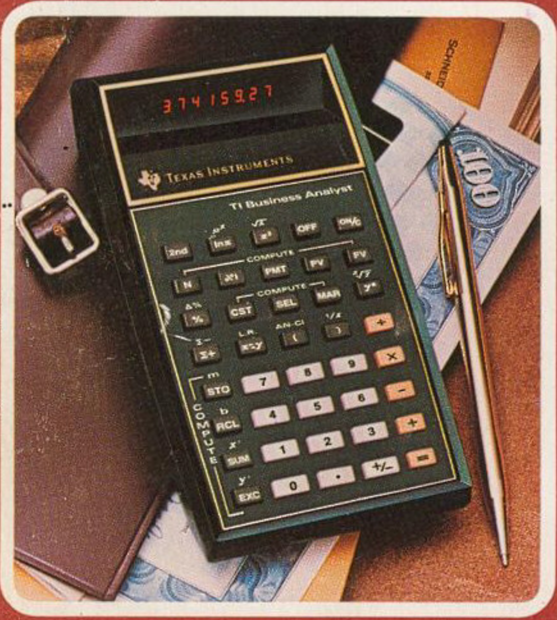
Texas Instruments
portable electronic calculator
TI Business Analyst



OWNER'S MANUAL

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Toll-Free Telephone Assistance

For assistance with your Business Analyst calculator, call one of the following toll-free numbers:

800-527-4980 (within all contiguous United States except Texas)
800-492-4298 (within Texas)

NOTICE: A copy of the sales receipt or other proof of purchase date is required when the calculator is returned for in-warranty repair.

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I. INTRODUCTION

Your Business Analyst represents the blending of versatile math operations with a broad array of financial and statistical capabilities. A wide range of math problems can be solved, from the simplest expressions to the most complex. Math operations can either be used independently or to prepare data for financial and statistical calculations or to analyze the results from those calculations. A flexible memory system complete with summation to memory and exchange is available to facilitate calculations.

Virtually all calculations used in the financial world are accessible through use of the Business Analyst. The seemingly endless variations of annuity, percentage, compound and simple interest, sinking fund, amortization, cash flow, cost control and depreciation can be analyzed wherever you go. No more dependence on the volumes of tables previously required for financial calculations. This calculator is capable of obtaining far more results than could ever be found in books of tables and charts – and the results will be more accurate, up to 8 digits for most calculations.

The availability of keys to perform statistical analyses combined with the financial and math capabilities of this calculator make it an extremely worthwhile investment. The versatility, accuracy and time-saving features of this tool will easily pay for itself in a short period of time.

FEATURES AND FUNCTIONS

- **Battery or AC Operation** – Totally portable when used with the included rechargeable battery pack or operated indefinitely with the AC Adapter/Charger connected while the calculator is being recharged.

- **Financial Capabilities** – Solves problems involving:

Simple Interest
Compound Interest
Rent Schedules
Mortgages
Savings Accounts
Installment Loans
Insurance Plans
Percentage/Decimal Conversions
Add-On and Discount Percentages
Interest Rate Conversions
Annuities
Add-On Interest
Amortization Schedules
Balloon Payment Loans
Sinking Funds
Profit Margins
Bond Yields
Bond Analyses (Discounting)
Depreciation
Change of Percent
Discounted Cash Flow Analysis for Net Present Value or Internal Rate of Return

- **Mathematical Functions** include:

Arithmetic (+, −, ×, ÷)
Square (x^2) and Square Root ($\sqrt{x}$)
Natural Logarithm (ln x) and Exponential (e^x)
Universal Roots ($\sqrt[x]{y}$) and Powers (y^x)
Reciprocal (1/x)

- **Parentheses** – 15 sets are available at each of 4 processing levels allow you to dictate the order of interpretation of any mathematical sequence.

- **Memory** – Totally accessible memory complete with summation to memory and memory-display exchange capabilities.

- **Statistical Analyses** – Special function keys provide linear regression and trend-line analysis of statistical information. Additional points can also be predicted.

- **Accuracy** – All calculations are made to 11 digits and rounded to 8 digits for display. 11 digits are carried for each result throughout all calculations.

- **Display Advantages** – Automatic display control provides a standard 8-digit display with scientific notation format available for displaying numbers up to $\pm 9.9999 \times 10^{99}$ and down to $\pm 1.0 \times 10^{-99}$.

- **Floating Minus Sign** occurs immediately to the left of every negative number.

- **Automatic Clearing** – Calculator automatically clears itself between independent calculations.

II. KEY DEFINITIONS

A brief definition of each key's function is listed here as well as a page number to serve as a quick-reference guide to the keys.

[ON/C] **On/Clear Key** – Initially this key applies power to the calculator. Once turned on, pressing this key clears an entry if no function or operation key has been pressed. When pressed after an operation or a functions, this key clears the display and all pending operations. Pressing this key twice at any time clears the display and all pending operations. [ON/C] must be pressed after use of the financial functions or linear regression to clear calculator registers. See page 8.

[OFF] **Off Key** – Removes power from the calculator.

[0] through [9] **Digit Keys** – Enter numbers 0 through 9. See page 8.

[•] **Decimal Point Key** – Enters a decimal point. See page 8.

[+/−] **Change Sign Key** – When pressed after number entry or a calculation, changes the sign of that number. See page 8.

[+] **Add Key** – Instructs the calculator to add the next entered quantity to the displayed number. See page 13.

[−] **Subtract Key** – Instructs the calculator to subtract the next entered quantity from the displayed number. See page 13.

[X] **Multiply Key** – Instructs the calculator to multiply the displayed number by the next entered quantity. This displayed value must be less than 1×10^{99} or an error condition may result. See page 13.

[÷] **Divide Key** – Instructs the calculator to divide the displayed number by the next entered quantity. See page 13.

[=] **Equals Key** