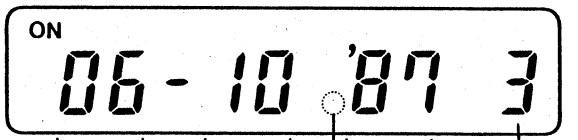


Display window



Display symbols

The display window shows calculation values and results.
In addition, in some calculations it shows dates or number of days as follows;



(Indicates June 10, 1987, Wednesday)

"•" mark appears for years from 2000 ~ 2099

Days of the Week

0 = Sunday 1 = Monday 2 = Tuesday 3 = Wednesday
4 = Thursday 5 = Friday 6 = Saturday

The "ON" symbol lights when power is turned ON. In addition, various symbols (SD, LR, CF, BGN, PRN, ΣPRN, INT, ΣINT, BAL, 360) light depending on the type of calculation being performed. An "[S]" symbol lights when the shift key is pressed, an "***M***" symbol indicates the use of an independent memory, and a "***K***" symbol indicates the use of the constant calculation function.
Note that an error symbol ("***E***") appears in last digit's place indicating an error (see page 15), and calculation is stopped at that point.

Power switch
Power is turned ON by sliding the power switch up. Note that data held in the independent memory, constant memory, and financial memories — as well as mode specifications (see page 14) — are held in memory even when power is turned OFF.

[SHIFT] Shift key
Press before using the function commands or functions marked in orange on the key panel. An [S] will illuminate on the display indicating that this key has been pressed. Pressing [SHIFT] again will cause the [S] to disappear from the display and the unit to return to the status it was in before [SHIFT] was originally pressed.

[DATE] Date key
Pressed before inputting a date for number of day or date calculations. Key operation and data input is as follows; (See page 30)

Month [DATE] day [DATE] year [DATE]

[▸APR] [▸EFF] Effective/percentage interest rate conversion key
- Used for conversion of percentage interest rate into effective interest rate.
- Press after the [SHIFT] key to convert effective interest rate into percentage interest rate (hereafter illustrated as [SHIFT] [▸APR]).

*Results can be obtained by pressing the [=] key. (See page 50 for details.)

[ACC] Accumulation key
Used when calculating the accumulated principal and accumulated interest at a given point in a loan payment plan ([MODE] [1]: FIN). Each time this key is pressed, amount changes from principal to interest to principal. ΣPRN symbol indicates principal amount, while ΣINT symbol indicates interest amount. (See page 48)

[AMRT] Amortization key
Used when principal and interest at any given point, as well as balance of principal ([MODE] [1]: FIN). Each time this key is pressed, displayed amount changes from principal to interest to balance to principal. Each amount is indicated by corresponding PRN, INT and BAL symbols on display. (See page 48)

[MODE] Mode key
Used when specifying operational modes. Press this key followed by a numeric key [1]~[8]. (See page 14)

[SET] [RCL] Data recall/Set key
- Used to verify data held in various memories ([n], [i%], [PV], [PMT], [FV], [CST], [SEL], [MAR], [CFj] (j=0~14), [Nj] (j=0~14)). Press this key followed by the key corresponding to data to be recalled.
- Used when correcting data held in [CFj] or [Nj]. Press after the [SHIFT] key (hereafter illustrated as [SHIFT] [SET]). (See page 53)
- When entering a estimated value to calculate IRR, enter the value and the press [SHIFT] [SET] [IRR].

[√x̄] [CFj] Cash flow input/Square Root key
- Used to input cash flow for investment appraisal ([MODE] [4]: CF). (See page 52 and 56)
- Used in square root calculations. Press after pressing [SHIFT] key (hereafter illustrated as [SHIFT] [√x̄]).

[x'] [Nj] Frequency/Square key
- Used to specify the number of inputs at the same amount in cash flow inputs ([MODE] [4]: CF). Press after pressing the corresponding numeric key. (See page 52 and 56)
- Used to square a displayed number. Press after the [SHIFT] key (hereafter illustrated as [SHIFT] [x²]).

[x↔K] [NPV] Net present value/Register change key
- Used in calculating net present value in investment appraisal ([MODE] [4]: CF). (See page 52)
- Used in exchanging displayed value and a constant memory. Used in combination with numeric keys, after the [SHIFT] key (hereafter illustrated as [SHIFT] [x↔K]).

[Kin] [IRR] Internal rate of return/Constant memory input key
- Used when calculating internal rate of return in investment appraisal ([MODE] [4]: CF). (See page 58)
- Used when inputting a number into a constant memory, in combination with numeric keys [1]~[6]. Press after the [SHIFT] key (hereafter illustrated as [SHIFT] [Kin]).

Kout
BGN **Beginning/end of term payment/Constant memory output key**

- Used to specify beginning or end of term payment methods in a compound interest calculation (MODE 1: FIN). Each time this key is pressed, specification changes from beginning to end to beginning. When the beginning of term payment method is selected, a "BGN" symbol appears on the display.
- Used to display the number held in the constant memories, in combination with numeric keys 1~6. Press after the SHIFT key (hereafter illustrated as SHIFT Kout).

COMP **Computation key**

Used to engage calculation of compound interest (n, i%, PMT, PV, FV), cost, selling price, margin (CST, SEL, MAR). Press corresponding keys after this key.

x12
n **Compound interest term/Term × 12 key**

- Used to input the number of compounded terms in a compound interest calculation. Also used to calculate this when used in combination with COMP key.
- Displayed value is automatically multiplied by 12 before input when pressed after the SHIFT key.

÷12
i% **Interest rate/Interest rate ÷12 key**

- Used to input/derive the interest rate in compound interest calculations (input as a percentage value) (MODE 1: FIN).
- Displayed value is automatically divided by 12 before input when pressed after the SHIFT key.

PV **Present value (principal) key**

Used to input/derive present value (principal) in compound interest calculations (MODE 1: FIN).

PMT **Payment key**

Used to input/derive pay out (pay in) amounts in compound interest calculations (MODE 1: FIN).

FV **Future value (principal plus interest) key**

Used to input/derive future value amount (principal plus interest) in compound interest calculations (MODE 1: FIN).

yx
► **Right shift/Power key**

- Used to delete the last digit when any number is input mistakenly. Pressing repeatedly deletes one digit at a time, from the last digit.
- Used when multiplying any given y by any x. Press after the SHIFT key, between the input of y and x (hereafter illustrated as SHIFT y^x).

log
CST **Cost/Common logarithm key**

- Used to input/derive cost in cost, selling price, margin calculations. (See page 69)
- Used when deriving common logarithms (logarithms with a base of 10). Press after the SHIFT key (hereafter illustrated as SHIFT log).

ln
SEL **Selling price/natural logarithm key**

- Used to input/derive selling price in cost, selling price, margin calculations. (See page 69)
- Used when deriving natural logarithms (logarithms with a base of e). Press after the SHIFT key (hereafter illustrated as SHIFT ln).

ex
MAR **Margin/natural antilogarithm key**

- Used to input/derive margin in cost, selling price, margin calculations. (See page 69)
- Used when deriving the natural antilogarithm (x as a multiple of e). Press after the SHIFT key (hereafter illustrated as SHIFT e^x).

√x
M− **Memory in/Inverse number key**
x̄,ȳ

- Used when inputting values into independent memory. Previously entered value is replaced with new value.
- Used when calculating inverse number of displayed value. Press after the SHIFT key (hereafter illustrated as SHIFT 1/x).
- When "LR" (MODE 2) is displayed, this key may be used as the [x data] input key for regression calculation (hereafter illustrated as x̄,ȳ).

n!
MR **Memory recall/Factorial key**
MIA MDF

- Used to display data held in independent memory. Memory contents are not altered.
- Used to derive factorials of displayed value. Press after the SHIFT key (hereafter illustrated as SHIFT n!).
- When LR (MODE 2) and SD (MODE 3) symbols are displayed, this key may be used for data input/deletion (hereafter illustrated as DATA, SHIFT DEL).

DATA .....When SD is displayed, press data DATA.
When LR is displayed, press x data x̄,ȳ y data DATA.

SHIFT DEL .....When data is input mistakenly, press SHIFT DEL instead of DATA in the above examples.

[0]~[9], [·] Numeric/decimal point keys

- When entering numeric values, press in order from the first digit. Use the decimal point key to input decimal points. Values containing up to 10 digits may be input. Any numeric keys pressed after this limit is reached are ignored and not input.

*Varying functions will be designated when you press [SHIFT] and a numeric key, as summarized below.

- [SHIFT] [0 RND] : Cutting off internal data
  The internal data (held in the Y-register) will be cut off so as to be equal to the displayed data.

*Use following sequences in calculation of standard deviation ([MODE] [3]) and in regression analysis ([MODE] [2]). For more details, refer to the section titled "STATISTICAL CALCULATIONS".

- [SHIFT] [1 $\bar{x}$] : Calculation of $\bar{x}$ (average of x)
- [SHIFT] [2 $x\sigma_n$] : Calculation of $x\sigma_n$ (population standard deviation of x)
- [SHIFT] [3 $x\sigma_{n-1}$] : Calculation of $x\sigma_{n-1}$ (sample standard deviation of x)
- [SHIFT] [4 $\bar{y}$] : Calculation of $\bar{y}$ (average of y)
- [SHIFT] [5 $y\sigma_n$] : Calculation of $y\sigma_n$ (population standard deviation of y)
- [SHIFT] [6 $y\sigma_{n-1}$] : Calculation of $y\sigma_{n-1}$ (sample standard deviation of y)
- [SHIFT] [7 A] : Calculation of A (constant terms in regression equations)
- [SHIFT] [8 B] : Calculation of B (regression coefficients)
- [SHIFT] [9 r] : Calculation of r (correlation coefficients)

*Different functions will be designated when you press [SHIFT] [Kout], then a numeric key as summarized below.

- [SHIFT] [Kout] [1 Σx^2]: Calculation of Σx^2 (square sum of x)
- [SHIFT] [Kout] [2 Σx]: Calculation of Σx (total sum of x)
- [SHIFT] [Kout] [3 n]: Calculation of n (number of data)
- [SHIFT] [Kout] [4 Σy^2]: Calculation of Σy^2 (square sum of y)
- [SHIFT] [Kout] [5 Σy]: Calculation of Σy (total sum of y)
- [SHIFT] [Kout] [6 Σxy]: Calculation of Σxy (product of x and y)

[+/−] Sign change key

Used to change the sign of the displayed number. Changes in succession each time this key is pressed, from positive to negative to positive.

[C] Clear key (value correction key)

- Used to delete an input value without interrupting the calculation. Must be pressed immediately after the mistaken input is made. Only the displayed value is cleared.
- Used to clear all constant memories and statistical memories. Press after the [SHIFT] key.

[AC ON] All clear key

- Used to clear all data from memories, with the exception of the independent memory, constant memories, financial memories, cost, selling price and margin memories, and the statistics memories — which remain unaffected. This key may also be used to turn power back ON after the auto power off function has automatically turned power OFF. (See page 6)
- To clear financial memories, cost, selling price and margin memories, first press the [SHIFT] key followed by the [AC] key.

[+], [−], [×], [÷], [=] Calculation command/Equal keys

- For addition, subtraction, multiplication and division, enter the calculation as it reads. Calculation results are derived after pressing the equal key. Note that pressing any of the calculation command keys twice in succession will cause the "*K*" symbol to appear, indicating constant calculation. (See page 17)
- When the "**LR**" symbol ([MODE] [2]) is displayed, the [+] and [−] keys become estimate calculation keys for regression calculation. Pressing the [SHIFT] key allows the derivation of $\hat{x}$ and $\hat{y}$ with the [$\hat{x}$] and [$\hat{y}$] keys.
- Press [SHIFT] followed by the [=] key for percentage calculation.

[M+ M−] Memory plus/Memory minus key

- Press to summate (add) values held in independent memory.
- Press after the [SHIFT] key to subtract values held in independent memory.
- [M+] ([SHIFT] [M−]) also obtains the results of arithmetic operations and automatically adds (subtracts) it to (from) the contents of the memory. The result obtained by the addition (subtraction) will be the new value stored in memory.

BEFORE BEGINNING CALCULATIONS

■ Modes

Before beginning calculations with this unit, it is necessary to specify what type of calculation is to be performed. This is accomplished by using the MODE key in combination with a number key.

•Calculation modes

MODE 1 ..... Used for basic calculations including function calculations, as well as financial calculations (excluding investment appraisal). (FIN mode)

MODE 2 ..... Used in regression calculation (paired variable statistics). ("LR" symbol lights on display when specified.) (LR mode)

MODE 3 ..... Used for standard deviation calculation. ("SD" symbol lights on display when specified.) (SD mode)

MODE 4 ..... Used for investment appraisal calculation ("CF" symbol lights on display when specified.) (CF mode)

*Modes 1 ~ 4 are entirely independent, and cannot be used in combination with each other. Also, mode specification is held in memory even if power is turned OFF.

•Display modes

MODE 5 ..... Used to specify the number of decimal places. Values are rounded at the specified decimal point. (FIX mode)

MODE 6 ..... Used to cancel the decimal place specification as made in the FIX mode. (NORM mode)

*Modes 5 and 6 can be used in combination with MODE 1 ~ MODE 4 and MODE 7 ~ MODE 8. In addition, mode specification is held in memory even when power is turned OFF.

•Number of day mode

MODE 7 ..... Used when calculating one year as 365 days. (365 day mode)

MODE 8 ..... Used when calculating one year as 360 days. ("360" symbol lights on display when specified.) (360 day mode)

*Modes 7 and 8 can be used in combination with MODE 1 ~ MODE 4 and MODE 5 ~ MODE 6. In addition, mode specification is held in memory even when power is turned OFF.

■ Corrections

•There are two different ways to make corrections if a mistake is made in number key operation (value input miss), as listed below.

1) Using the ► key ..... Each time the ► key is pressed, an input digit is deleted, beginning from the last one. Deleted values can be replaced with new values using the numeric keys.

Example: 1 2 3 5 →1 2 3 4

Operation	Display
1 2 3 5	1235.
►	123.
4	1234.

2) Using the C key ..... Press this key to clear the entire input value. Values previously input in the calculation are held in memory, so the calculation may be continued after reinputting the correct value.

•If calculation command keys (+, −, ×, ÷) or power key (SHIFT y^x) keys are mistakenly pressed, correction can be made by subsequently pressing the correct key (before pressing any other key).

■ Overflow and Errors

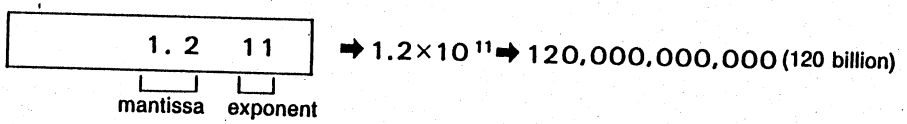
If the calculation range of this unit is exceeded, or incorrect inputs are made, an error symbol will appear on the display and subsequent operation will be impossible. This is the error check function. The following operations will result in errors:

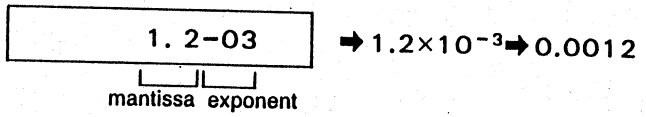
1. The answer, whether intermediate or final, or any value in memory (including basic, financial, function, and statistical calculations) exceeds the value of $\pm 9.999999 \times 10^{99}$. (The value before the error is generated is retained in memory.)
2. An attempt is made to perform function calculations that exceed the input range (see page 71).
3. Improper operation during standard deviation or regression calculation. (Example: calculations wherein a divisor is "0", such as 6 ÷ 0 =, or when obtaining the values of $\bar{x}$ and σn when $n = 0$, etc.)

***After an error check, press the AC key to begin a new calculation.**

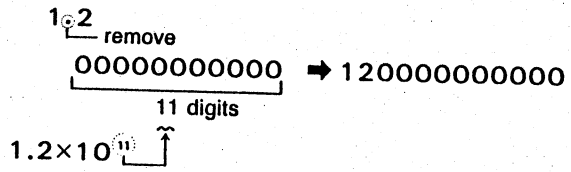
■ How to Read the Display

The display window generally displays 10 digits. However, during a calculation or when the resulting answer exceeds the display limit, the value is displayed using exponents. The display enters this exponent mode whenever a value exceeds 10 billion (10^{10}) or is less than 0.01 (10^{-2}). The display is read as follows in these cases:

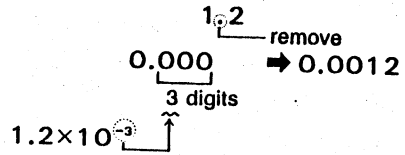




When the exponent is a positive number, it represents the number of digits for the decimal places. Removing the decimal point then gives the total value.



When the exponent is negative, the first digit in the mantissa indicates the number of digits after the decimal point.



In this way, it is easy to convert figures shown exponentially into fully written values.

■ Internal Calculation and Rounding

Basically, calculations are performed using a mantissa of up to 12 digits internally, with the result being rounded at the 11th digit. However, the mantissa is held in the register in its 12-digit form. The 10th, 11th, and 12th digits are cut off when they are within the range of 001 ~ 007, and rounded to 000 (with the 9th digit being incremented) when they are in the range of 993 ~ 999.

BASIC CALCULATIONS

•Press [MODE] followed by [1] to enter the FIN mode.

■ Arithmetic Operations

Example	Operation	Display
53+123−63=113	53 [+] 123 [−] 63 [=]	113.
0.456×(−89)÷12=−3.382	[(−)] 456 [×] 89 [+/−] [÷] 12 [=]	−3.382
(56×3−89)÷5.2+63 =78.19230769·····	56 [×] 3 [−] 89 [÷] 5.2 [+] 63 [=]	78.19230769
123456×741852=9.158608×10¹⁰ (=91586080000)	123456 [×] 741852 [=]	9.158608 10
1.2÷(−963)=−1.246105×10⁻³ (=−0.001246105)	1.2 [÷] 963 [+/−] [=]	−1.246105−03

■ Constant Calculations

Example		Operation		Display
12+23=35	*Press a calculation command key twice to display "K". The displayed number is held in memory as a constant. After this, inputting a value and pressing the [=] key will obtain a result.	23 [+] [+] 12 [=]	K	35.
45+23=68		45 [=]	K	68.
7−5.6=1.4		5.6 [−] [−] 7 [=]	K	1.4
2−5.6=−3.6		2 [=]	K	−3.6
2.3×12=27.6		12 [×] [×] 2.3 [=]	K	27.6
4.5×12=54		4.5 [=]	K	54.
45÷9.6=4.6875		9.6 [÷] [÷] 45 [=]	K	4.6875
78÷9.6=8.125		78 [=]	K	8.125
(2.3²)²=27.9841		2.3 [×] [=] [×] [=]		27.9841
(2.3×2.3×2.3×2.3=)		(or 2.3 [×] [×] [=] [=] [=])		

■ Specifying the Number of Decimal Places

- To specify the number of decimal places, press [MODE] followed by [5], followed by [n] (numeric key [1]~[9] corresponding to number of decimal places). This specification can be cancelled by pressing [MODE] followed by [6].
- Internal calculation is carried out in 12-digit form even though the number of decimal places has been specified. To convert internal values to the displayed value, press [SHIFT] followed by [RND].

Example	Operation	Display
100÷6=16.6666666……	100 ÷ 6 =	16.66666667
	(4 decimal places specified) MODE 5 4	16.6667
	MODE 6	16.66666667
*When the number of decimal places are specified, display shows rounded off values, however the actual value is held in the register. In addition, all specifications can be made before or during actual calculation.		
200÷7×14=400	(3 decimal places specified) MODE 5 3	
	200 ÷ 7 =	28.571
	(Calculation completed in 12-digit internal form) × 14 =	400.000
	(Same calculation performed using internal rounding) 200 ÷ 7 =	28.571
	SHIFT RND × 14 =	399.994
	(Decimal place number specification cancelled) MODE 6	399.994

■ Percentage Calculations

Example	Operation	Display
•Percentage		
26% of 1,500	1500 × 26 SHIFT %	390.
•Add-on		
15% add-on of 3,620	3620 × 15 SHIFT % +	4163.
•Discount		
4% discount of 4,750	4750 × 4 SHIFT % −	4560.
•Ratio		
Percentage of 75 against 250	75 ÷ 250 SHIFT %	30. (%)
•Increase/decrease		
141 is what percent increase from 120?	141 − 120 SHIFT %	17.5 (%)
240 is what percent decrease from 300?	240 − 300 SHIFT %	−20. (%)
•Mark-up		
What would the selling price and profit be when the purchase price of an item is $480 and the profit rate to the selling price is 25%?	480 + 25 SHIFT %	640. (Selling price)
	(Subsequently) −	160. (Profit)
•Mark-down		
What would the bargain price and loss be for a $130 item sold at a loss rate of 4% of the bargain price?	130 + 4 +/− SHIFT %	125. (Bargain price)
	(Subsequently) −	−5. (Loss)
•Percent constant		
1,200×12%=144	1200 × × 12 SHIFT %	144.
1,200×15%=180	15 SHIFT %	180.

■ Memory Calculations

- This unit features an independent memory which utilizes the [Mm], [M+], [M−] and [MR] keys, as well as 6 constant memories, which use the [Kin] and [Kout] keys in combination with the [1]~[6] number keys.
- The contents of memories are not erased when power is turned OFF.

•Independent memory

- Addition or subtraction (cumulative) can be made directly into this memory, allowing the derivation of successive cumulative totals. Because of this, this memory is extremely useful in totalizing calculations.

Example	Operation	Display
23+9=32	23 [+] 9 [=] [Mm]	32.
53−6=47	53 [−] 6 [M+]	47.
−) 45×2=90	45 [×] 2 [SHIFT] [M−]	90.
99÷3=33	99 [÷] 3 [M+]	33.
(Total) 22	[MR]	22.

*The [Mm] key is used when entering initial values into the independent memory. (It is therefore not necessary to clear the memory before entering the first value.)
Also, the [M+] and [M−] keys can be used in place of the [=] key. Also, note that using [SHIFT] [M−] and [+/−] [M+] produces the same results.

7+7+7+(2×3)+(2×3) +(2×3)−(2×3)=33	7 [Mm] [M+] [M+] 2 [×] 3 [M+] [M+] [M+] [SHIFT] [M−] [MR]	33.
45×6=270	6 [×] [×] 45 [=] [Mm]	270.
−) 12×6= 72	12 [SHIFT] [M−]	72.
78×6=468	78 [M+]	468.
(Total) 666	[MR]	666.

•Constant memories

- There are six sets of constant memories — K_1 ~ K_6 — which can be freely used to preserve data, constants, results of calculations, etc.
- If a calculation command key is pressed immediately after pressing the [Kin] key and a register ([1]~[6]) is specified, arithmetic operations can be performed in the K registers.
- To clear all constant memories, press [SHIFT] followed by [KAC].

Example	Operation	Display
193.2÷23=8.4	193.2 [SHIFT] [Kin] [1] [÷] 23 [=]	8.4
193.2÷28=6.9	[SHIFT] [Kout] [1] [÷] 28 [=]	6.9
193.2÷42=4.6	[SHIFT] [Kout] [1] [÷] 42 [=]	4.6

*Another operation using the independent memory is as follows
193.2 [Mm] [÷] 23 [=], [MR] [÷] 28 [=], [MR] [÷] 42 [=]

$\frac{9\times6+3}{5\times8}$=1.425	9 [×] 6 [+] 3 [=] [SHIFT] [Kin] [1]	57.
	5 [×] 8 [=] [SHIFT] [Kin] [2]	40.
	[SHIFT] [Kout] [1] [÷] [SHIFT] [Kout] [2] [=]	1.425

*Another operation using the independent memory is as follows
5 [×] 8 [=] [Mm] 9 [×] 6 [+] 3 [=] [÷] [MR] [=]

7×8×9=504	7 [SHIFT] [Kin] [1] [×] 8		
4×5×6=120	[SHIFT] [Kin] [2] [×] 9 [Kin] [3] [=] [Mm]		504.
3×6×9=162	4 [SHIFT] [Kin] [+] [1] [×] 5 [SHIFT] [Kin]	4 is added to constant memory 1.	
(Total) 14 19 24 786	[+] [2] [×] 6 [SHIFT] [Kin] [+] [3] [M+]		120.
	3 [SHIFT] [Kin] [+] [1] [×] 6 [SHIFT] [Kin]		
	[+] [2] [×] 9 [SHIFT] [Kin] [+] [3] [M+]		162.
	[SHIFT] [Kout] [1]		14.
	[SHIFT] [Kout] [2]		19.
	[SHIFT] [Kout] [3]		24.
	[MR]		786.

*In the same way, [−], [×] and [÷] operations can be carried out in the K register.

2.3+3.4=5.7	2.3+3.4= [SHIFT] [Kin] [1]	5.7
2.3+3.4+4.5−15−4.5=−9.3	4.5 [SHIFT] [Kin] [+] [1] [SHIFT] [x↔K] [1]	
	[−] 15 [−] [SHIFT] [Kout] [1] [=]	−9.3

■ Function Calculations ($\sqrt{x}$, x^2, y^x, log, ln, e^x, $1/x$, N.!)

- $^1/_x$ and N! cannot be used in the LR mode (MODE 2) and SD mode (MODE 3). Perform these calculations in the FIN mode (MODE 1).

Example	Operation	Display
$\sqrt{2}+\sqrt{5}=3.65028154$	2 SHIFT $\sqrt{x}$ + 5 SHIFT $\sqrt{x}$ =	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 =	54.
$5.6^{2.3}=52.58143837$	5.6 SHIFT y^x 2.3 =	52.58143837
$123\frac{1}{7}\ (=\sqrt[7]{123})=1.988647795$	1 ÷ 7 = Mn 123 SHIFT y^x MR =	1.988647795
$4^{2.5}=32$	2.5 SHIFT y^x SHIFT y^x 4 =	* 32.
$0.16^{2.5}=0.01024$	⊡ 16 =	* 0.01024

*y^x can be calculated using constant calculation as with arithmetic calculations.

$\log 1.23\ (=\log_{10}1.23)=0.089905111$	1.23 SHIFT log	0.089905111
$\ln 90\ (=\log_e 90)=4.49980967$	90 SHIFT ln	4.49980967
$\log 456 \div \ln 456=0.434294481$	456 Mn SHIFT log ÷ MR SHIFT ln =	0.434294491
$e^{4.5}=90.0171313$ (Calculate the anti-logarithm of the natural logarithm 4.5)	4.5 SHIFT e^x	90.0171313
$\frac{1}{\frac{1}{3}-\frac{1}{4}}=12$	3 SHIFT $1/x$ − 4 SHIFT $1/x$ = SHIFT $1/x$	12.
$8!\ (=1\times2\times3\times\cdots\cdots\times7\times8)=40320$	8 SHIFT N!	40320.

STATISTICAL CALCULATIONS

- Begin all statistical calculations by pressing SHIFT followed by KAC to clear the statistical memories. (These data are not cleared from memory by turning the power OFF or by AC operations.)

■ Standard Deviation

- Enter the SD mode by pressing MODE followed by 3. An "SD" symbol appears on the display.
- Individual data are input using DATA (MR). Use the +/− key if the data is a negative number.
  Example: 50 +/− DATA (to input −50)
- When the same data is to be input repeatedly, press the DATA key repeatedly or use the DATA in combination with the × key after inputting the data.
  Example: 10 × 5 DATA (to input five times ten)
- Standard Deviation

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

(Using the entire data of a finite population to determine the standard deviation for the population.)

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

(Using sample data for a population to determine the standard deviation for the population.)

- Mean

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

Example	Operation	Display
Data 55, 54, 51, 55, 53, 53, 54, 52 Press MODE followed by 3 to display the "SD" symbol. *Keys may be pressed in any order to obtain results. What is deviation of the unbiased variance, the difference between each datum, and the mean of the above data?	MODE 3 → "SD" SHIFT AC(KAC) 55 DATA 54 DATA 51 DATA 55 DATA 53 DATA DATA 54 DATA 52 DATA	52.
	(Standard deviation σn) SHIFT 2	1.316956719
	(Standard deviation $\sigma n-1$) SHIFT 3	1.407885953
	(Mean $\bar{x}$) SHIFT 1	53.375
	(Number of data) SHIFT Kout 3	8.
	(Sum of data) SHIFT Kout 2	427.
	(Sum of square of data) SHIFT Kout 1	22805.
	(Subsequently) SHIFT 3 SHIFT x^2	1.982142857 (Unbiased variance)
	SHIFT 1 − − 55 =	1.625 $(55-\bar{x})$
	54 =	0.625 $(54-\bar{x})$
	51 =	−2.375 $(51-\bar{x})$
	⋮	

Example	Operation	Display
What is $\bar{x}$ and $x\sigma_{n-1}$ for the following table? Class No. / Value / Frequency 1 / 110 / 10 2 / 130 / 31 3 / 150 / 24 4 / 170 / 2 5 / 190 / 3	SHIFT AC(KAC) 110 × 10 DATA	110.
	130 × 31 DATA	130.
	150 × 24 DATA	150.
	170 DATA DATA	170.
	190 DATA DATA DATA	190.
	SHIFT Kout 3	70.
	SHIFT 1	137.7142857
	SHIFT 3	18.42898069

★Erroneous data clear/correction I
(correct data operation: 51 DATA)
① If 50 DATA is entered, enter correct data after pressing SHIFT DEL.
② If 49 DATA was input a number of entries previously, enter correct data after pressing 49 SHIFT DEL.
③ If 51 × is entered, press 1 DATA, or enter correct data after pressing AC.

★Erroneous data clear/correction II
(correct data operation: 130 × 31 DATA)
① If 120 × is entered, enter correct data after pressing AC.
② If 120 × 31 is entered, enter correct data after pressing AC.
③ If 120 × 30 DATA was entered previously, enter correct data after pressing 120 × 30 SHIFT DEL.
④ If 120 × 30 DATA was entered previously, enter correct data after pressing 120 × 30 SHIFT DEL.

■ Regression Calculations

- Regression calculations are performed in the LR mode (press MODE 2, and LR appears on the display).
- Individual data are entered as x data x_0y_0, y data DATA.
- Multiple data of the same value can be entered by repeatedly pressing DATA. This operation can also be performed by entering x data x_0y_0, y data ×, followed by a value representing the number of times the data is repeated, and then DATA.
- If only x data is repeated (x data having the same value), enter y data DATA.
- If only y data is repeated (y data having the same value), enter x data x_0y_0 DATA.

•Linear regression

•The regression formula is $y = A + Bx$, and constant term A and regression coefficient B are calculated using the following formulas:

Regression coefficient of regression formula

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

Constant term of regression formula

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

•Estimated values $\hat{X}$ and $\hat{Y}$ based on the regression formula can be calculated.
•The correlation coefficient r for input data can be computed using the following formula:

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

Example

•Temperature and the length of a steel bar

Temp.	Length
10℃	1003mm
15	1005
20	1010
25	1011
30	1014

Using this table the regression formula and correlation coefficient can be obtained. Based on the coefficient formula, the length of the steel bar at 18°C and the temperature at 1000mm can be estimated. Furthermore, the critical coefficient (r^2) can also be calculated.

Operation	Display
MODE 2	
↓ "LR"	
SHIFT AC	0.
10 $x_{o,}y_{b}$	10.
1003 DATA	1003.
15 $x_{o,}y_{b}$ 1005 DATA	1005.
20 $x_{o,}y_{b}$ 1010 DATA	1010.
25 $x_{o,}y_{b}$ 1011 DATA	1011.
30 $x_{o,}y_{b}$ 1014 DATA	1014.
(Constant term A) SHIFT 7 (A)	997.4
(Regression coefficient B) SHIFT 8 (B)	0.56
(Correlation coefficient r) SHIFT 9 (r)	0.982607368
(Length at 18°C) 18 SHIFT 2	1007.48
(Temperature at 1000mm) 1000 SHIFT 1	4.642857143
(Critical coefficient) SHIFT 9 (r) SHIFT x^2	0.965517241

★Erroneous data clearing/correction (correct data operation; 10 $x_{o,}y_{b}$ 1003 DATA)
① If 11 $x_{o,}y_{b}$ 1003 is entered, enter correct data after pressing AC.
② If 11 $x_{o,}y_{b}$ 1003 DATA is entered, enter correct data after pressing SHIFT DEL.
③ If 11 $x_{o,}y_{b}$ 1003 DATA was entered previously, enter correct data after pressing 11 $x_{o,}y_{b}$ 1003 SHIFT DEL.

•Logarithmic regression

•The regression formula is $y = A + B \cdot \ln x$. Enter the x data as the logarithm (ln) of x, and the y data inputs the same as that for linear regression.
•The same operation as with linear regression can be used to obtain the regression coefficient and for making corrections. To obtain the estimated value $\hat{Y}$, x SHIFT ln SHIFT 2 is used, and to obtain estimated value $\hat{X}$, y SHIFT 1 SHIFT e^x is used. Furthermore, Σx, Σx^2 and Σxy are obtained as $\Sigma \ln x$, $\Sigma (\ln x)^2$, and $\Sigma \ln x \cdot y$ respectively.

Example

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

Through logarithmic regression of the above data, the regression formula and correlation coefficient are obtained. Furthermore, respective estimated values $\hat{Y}$ and $\hat{X}$ can be obtained for $xi = 80$ and $yi = 73$ using the regression formula.

Operation	Display
MODE 2 SHIFT AC 29 SHIFT ln $x_{o,}y_{b}$	3.36729583
↓ "LR" 1.6 DATA	1.6
50 SHIFT ln $x_{o,}y_{b}$ 23.5 DATA	23.5
74 SHIFT ln $x_{o,}y_{b}$ 38.0 DATA	38.
103 SHIFT ln $x_{o,}y_{b}$ 46.4 DATA	46.4
118 SHIFT ln $x_{o,}y_{b}$ 48.9 DATA	48.9
(Constant term A) SHIFT 7 (A)	−111.1283975
(Regression coefficient B) SHIFT 8 (B)	34.02014748
(Correlation coefficient r) SHIFT 9 (r)	0.994013946
($\hat{Y}$ when $xi = 80$) 80 SHIFT ln SHIFT 2	37.94879481
($\hat{X}$ when $yi = 73$) 73 SHIFT 1 SHIFT e^x	224.1541315

•Exponential regression

- The regression formula is $y = A \cdot e^{B \cdot x}$ ($\ln y = \ln A + Bx$). Enter the y data as the logarithm of y(ln), and the x data the same as that for linear regression.
- Correction is performed the same as in linear regression. Constant term A is obtained by [SHIFT] [A] [SHIFT] [e^x], estimated value $\hat{Y}$ is obtained by x [SHIFT] [$\hat{y}$] [SHIFT] [e^x], and estimated value $\hat{X}$ is obtained by y [SHIFT] [ln] [SHIFT] [$\hat{x}$]. Σy, Σy^2 and Σxy are obtained by $\Sigma \ln y$, $\Sigma(\ln y)^2$ and $\Sigma x \ln y$ respectively.

Example		Operation	Display
x_i	y_i		
6.9	21.4	[MODE] [2]	
12.9	15.7	↓	
19.8	12.1	"LR"	
26.7	8.5	[SHIFT] [AC] 6.9 [x_0,y_0]	6.9
35.1	5.2	21.4 [SHIFT] [ln] [DATA]	3.063390922
		12.9 [x_0,y_0] 15.7 [SHIFT] [ln] [DATA]	2.753660712
		19.8 [x_0,y_0] 12.1 [SHIFT] [ln] [DATA]	2.493205453
		26.7 [x_0,y_0] 8.5 [SHIFT] [ln] [DATA]	2.140066163
		35.1 [x_0,y_0] 5.2 [SHIFT] [ln] [DATA]	1.648658626
		(Constant term A) [SHIFT] [7 A] [SHIFT] [e^x]	30.49758742
		(Regression coefficient B) [SHIFT] [8 B]	−0.049203708
		(Correlation coefficient r) [SHIFT] [9 r]	−0.997247351
		($\hat{Y}$ when $xi = 16$) 16 [SHIFT] [$\hat{y}$] [SHIFT] [e^x]	13.87915739
		($\hat{X}$ when $yi = 20$) 20 [SHIFT] [ln] [SHIFT] [$\hat{x}$]	8.574868046

Through exponential regression of the above data, the regression formula and correlation coefficient are obtained. Furthermore, the regression formula is used to obtain the respective estimated value $\hat{Y}$ and $\hat{X}$ when $xi = 16$ and $yi = 20$.

•Power regression

- The regression formula is $y = A \cdot x^B$ ($\ln A + B \ln x$). Enter both data x and y as logarithms (ln).
- Estimated values $\hat{x}$, and $\hat{y}$ based on the regression formula can be computed using the following formulas:

$$\hat{y} = A \cdot x^B \qquad \hat{x} = \exp\left(\frac{\ln y - \ln A}{B}\right)$$

- Correction is performed the same as in linear regression. Constant term A is obtained by [SHIFT] [A] [SHIFT] [e^x], estimated value $\hat{Y}$ is obtained by x [SHIFT] [ln] [SHIFT] [$\hat{y}$] [SHIFT] [e^x], and estimated value $\hat{X}$ is obtained by y [SHIFT] [ln] [SHIFT] [$\hat{x}$] [SHIFT] [e^x]. Σx, Σx^2, Σy, Σy^2 and Σxy are obtained by $\Sigma \ln x$, $\Sigma(\ln x)^2$, $\Sigma \ln y$, $\Sigma(\ln y)^2$ and $\Sigma \ln x \cdot \ln y$ respectively.

Example		Operation	Display
x_i	y_i		
28	2410	[MODE] [2]	
30	3033	↓	
33	3895	"LR"	
35	4491	[SHIFT] [AC] 28 [SHIFT] [ln] [x_0,y_0]	3.33220451
38	5717	2410 [SHIFT] [ln] [DATA]	7.787382026
		30 [SHIFT] [ln] [x_0,y_0] 3033 [SHIFT] [ln] [DATA]	8.017307508
		33 [SHIFT] [ln] [x_0,y_0] 3895 [SHIFT] [ln] [DATA]	8.267448958
		35 [SHIFT] [ln] [x_0,y_0] 4491 [SHIFT] [ln] [DATA]	8.409830673
		38 [SHIFT] [ln] [x_0,y_0] 5717 [SHIFT] [ln] [DATA]	8.651199471
		(Constant term A) [SHIFT] [7 A] [SHIFT] [e^x]	0.238801082
		(Regression coefficient B) [SHIFT] [8 B]	2.771866148
		(Correlation coefficient r) [SHIFT] [9 r]	0.998906256
		($\hat{Y}$ when $xi = 40$) 40 [SHIFT] [ln] [SHIFT] [$\hat{y}$] [SHIFT] [e^x]	6587.674743
		($\hat{X}$ when $yi = 1000$) 1000 [SHIFT] [ln] [SHIFT] [$\hat{x}$] [SHIFT] [e^x]	20.26225659

Through power regression of the above data, the regression formula and correlation coefficient are obtained. Furthermore, the regression formula is used to obtain the respective estimated value $\hat{Y}$ and $\hat{X}$ when $xi = 40$ and $yi = 1000$.

NUMBER OF DAYS/DATE CALCULATIONS

In the 365-day mode (1 year calculated as 365 days) both number of days and date calculations can be performed, while in the 360-day mode (1 year calculated as 360 days) only number of day calculations can be made.
*In the 365-day mode, leap years are calculated automatically.

•Selecting the 365-day and 360-day modes

Press [MODE] followed by [7] to specify the 365-day mode.
Press [MODE] followed by [8] to specify the 360-day mode. A "360" symbol appears, indicating that this mode is selected. This symbol disappears when the 365-day mode ([MODE] [7]) is selected.

•Calculation range

1/1/1901 ~ 12/31/2099

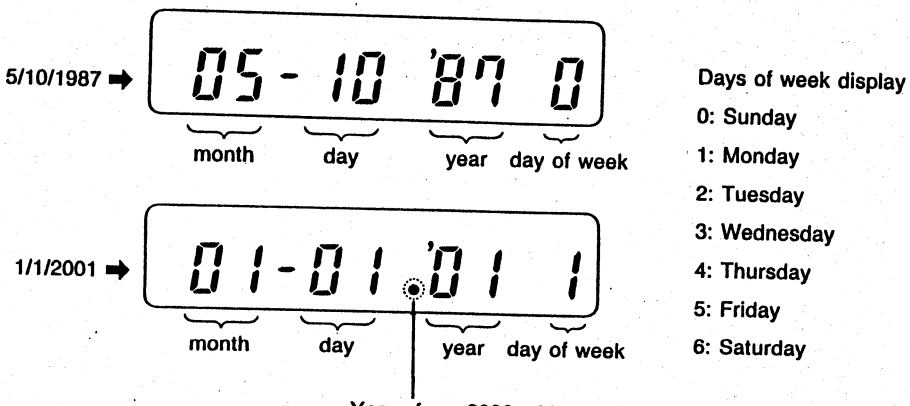
•Date input

Input date by pressing month [DATE] day [DATE] year [DATE]. For years in this century (1900 ~ 99), input of the last two digits is sufficient, however all four digits must be input for years in the next century (2000 ~ 2099).

Example: Input 5/10/1987

5 [DATE] 10 [DATE] (19) 87 [DATE]

•How to read the display



Days of week display
0: Sunday
1: Monday
2: Tuesday
3: Wednesday
4: Thursday
5: Friday
6: Saturday

•Types of calculations

The following 4 types of Number of Days and Date calculations are possible.
① Date – date = number of days (both Mode 7 and Mode 8)
② Date + number of days = date (Mode 7 only)
③ Date – number of days = date (Mode 7 only)
④ Number of days + date = date (Mode 7 only)

Example	Operation	Display
In the 360-day mode, how many days are there from 6/1/1987 to 1/1/1992?	[MODE] [8] 6 [DATE] 1 [DATE] 87 [DATE] [−]	06-01 '87 ^{360}1
	1 [DATE] 1 [DATE] 92 [DATE] [=]	^{360}1650.
In the 365-day mode, how many days are there from 6/1/1987 to 1/1/1992?	[MODE] [7] 6 [DATE] 1 [DATE] 87 [DATE] [−]	06-01 '87 1
	1 [DATE] 1 [DATE] 92 [DATE] [=]	1675.
Determine the date after 200 days from 11/30/2001. (365-day mode)	11 [DATE] 30 [DATE] 2001 [DATE] [+]	11-30 '01 5
	200 [=]	06-18 '02 2
Determine the month and date 50 days, 100 days and 150 days from 5/20/1987. (number of days constant calculation – 365-day mode)	5 [DATE] 20 [DATE] 87 [DATE] [+] [+]	K 05-20 '87 3
	50 [=]	K 07-09 '87 4
	100 [=]	K 08-28 '87 5
	150 [=]	K 10-17 '87 6
Determine the year, month and date 15 days before, 30 days before and 45 days before 6/3/1987. (number of days memory calculation – 365-day mode)	6 [DATE] 3 [DATE] 87 [DATE] [M−]	M 06-03 '87 3
	[−] 15 [=]	M 05-19 '87 2
	[MR] [−] 30 [=]	M 05-04 '87 1
	[MR] [−] 45 [=]	M 04-19 '87 0

FINANCIAL CALCULATIONS

This unit can be used to perform a variety of complex financial calculations, including compound interest, amortization, mutual conversion of percentage and effective interest rate, investment appraisal, and others.

■ Before Beginning Financial Calculations

- All financial calculations (with the exception of investment appraisal calculations) are carried out in the FIN mode (MODE 1). (Investment appraisal calculations are carried out in MODE 4 .)
- Before beginning financial calculations, it is necessary to press SHIFT followed by CA to clear the financial memories. Simply pressing AC will not clear these memories.
- Interest rate calculations using the % key are performed in percentages.
- There is a direct correspondence between terms and interest rates;
  i.e.: If the term is expressed in days, the interest rate is per day.
  If the term is expressed in months, the interest rate is monthly.
  If the term is expressed in years, the interest rate is annual.

NOTES

*When calculating *i*% or IRR, an unusual amount of calculation time may be necessary. To cancel these calculations, simply press AC.
*It is impossible to calculate *i*% or IRR calculations wherein the result is 0% or less. An error results if this type of calculation is attempted.

■ Financial Memories

There are various independent memories which are used in financial calculation, including n, *i*%, PMT, PV and FV memories. In addition, there are 15 memories maintained by CF*j* and N*j* in the CF mode (investment appraisal). However, the constant memories (K memories) cannot be used in the CF mode. Note that data held in the financial memories (n, *i*%, PMT, PV, FV, CF*j* and N*j*) is preserved even when power is turned OFF. (NOTE: CF*j* and N*j* memories are cleared when mode is switched from FIN mode to CF mode, or vice versa.)

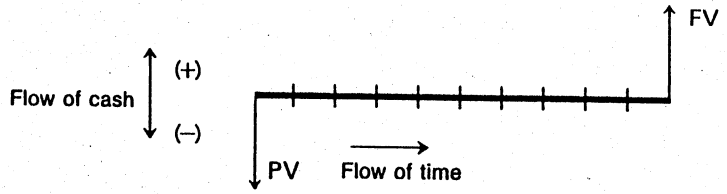
■ Number Input and Flow of Payments (in and out)

All payments (out) are treated as credits and input as minus values. Receipts (in) are treated as debits and are input as plus values. All calculation results can be judged in the same way, with negative numbers representing a negative balance and positive numbers representing a positive balance.

■ Cash Flow Diagrams

As stated before, payments (out) are input as minus values, while money received is input as plus values. Constructing a cash flow diagram as shown below may make this concept easier to understand. The cash flow diagram shows the flow of money received and paid out over time. It may be drawn according to the following instructions;

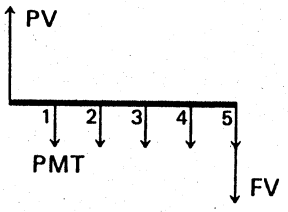
① Time is represented by the horizontal axis, right to left.
② Money received/paid out is represented by vertical lines — above the time axis for money received, below it for money paid out.
For example, the following cash flow diagram can be used when calculating both principal and interest on basic compound interest.



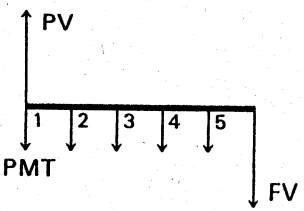
The principal (PV) is treated as a payment (out) in this case, so it is represented by a vertical arrow in the negative direction. The total amount of principal and interest (FV) will be paid in the future, so it is represented by a vertical arrow in the positive direction. Cash flow diagrams such as the one listed above accompany the examples throughout this manual, so a clear understanding of their function is beneficial.

NOTE: Constructing cash flow diagram differs between payment at end of term and payment at beginning of term.

•Payment at end of term



•Payment at beginning of term



■ Compound Interest Calculations

1) Formula

The following is the basic compound interest calculation formula:

$$PV + (1 + i \times S)PMT\frac{1-(1+i)^{-n}}{i} + FV(1+i)^{-n} = 0$$

S = 0 payment at end of term S = 1 payment at beginning of term

When PMT = 0, the basic compound interest formula can be simplified to:

$$FV = -PV(1+i)^{n}$$

When FV = 0, a loan formula can be expressed as:

$$PV = -PMT\frac{1-(1+i)^{-n}}{i}$$ (payment at end of term)

$$PV = -PMT(1+i)\frac{1-(1+i)^{-n}}{i}$$ (payment at beginning of term)

When PV = 0, the loan formula can be expressed as:

$$FV = -PMT\frac{(1+i)^{n}-1}{i}$$ (payment at end of term)

$$FV = -PMT(1+i)\frac{(1+i)^{n}-1}{i}$$ (payment at beginning of term)

*When i% is equal to "0" , the following formula can be used:

$$PV + PMT \times n + FV = 0$$

The unit performs financial calculations in accordance with the formulas listed above. It should be noted, however, that formulas and rounding methods may differ according to your accepted local or industry customers. If these formulas differ from those which are used in your industry or applications, correct results can be obtained by performing the calculations using manual input with the unit.

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

2) Data input

Pressing [n], [i%], [PMT], [PV], or [FV] inputs the currently displayed value. Input can be performed in any seuquence desired. [n] and [i%] are helpful when converting between years and months. [SHIFT] [×12 n] multiplies the displayed value by 12 before input, while [SHIFT] [÷12 i%] multiplies by 1/12 before input.

3) Data editing

Input data can be changed or corrected by simply reinputting the new data.

4) Beginning of term/end of term payments

Each press of the [BGN] key switches between the beginning of term and end of term payment modes. The BGN symbol is shown on the display while the unit is in the beginning of term payment mode. Switching between modes can be performed at any time, but the change only affects payment (PMT) related calculations.

5) Calculation result output

The following keys produce the corresponding results on the display when pressed following the [COMP] key.

[COMP] [n] ..... terms
[COMP] [PMT] ..... payment amount
[COMP] [PV] ..... principal
[COMP] [FV] ..... total of principal and interest
[COMP] [i%] ..... interest rate

*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) Input data verification

Pressing the [n], [i%], [PMT], [PV], and [FV] keys following [RCL] displays the corresponding data for the keys for verification.

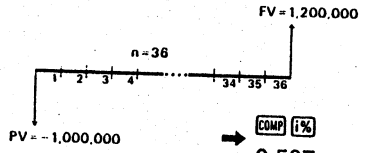
IMPORTANT

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

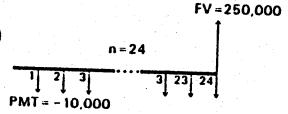
<Input Condition>

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.

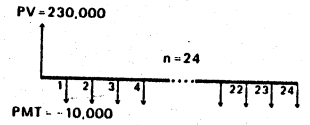
Savings (standard compound interest)

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

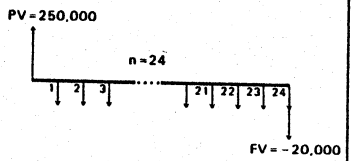
Installment savings, etc.

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 × PMT when FV > 0 −FV > n × PMT when FV < 0
EXAMPLE	PMT = −10000 (Installment amount) FV = 250000 (Total of principal and interest) n = 24 (Number of installments)  −FV < n × PMT (−250000 < 24 × (−10000)) → COMP 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 × PMT when PV > 0 −PV < n × PMT when PV < 0
EXAMPLE	PV = 230000 (Amount borrowed) PMT = −10000 (Payment amount) n = 24 (Number of payments)  −PV > n × PMT (−230000 > 24 × (−10000)) → COMP 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 × PMT when FV > PV PV + FV < −n × PMT when FV < PV
EXAMPLE	PV = 250000 (Amount borrowed) FV = −20000 (Final full payment) PMT = −10000 (Equal repayment) n = 24 (Term)  PV + FV < −n × PMT (250000 − 20000 < (−24) × (−10000)) → COMP 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.

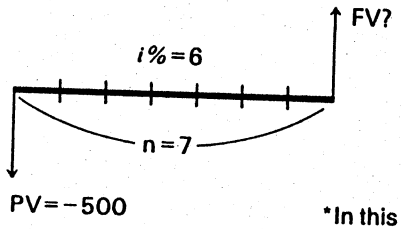
Therefore, it is suggested that PV (COMP PV), PMT (COMP PMT) or FV (COMP FV) be determined for comparison with input values to see if the calculated values fall within the allowable range.

Savings

•Total of principal and interest

Example 1

What is the total principal and interest after 7 years for a principal of $500 at 6%, compounded annually.

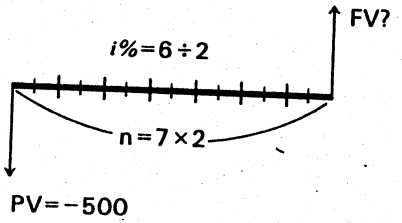


*In this case, the principal is treated as a credit, and is therefore input as a negative amount.

Operation	Display
MODE 1 MODE 6 SHIFT AC	0.
(Term) 7 n	7.
(Interest rate) 6 i%	6.
(Principal) 500 +/− PV	−500.
(Total of principal and interest) COMP FV	751.8151295 ($)

Example 2

What would the principal and interest be in Example 1 if compounding is performed every six months.



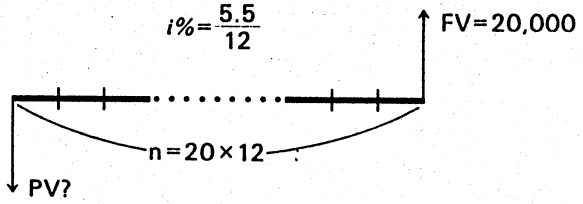
Operation	Display
(After completing the operation in example 1...)	
(Term) 7 × 2 = n	14.
(Interest rate) 6 ÷ 2 = i%	3.
COMP FV	756.2948624 ($)

*To convert the calculation for compound interest, compounded semi-annually, double the term and reduce the interest rate by 1/2.

•Calculating principal

Example

You want to bring the total amount of savings to $20,000 in 20 years. Your annual interest rate is 5.5%, compounded monthly. How much principal must be invested to reach your goal?

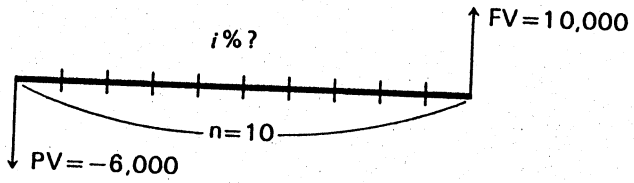


Operation	Display
MODE 1 MODE 6 SHIFT AC	0.
(Term) 20 SHIFT n (12)	240.
(Interest rate) 5.5 SHIFT i% (12)	0.458333333
(Total of principal and interest) 20000 FV	20000.
(Principal) COMP PV	−6674.173868 ($)

•Calculating interest rate of compound interest

Example

You are going to invest $6,000. To increase this amount to $10,000 in 10 years, what interest rate is necessary for a savings account compounded annually? (Calculate to the nearest two decimal places.)

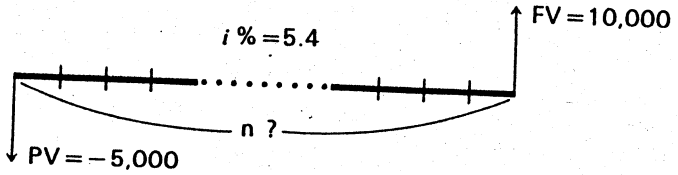


Operation		Display
	MODE 1 MODE 5 2 SHIFT AC	0.
(Term)	10 n	10.00
(Total of principal and interest)	10000 FV	10000.00
(Principal)	6000 +/− PV	−6000.00
(Interest rate)	AC i% COMP i%	5.24 (%)
(Verification)	COMP FV	10000.00

•Periodic Calculation of Compound Interest

Example

How many years are required to increase a principal amount of $5,000 to a total of $10,000 at an annual interest rate of 5.4%, compounded monthly?



Operation		Display
	MODE 1 MODE 6 SHIFT AC	0.
(Interest rate)	5.4 SHIFT ÷12 i%	0.45
(Principal)	5000 +/− PV	−5000.
(Total of principal and interest)	10000 FV	10000.
(Term — number of months)	COMP n	154.379021
(Term — number of years)	÷ 12 =	12.86491842

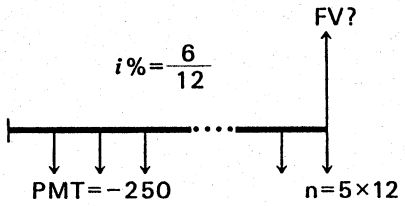
Installment savings

•Calculation of total of principal and interest

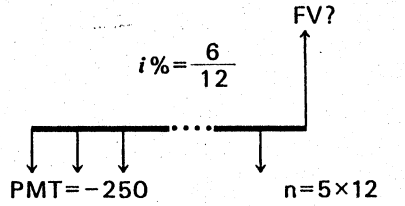
Example

If you invest $250 in installment savings each month for 5 years at 6% annual interest compounded monthly, what will the total of principal and interest be at the end of the term? (Calculate for payment at end of term, as well as payment at beginning of term.)

•Payment at end of term



•Payment at beginning of term



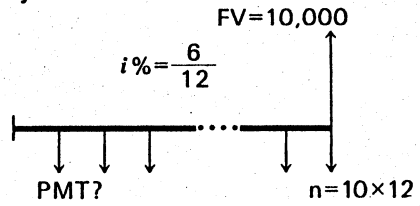
Operation		Display	
	MODE 1 MODE 6 SHIFT AC	0.	
(Term)	5 SHIFT x12 n	60.	
(Interest rate)	6 SHIFT ÷12 i%	0.5	
(Installment amount)	250 +/− PMT	−250.	
(Total of principal and interest)	COMP FV	17442.50763	(Payment at end of term)
	BGN	BGN 17442.50763	
(Total of principal and interest)	COMP FV	BGN 17529.72017	(Payment at beginning of term)

•Calculating amount of installment

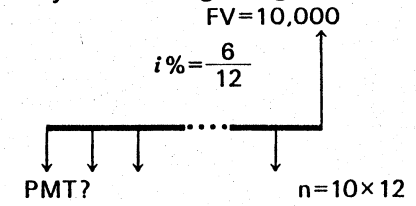
Example

In order to save a total of $10,000 in ten years, how much will each savings installment be at an annual interest rate of 6% compounded monthly?

•Payment at end of term



•Payment at beginning of term



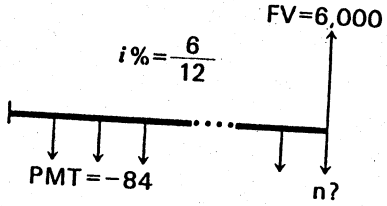
Operation		Display
	MODE 1 MODE 6 SHIFT FC AC	0.
(Term)	10 SHIFT x12 n	120.
(Interest rate)	6 SHIFT ±12 i%	0.5
(Total of principal and interest)	10000 FV	10000.
(Installment amount)	COMP PMT	-61.02050194 (Payment at end of term)
	BGN	BGN -61.02050194
(Installment amount)	COMP PMT	BGN -60.71691736 (Payment at beginning of term)

•Calculating number of installments

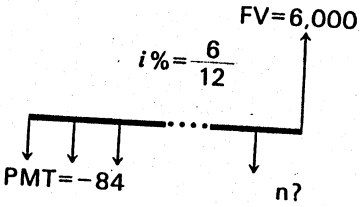
Example

How many installment deposits of $84 must be made to reach a goal of $6,000 at an annual interest rate of 6% compounded monthly?

•Payment at end of term



•Payment at beginning of term



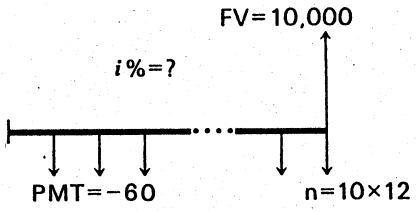
Operation		Display
	MODE 1 MODE 6 SHIFT FC AC	0.
(Interest rate)	6 SHIFT ±12 i%	0.5
(Installment amount)	84 +/- PMT	-84.
(Total of principal and interest)	6000 FV	6000.
(Term — number of months)	COMP n	61.22889381 (Payment at end of term)
(Term — number of years)	÷ 12 =	5.102407817 (Payment at end of term)
	BGN	BGN 5.102407817
(Term — number of months)	COMP n	BGN 60.96621909 (Payment at beginning of term)
(Term — number of years)	÷ 12 =	BGN 5.080518257 (Payment at beginning of term)

•Calculating interest rate for installment savings

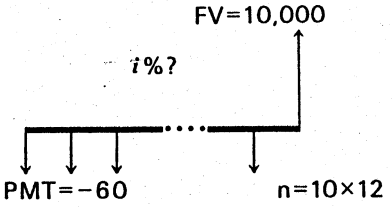
Example

What rate of annual interest is necessary so that installment payments of $60 will reach a principal + interest total of $10,000 in 10 years? (Calculate to the nearest two decimal places.)

•Payment at end of term



•Payment at beginning of term

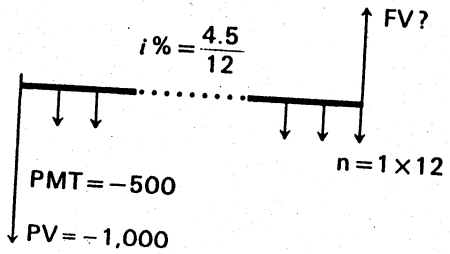


Operation		Display
	MODE 1 MODE 5 2 SHIFT FC AC	0.
(Term)	10 SHIFT x12 n	120.00
(Installment amount)	60 +/- PMT	-60.00
(Total of principal and interest)	10000 FV	10000.00
(Interest rate — monthly)	COMP i%	0.53 (Payment at end of term)
(Interest rate — annual)	× 12 =	6.31 (Payment at end of term)
(Verification)	COMP FV	10000.00
	BGN	BGN 10000.00
(Interest rate — monthly)	COMP i%	BGN 0.52 (Payment at beginning of term)
(Interest rate — annual)	× 12 =	BGN 6.22 (Payment at beginning of term)
(Verification)	COMP FV	BGN 10000.00

•Total of principal and interest when a down-payment is included

Example

What is the total of principal and interest after one year if an installment savings account is opened with a down payment of $1,000 and installments of $500 are added each month at an interest rate of 4.5% compounded monthly?



Operation		Display
	MODE 1 MODE 6 SHIFT FC AC	0.
(Term)	12 n	12.
(Interest rate)	4.5 SHIFT ÷12 i%	0.375
(Principal)	1000 +/− PV	−1000.
(Installment amount)	500 +/− PMT	−500.
(Total of principal and interest)	COMP FV	7171.24983

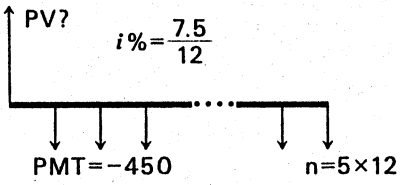
Loans (equal repayment of principal and interest)

•Loan Borrowing Power

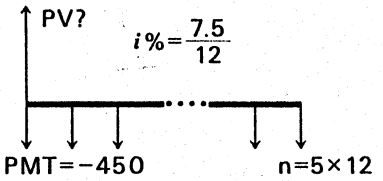
Example

If you are capable of repaying $450 per month, how much can you borrow on a 15 year loan at a 7.5% annual interest rate?

•Payment at end of term



•Payment at beginning of term

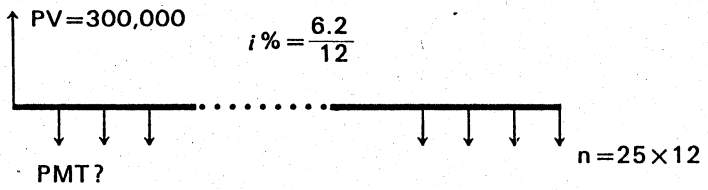


Operation		Display	
	MODE 1 MODE 6 SHIFT FC AC	0.	
(Installment amount)	450 +/− PMT	−450.	
(Interest rate)	7.5 SHIFT ÷12 i%	0.625	
(Term)	15 SHIFT X12 n	180.	
(Amount of loan)	COMP PV	48543.04208	(Payment at end of term)
	BGN	BGN 48543.04208	
(Amount of loan)	COMP PV	48846.43609	(Payment at beginning of term)

•Calculating loan payments

Example

If your borrow $300,000 on a home loan for 25 years at 6.2% interest, how much will your monthly payments be? (Payment obtained using formula for payment at end of term.)



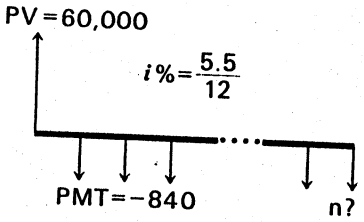
Operation		Display
	MODE 1 MODE 6 SHIFT FC AC	0.
(Amount borrowed)	300000 PV	300000.
(Interest rate)	6.2 SHIFT ±12 i%	0.516666666
(Term)	25 SHIFT x12 n	300.
(Monthly payment)	COMP PMT	−1969.74629 ($)

•Calculating the number of payments

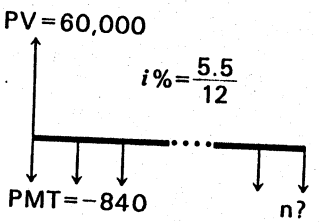
Example

If you borrow $60,000 at a 5.5% annual interest rate and you repay $840 per month, how many years will it take to repay the loan?

•Payment at end of term



•Payment at beginning of term



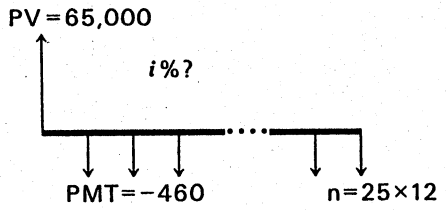
Operation		Display	
	MODE 1 MODE 6 SHIFT FC AC	0.	
(Amount borrowed)	60000 PV	60000.	
(Monthly payment)	840 +/− PMT	−840.	
(Interest rate)	5.5 SHIFT ±12 i%	0.458333333	
(Term — number of months)	COMP n	86.72384481	(Payment at end of term)
(Term — number of years)	÷ 12 =	7.226987067	(Payment at end of term)
	BGN	BGN 7.226987067	
(Term — number of months)	COMP n	BGN 86.2387687	(Payment at beginning of term)
(Term — number of years)	÷ 12 =	BGN 7.186564059	(Payment at beginning of term)

•Calculate effective interest rate of repay amount

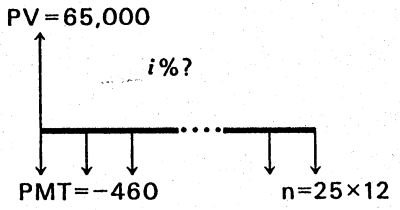
Example

If a loan of $65,000 is repayed in monthly payments of $460 over a period of 25 years, what is the effective interest rate? (Calculate to the nearest two decimal places.)

•Payment at end of term



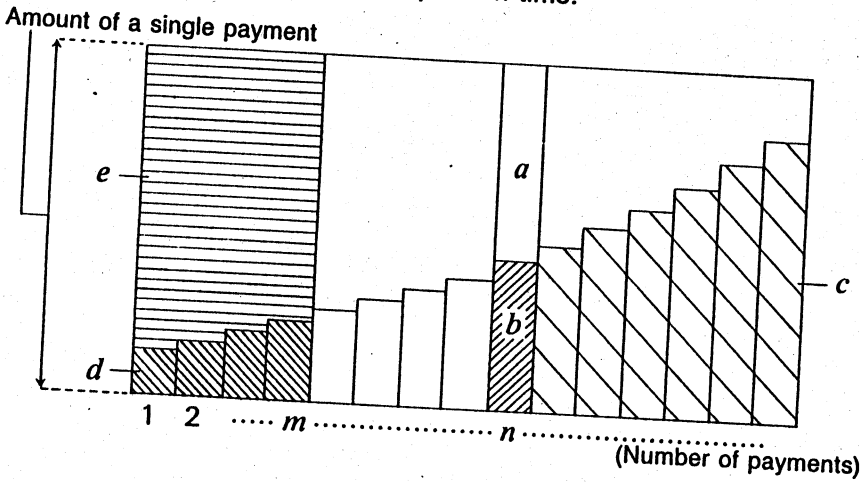
•Payment at beginning of term



Operation		Display	
	MODE 1 MODE 5 2 SHIFT FC AC	0.	
(Term)	25 SHIFT x12 n	300.00	
(Monthly payment)	460 +/− PMT	−460.00	
(Amount borrowed)	65000 PV	65000.00	
(Interest rate — monthly)	AC i% COMP i%	0.58	(Payment at end of term)
(Interest rate — annual)	× 12 =	7.01	(Payment at end of term)
(Verification)	COMP PV	65000.00	
	BGN	BGN 65000.00	
(Interest rate — monthly)	AC i% COMP i%	0.59	(Payment at beginning of term)
(Interest rate — annual)	× 12 =	7.08	(Payment at beginning of term)
(Verification)	COMP PV	BGN 65000.00	

■ Amortization

This calculation allows the derivation of the principal, interest and principal balance of loans, as well as the amounts of principal and interest repayed from the initial payment to a given point in time.



a: amount which interest constitutes at nth payment. (INT)
b: amount which principal constitutes at nth payment. (PRN)
c: balance of principal after paying nth payment. (BAL)
d: total amount of principal paid from 1st payment through mth payment. (ΣPRN)
e: total amount of interest paid from 1st installment through mth payment. (ΣINT)
*$a+b$: amount of a single payment

1) Formula

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

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

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

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

e: $\Sigma\,\mathrm{INT}_m = \mathrm{INT}_1 + \mathrm{INT}_2 + \cdots\cdots + \mathrm{INT}_m$ (However, $\mathrm{INT}_1 = 0$ for payment at beginning of term)

2) Data Input

As a rule, 4 types of data must be input, including [PV], [i%], [n], and [PMT]. If only 3 pieces are available, obtain the 4th before inputting the data.

3) Outputting Calculation Results

After inputting for which PRN, INT and BAL are to be obtained, the results for each are displayed each time the [AMRT] key is pressed. Symbols representing each figure (PRN, INT and BAL) appear, indicating which is presently displayed.

After inputting for which ΣPRN and ΣINT are to be obtained, the results for each are displayed each time the [ACC] key is pressed (data expressed with exponential notations cannot be input). Symbols representing each figure (ΣPRN and ΣINT) appear, indicating which is presently displayed.

*Values input at this time must be natural numbers — input of any other types will result in an error.

*When calculating amortization, an unusual amount of calculation time may be necessary.

4) Verification of Input Data

After pressing [RCL], input data can be verified by pressing each corresponding key ([PV], [i%], [n], [PMT]).

Example

What is the monthly payment on a $140,000, 15-year home mortgage at an annual interest rate of 6.5%? Also, What are the totals of PRN, INT and BAL at the 5-year (49th payment) mark. In addition, calculate both ΣPRN and ΣINT at the 2-year mark (24th payment). (Calculate using formula for payment at end of term method.)

Operation		Display
	[MODE] [1] [MODE] [6] [SHIFT] [FC AC]	0.
(Amount borrowed)	140000 [PV]	140000.
(Term)	15 [SHIFT] [×12 n]	180.
(Interest rate)	6.5 [SHIFT] [÷12 i%]	0.541666666
(Payment amount)	[COMP] [PMT]	−1219.550312
	49 [AMRT]	-597.74663^{PRN} (PRN of 49th payment)
	[AMRT]	-621.8036823^{INT} (INT of 49th payment)
	[AMRT]	114196.7793^{BAL} (BAL of 49th payment)
	24 [ACC]	$-11786.91217^{\Sigma PRN}$ (ΣPRN up to 24th payment)
	[ACC]	$-17482.29532^{\Sigma INT}$ (ΣINT up to 24th payment)

■ Conversion of Percentage/Effective Interest Rate

By using the [►EFF] or [SHIFT] [►APR] keys, mutual conversion of percentage/effective interest rate is simply performed.

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

1) Formula

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

2) Operations

n [►EFF] percentage interest rate(APR) [=] (n: number of compounded terms per year)

Example

What is effective interest rate on an account yielding annual interest of 12%, compounded quarterly? (Calculate to the nearest two decimal places.)

Operation	Display
[AC] [MODE] [5] [2]	0.00
4 [►EFF] 12 [=]	12.55

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

1) Formula

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

2) Operations

n [SHIFT] [►APR] effective interest rate (EFF) [=] (n: number of compounded terms per year)

Example

What is the percentage interest rate on an account which is compounded quarterly, and which yields an annual interest of 12.55%? (Calculate to two decimal places.)

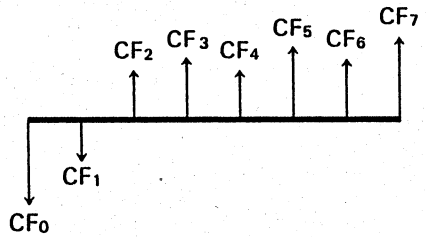
Operation	Display
[AC] [MODE] [5] [2]	0.00
4 [SHIFT] [►APR] 12.55 [=]	12.00

■ Investment Appraisal

This calculator allows investment appraisal, by using the DCF (Discounted Cash Flow) method. Investment appraisal entails totaling cash flow for a set of standardized periods, allowing analysis of the given investment's effectiveness. The following two types of investment appraisal are possible;

1. Net Present Value (NPV)
2. Internal Rate of Return (IRR)

The following diagram illustrates this cash flow graphically;



When an investment is made, it is represented as CF0. Cash flow from this investment for the following 1 year is represented as CF1, and as CF2 for the second year, etc.

Investment appraisal clearly shows whether the investment is realizing profits as targeted when it was made.

•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) Modes

After pressing the [MODE] and [4] keys, perform operations in the CF mode. (The "CF" symbol lights on the display.)

Note: If operation is switched from the CF mode to any other calculation mode (FIN, LR, SD), the contents of [CFj] and [Nj] will be cleared.

3) Inputting Data

a) Before inputting data, it is necessary to press the [SHIFT] and [AC] keys to clear the [i%], [CFj] and [Nj] memories. (Note that all other financial memories as well as cost, selling price and interest rate memories are cleared with this procedure.)

b) The [i%], [CFj] and [Nj] keys are used to input corresponding data. (The amount of initial investment (CF_0) is input as a negative amount.)

c) Each time the [CFj] key is pressed, the CF number is incremented, from CF_0 to CF_{14}. (Up to 15 sets of CF*j* inputs can be made.)

d) If successive cash flows contain the same amounts, the [Nj] key can be used in place of the [CFj] key. In these cases, the [Nj] number must be a natural number, and it must be input immediately after the [CFj].

Example: 3200 [CFj] 4 [Nj]
($3,200 of revenue for 4 successive years)

*Up to 99 [Nj] inputs may be made per [CFj]. If [Nj] is omitted, the [Nj] value is automatically set to "1".

If anything but a natural number is input, an error results. Press the [AC] key to clear the error message and input data again.

4) NPV calculation

Results can be output by pressing the [NPV] key.

If positive ..... Revenue target has been exceeded } Effective investment
If "0" ..... Revenue target has been met exactly }
If negative ..... Revenue target has not been met — Ineffective investment

5) Verification of input data

a) [CFj]

After pressing [RCL] and [CFj] keys, input the number of the cash flow to be recalled. The contents are then displayed. (Note that [CFj] may be omitted.)

b) [Nj]

After pressing [RCL] and [Nj] keys, input the number of the cash flow to be recalled. The contents are then displayed.

c) [i%]

Press the [RCL] and [i%] keys. Data is then displayed.

<Cash Flows and related 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}	.0
CF_{11}	.1
CF_{12}	.2
CF_{13}	.3
CF_{14}	.4

Example: To recall data for CF_{11} ➡ [RCL] [CFj] [·] [1]
(decimal point key)

6) Correcting data

[CFj] and [Nj] data can be corrected by using the [SHIFT] and [SET] keys.

a) [CFj]

<New CF*j* data> [SHIFT] [SET] [CFj] <cash flow number>

* [CFj] key may be omitted.

b) [Nj]

<New N*j* data> [SHIFT] [SET] [Nj] <cash flow number>

Example:
The following type of data can be corrected so that CF_1 equals "2,500".

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

Operation:

2500 SHIFT SET (CFj) 1

Value to be corrected; (may be omitted); Cash flow number

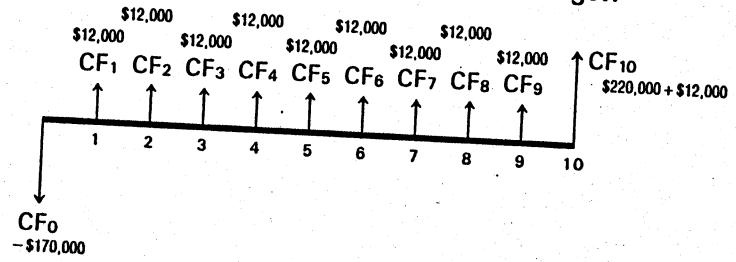
*Subsequently inputting data and pressing CFj key completes correction, and operation is then advanced to next CF number (CF_2 in this example).

7) Constant memories

The constant memories cannot be used in the CF mode (see page 21). In addition, the constant memories are cleared when the CF mode is selected.

Example 1

You're thinking of purchasing a condominium. According to your plan, you can rent the condo to students for 10 years, after which you will sell it, hoping to see yield of 8% per year.
If the purchase price is $170,000, you charge $1,000 in rent per month ($12,000 per year), and assuming you can sell the condominium in 10 years for $220,000, will you be able to reach your profit target?



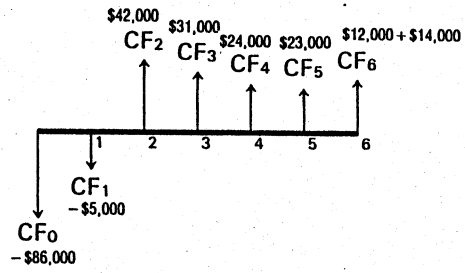
Operation	Display
MODE 4 MODE 6 SHIFT FC AC	CF 0.
(Initial investment: CF_0) 170000 +/− CFj	CF −170000.
(Input CF_1 ~ CF_9) 12000 CFj 9 Nj	CF 9.
(Input CF_{10}) 12000 + 220000 = CFj	CF 232000.
(Yield) 8 i%	CF 8.
(NPV) NPV	CF 12423.54417

Notice that the resulting NPV is positive (above your expected amount of profit by $12423.54). In this case, the investment may be appraised as effective.

Example 2

By investing $86,000 in equipment, yearly revenues are expected to change as shown below (revenue all realized at the end of the fiscal year).
The useful life of the equipment is 6 years, and its resale value after 5 years is expected to be $14,000. If the capital cost is 11%, what will be the net profit realized from this investment?

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



Operation	Display
MODE 4 MODE 6 SHIFT FC AC	CF 0.
(Input CF0) 86000 +/− CFj	CF −86000.
(Input CF1) 5000 +/− CFj	CF −5000.
(Input CF2) 42000 CFj	CF 42000.
(Input CF3) 31000 CFj	CF 31000.
(Input CF4) 24000 CFj	CF 24000.
(Input CF5) 23000 CFj	CF 23000.
(Input CF6) 12000 + 14000 = CFj	CF 26000.
(Capital cost) 11 i%	CF 11.
(NPV) NPV	CF 9610.156175 ($)

•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 (where NPV = 0), IRR is equal to $i \times 100$. Note, however, that NPV is never actually "0", due to continuous internal calculations which cause errors. However, the closer to "0" that the NPV is, the more accurate the Internal Rate of Return.

2) Modes

After pressing the MODE and 4 keys, perform operations in the CF mode. (The "CF" symbol lights on the display.) Note: If operation is switched from the CF mode to any other calculation mode (FIN, LR, SD), the contents of CFj and Nj will be cleared from memory.

3) Inputting Data

a) Before inputting data, it is necessary to press the SHIFT and AC keys to clear the CFj and Nj memories. (Note that all other financial memories, as well as cost, selling price and margin memories, are cleared with this procedure.)

b) The CFj and Nj keys are used to input corresponding data.
(The amount of initial investment (CF_0) is input as a negative amount.)

c) Each time the CFj key is pressed, the CF number is incremented, from CF_0 to CF_{14}. (Up to 15 sets of CF_j inputs can be made.)

d) If successive cash flows contain the same amounts, the Nj key can be used in place of the CFj key. In these cases, the Nj number must be a natural number, and it must be input immediately after the CFj.
Example: 3200 CFj 4 Nj
($3,200 of revenue for 4 successive years)
*Up to 99 Nj inputs may be made per CFj. If Nj is omitted, the Nj value is automatically set to "1".
If anything but a natural number is input, an error results. Press the AC key to clear the error message and input data again.

IMPORTANT

The following shows the precision for IRR calculations.

<Precision>

IRR 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 lesser precision. Therefore, it is suggested that NPV (NPV) be determined following IRR, to see if it is within the allowable range.

1) IRR calculation

Results can be output by pressing the IRR key. (It may take a while for the data to be output. If you wish to stop the operation, press the AC key.) The calculated IRR is automatically stored in the i% memory. Press RCL and i% to review the calculated IRR. Pressing the RCL and i% keys allows speedy retrieval of this data.

2) 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) SHIFT SET IRR

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).

3) Verification of input data

a) CFj
After pressing RCL and CFj keys, input the number of the cash flow to be recalled. The contents are then displayed. (Note that CFj may be omitted.)

b) Nj
After pressing RCL and Nj keys, input the number of the cash flow to be recalled. The contents are then displayed.

<Cash Flows and related 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}	.0
CF_{11}	.1
CF_{12}	.2
CF_{13}	.3
CF_{14}	.4

Example: To recall data for CF_{11} ➡ [RCL] [CFj] [.] [1]

decimal point key

4) Correcting data

[CFj] and [Nj] data can be corrected by using the [SHIFT] and [SET] keys.

a) [CFj]

<New CF*j* data> [SHIFT] [SET] [CFj] <cash flow number>

* [CFj] key may be omitted.

b) [Nj]

<New N*j* data> [SHIFT] [SET] [Nj] <cash flow number>

Example:

The following type of data can be corrected so that CF_1 equals "2,500"

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

Operation:

2500 [SHIFT] [SET] ([CFj]) 1

Value to be corrected — Cash flow number

(may be omitted)

*Subsequently inputting data and pressing the [CFj] key completes correction, and operation is then advanced to next CF number (CF_2 in this example).

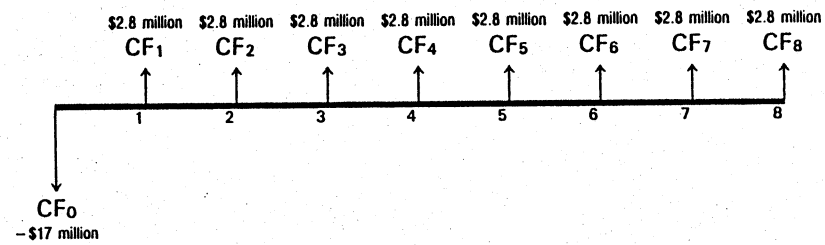
5) Constant memories

The constant memories cannot be used in the CF mode (see page 21). In addition, the constant memories are cleared when the CF mode is selected.

Example

Company XYZ is planning to construct a new plant. The data listed below have been gathered with regards to the project. What is the yearly IRR for this investment plan (to the nearest two decimal places)?

Initial investment:	$17 Million
Useful life of plant:	8 years
Yearly revenues related to plant:	$2.8 million



Operation	Display
[MODE] [4] [MODE] [5] [2] [SHIFT] [FC ACC]	CF 0.
17 [+/−] [CFj]	CF −17.00
2.8 [CFj] 8 [Nj]	CF 8.00
[IRR]	CF 6.57 (%)
[NPV]	CF 0.00

■ Conditions Causing Errors in Financial Calculations

•Compound interest calculation

<When calculating "n">
•When i% is $\leqq -100$
•When the value obtained for n is negative

<When calculating "i%">
When the signs of PV, PMT, and FV are the same (except when they are 0)
•When $n \leqq 0$
•When the value obtained for i% is −100% or less

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

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

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

•Amortization of loans

•When a number other than a natural number is input in reference to AMRT or ACC calculation
Example: 4.23 [AMRT] → E (error)

•Investment appraisal calculation

<When inputting CFj>
•When more than 15 CF numbers have been input

<When inputting Nj>
•When a number other than a natural number between 1 ~ 99 is input

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

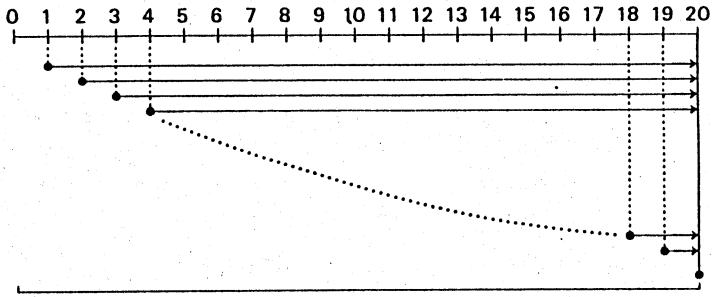
<When calculating IRR>
•When the value obtained for IRR is −100% or less

■ Financial Calculation Application Examples

Example 1

You've just had your first child, and decided to buy a $1,000 government bond in celebration of the event. If this bond yields 5% interest deposited semi-annually in your bank account, which annual interest of 4%, compounded semi-annually, how much will the bond have yielded in 10 years in total principal and interest?

<Basic principle>
You will receive a total of $250 twice a year (10,000 × (5% ÷ 2). It is a ten-year bond, so you will receive this amount 20 times. Now, simply determine the principal and interest on your compound interest account, into which this money is to be deposited.



Compounded semi-annually •means interest received (on $250)

Operation	Display
(Specify FIN mode and clear memories) MODE 1 MODE 6 SHIFT FC AC	0.
(Input cost of bond into memory) 10000 M+	10000.
(Total of principal and interest at 1st interest payment) 250 +/- PV 19 n 4 ÷ 2 = i% COMP FV M+	364.2027931
(Total of principal and interest at 2nd interest payment) 18 n COMP FV M+	357.0615619
(Total of principal and interest at 3rd interest payment) 17 n COMP FV M+	350.0603548
⋮	
follows same pattern	
⋮	
(Total of principal and interet at 19th interest payment) 1 n COMP FV M+	255.
(Total of principal and interest at 20th interest payment) 0 n COMP FV M+	250.
(Grand total) MR	16074.34245 ($)

Example 2

Your child will be ready to enter a university in 7 years. At this time, you'll need some $20,000. If you utilize an installment savings plan at 4.5% interest per year, how much should you put away each month in order to meet your goal?

<Basic principle>

The monthly installment amount can be derived through the following formula;

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

For this problem, FV = $20,000, n = 7 years, m = 84 payments, and i is equal to 4.5%.
Since this formula is not built-in, it must be calculated.

Operation	Display
(Specify FIN mode and clear memories) MODE 1 MODE 6 AC	0.
(Calculation of denominator) 7 × 12 = M+ × 85 ÷	
2 × 4.5 ÷ 100 ÷ 12 M+	13.3875
(Monthly installment amount) 20000 ÷ MR =	205.3651649 ($)

Example 3

Let's compare both fixed rate and floating rate repayment plans for home mortgages in the next two examples.

① What will be the total amount of repayment for a $100,000 home loan with a fixed rate at 6.6% per year over 25 years? (Payment at end of term.)

<Basic principle>

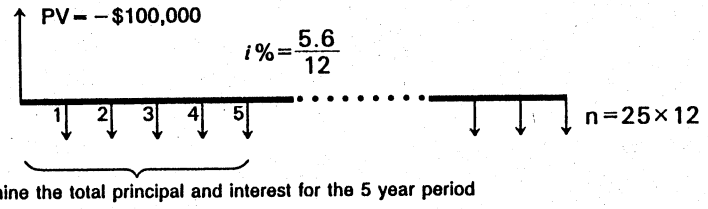
Determine the monthly repayment amount and multiply by the number of payments to be made.

Operation	Display
(Specify FIN mode and clear memories) MODE 1 MODE 6 SHIFT FC AC	0.
(Input number of payments) 25 SHIFT ×12 n	300.
(Input interest rate) 6.6 SHIFT ÷12 i%	0.55
(Input amount borrowed) 100000 PV	100000.
(Amount of monthly payment) COMP PMT	-681.4690995
× 12 × 25 =	-204440.7298 ($)

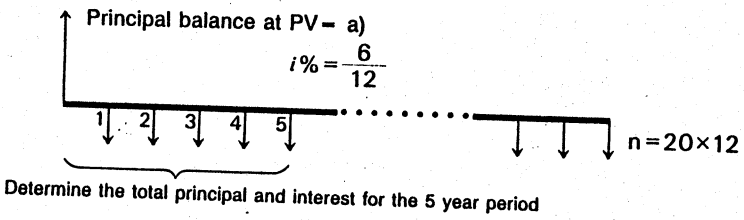
② On the other hand, imagine the same loan borrowed at a floating rate which began at 5.6% but was raised to 6% after 5 years. You are told that it will rise to 7% after another 5 years, and want to know what the total principal and interest would be if the final 10 years were financed at 6%. (Payment at end of term.)

<Basic principle>

a)

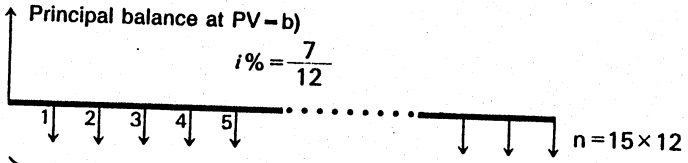


b)



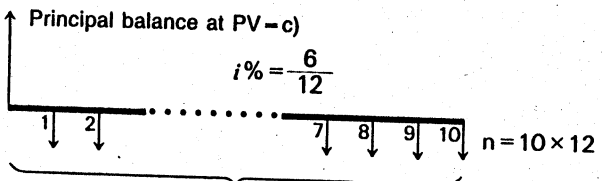
Determine the total principal and interest for the 5 year period

c)



Determine the total principal and interest for the 5 year period

d)



Determine the total principal and interest amount for 10 year period

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.

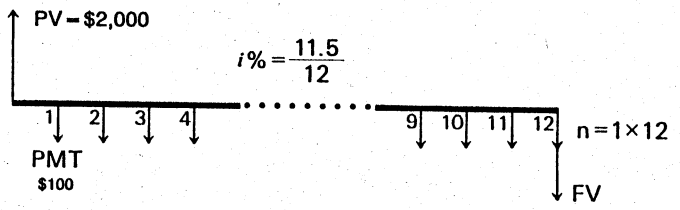
Operation		Display
(Specify FIN mode and clear memories)	MODE 1 MODE 6 SHIFT FC AC	0.
(Number of payments for a)	25 SHIFT ×12 n	300.
(Interest rate for a)	5.6 SHIFT ÷12 i%	0.466666666
(Amount of a borrowed)	100000 PV	100000.
(Monthly payment for a)	COMP PMT	-620.0737297
(Total principal/interest paid over 5 years for a)	× 5 × 12 = M-	M 37204.42378
(Principal of b)	5 × 12 = AMRT AMRT AMRT	M BAL 89406.09192
(b data input)	PV 20 SHIFT ×12 n 6 SHIFT ÷12 i%	
	COMP PMT × 5 × 12 M+	M 38431.98064
(c data input)	5 × 12 = AMRT AMRT AMRT	
	PV 15 SHIFT ×12 n 7 SHIFT ÷12 i%	
	COMP PMT × 5 × 12 M+	M 40935.55869
(d data input)	5 × 12 = AMRT AMRT AMRT	
	PV 10 SHIFT ×12 n 6 SHIFT ÷12 i%	
	COMP PMT × 10 × 12 M+	M 78283.45184
(Grand total of principal and interest)	MR	M -194855.415 ($)

Example 4

You've borrowed $2,000 on a short-term loan at 11.5% interest, repayable in 12 installments. You want to repay $100 as a monthly payment, and repay the shortage with the final payment. How much will your final payment be? (Payment at end of term.)

<Basic principle>

First, determine the FV (principal and interest) if 12 payments of $100 per month are made. This FV is short the balance, so add $100 to this amount.



Operation		Display
(Specify FIN mode and clear memories)	MODE 1 MODE 6 SHIFT FC AC	0.
(Amount borrowed)	2000 PV	2000.
(Number of payments)	1 SHIFT ×12 n	12.
(Interest rate)	11.5 SHIFT ÷12 i%	0.958333333
(Monthly payment)	100 +/- PMT	-100.
(Payoff balance)	COMP FV	-977.2039283
(Amount of last payment)	+ RCL PMT −	-1077.203928 ($)

Example 5

Company A has introduced an office computer system for automated processing of their accounting data. The cost of the equipment was $100,000, however what would the lease rate be per month given the term of the lease and the tax considerations listed below.

Conditions

1. Cost of equipment: $100,000
2. Term of lease: 60 months
3. Interest rate: 9%
4. Tax on fixed assets (carrying price × 14/1000)
   $\$304{,}900 \times \frac{14}{1000} = \text{approx } \$4300$
5. Insurance: carrying price × 3/1000 ...
   $\$304{,}900 \times \frac{3}{1000} = \text{approx } \$900$
6. Sales promotion cost: carrying price × 0.5%/year
   $\$100{,}000 \times \frac{0.5}{100} = \$500$ ($2,500 in five years)
7. Profit realized: carrying price × 0.5%/year
   $\$100{,}000 \times \frac{0.5}{100} = \$500$ ($2,500 in five years)

<Basic principle>

In the case of leases, the beginning of the term payment method is used. The calculation is the same as for loan calculation. First, derive the monthly lease cost, and then the total amount paid during a 5 year period plus other conditions, and divide by the term (60 months).

Operation		Display
(Specify FIN mode and clear memories)	MODE 1 MODE 6 SHIFT FC AC	0.
(Specify beginning of term payment)	BGN	BGN 0.
	100000 PV	BGN 100000.
(Specify term)	60 n	BGN 60.
(Interest rate)	9 SHIFT ÷12 i%	BGN 0.75
(Monthly payment)	COMP PMT	BGN -2060.382653
(Total net lease cost over 5 years)	× 60 − Min	M BGN -123622.9592
(Taxes and other considerations)	4300 +/- M+ 900 +/- M+ 2500 +/- M+ 2500 +/- M+	M BGN -2500.
(Monthly lease rate)	MR ÷ 60 −	M BGN -2230.382653 ($)

COST, SELLING PRICE, MARGIN CALCULATION

In these calculations involving cost (CST), selling price (SEL) and margin (MAR), any third variable can be attained by inputting the other two.

1) Formula

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

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

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

2) Inputting data

Data is input by inputting a number and pressing any of the related keys (CST , SEL , MAR). This data is held in memory even when power is turned OFF.

*Data are input as percentages.

3) Outputting results

After pressing the COMP key, results can be displayed by pressing the corresponding keys.

4) Verification of input data

After pressing RCL, input data can be verified by pressing each corresponding key (CST , SEL , MAR).

5) Clearing input data

To clear data which have been input, press SHIFT and AC. (Caution: all financial memories are cleared with this operation.)

6) Modes

Any of the calculation modes (FIN, LR, SD, or CF) may be used to perform these operations. In addition, decimal place specification can also be performed with these operations.

■ Cost Calculation

Example

What is cost (to two deimal places) at margins of 12%, 15%, and18% and a selling price of $20?

Operaion	Display
MODE 5 2 SHIFT AC	0.
20 SEL	20.00
12 MAR	12.00
COMP CST	17.60
15 MAR	15.00
COMP CST	17.00
18 MAR	18.00
COMP CST	16.40

■ Selling Price Calculation

Example

What is the selling price (to two decimal places) at margins of 40%, 45%, and 50%, and a cost of $12?

Operation	Display
MODE 5 2 SHIFT AC	0.
12 CST	12.00
40 MAR	40.00
COMP SEL	20.00
45 MAR	45.00
COMP SEL	21.82
50 MAR	50.00
COMP SEL	24.00

■ Margin Calculation

Example

What is the percent of margin (to two decimal places) at costs of $12.5, $15 and $17.5 and a selling price of $25?

Operation	Display
MODE 5 2 SHIFT AC	0.
25 SEL	25.00
12.5 CST	12.50
COMP MAR	50.00
15 CST	15.00
COMP MAR	40.00
17.5 CST	17.50
COMP MAR	30.00

•Input range of functions (general principles)

Function name	Input range	Output accuracy
$\log x$、$\ln x$	$10^{-99} \leqq x < 10^{100}$	±1 in the 10th digit
e^x	$-10^{100} < x \leqq 230.2585092$	–„–
$\sqrt{x}$	$0 \leqq x < 10^{100}$	–„–
x^2	$\lvert x \rvert < 10^{50}$	–„–
$1/x$	$\lvert x \rvert < 10^{100}$、$x \neq 0$	–„–
$N!$	$0 \leqq N \leqq 69$ (N: integer)	–„–
y^x	$y>0$: $-1\times10^{100} < x\log y < 100$ $y=0$: $x>0$ $y<0$: $x=n$、$1/(2n+1)$ *n: integer	–„–
SD	$\lvert x \rvert < 10^{50}$、$\lvert n \rvert < 10^{100}$ σ_n、$\bar{x}$: $n \neq 0$ σ_{n-1} : $n \neq 1, 0$	–„–
LR	$\lvert x \rvert < 10^{50}$、$\lvert y \rvert < 10^{50}$、$\lvert n \rvert < 10^{100}$ $x\sigma_n$、$y\sigma_n$、$\bar{x}$、$\bar{y}$、a、b、r : $n \neq 0$ $x_{\sigma_{n-1}}$、$y_{\sigma_{n-1}}$: $n \neq 1, 0$	–„–

*Errors are cumulative with such internal continuous calculations as y^x and $N!$, so accuracy may be adversely affected.

SPECIFICATIONS

Model:	FC-100
Basic operations:	4 basic calculations, constants for +/−/×/÷, cost/price/margin calculations and other mixed calculations
Built-in functions:	Square roots, squares, powers, logarithmic/exponential functions, reciprocals, factorials and percentages
Financial functions:	Compound interest calculations (savings, installment savings, loans), amortizations, percentage/effective rate conversions, investment appraisals (net present value, internal rate of return)
Statistical functions:	Standard deviation, linear regression, logarithmic regression, exponential regression, and power regression
Memory:	1 independent memory and 6 constant memories
Display/digits:	Liquid crystal display, 10-digit mantissa or 7-digit mantissa plus 2-digit exponent
Decimal point:	Full floating with underflow
Overflow check:	Indicated by the "E" sign, locking the calculator.
Main component:	LSI
Power consumption:	0.0006W
Power source:	One lithium battery (Type: CR2025C) The unit gives approximately 1,300 hours continuous operation on type CR2025C.
Auto power off:	After approximately 6 minutes.
Ambient temperature range:	0°C ~ 40°C (32°F ~ 104°F)
Dimensions:	9mmH × 72mmW × 129mmD ($^3/_8$"H × $2^7/_8$"W × $5^1/_8$"D)
Weight:	73 g (2.6 oz) including battery.

**Design and specifications may be subject to change without notice.*

PROLOGO

Muchas gracias por la compra de la CASIO FC-100.
Esta unidad es una avanzada calculadora financiera de 10 dígitos, la cual viene incorporada con funciones y características que permiten efectuar cálculos financieros incluyendo intereses compuestos, amortizaciones, conversión de tasas de intereses y evaluación de inversiones, así como también cálculos de análisis de regresión y desviación estándar.
Este manual proporciona una explicación básica de las operaciones unitarias e instrucciones para el manejo. Cerciórese de leerlo para obtener una completa comprensión de esta unidad y garantizar una operación adecuada como también una larga vida de servicio.
Los métodos de redondeo y cálculos difieren de acuerdo al tipo de establecimiento para el cual se utilizan los cálculos. Se sugiere que los resultados obtenidos por esta unidad sean cuidadosamente comparados con los resultados obtenidos por otros medios para asegurar compatibilidad.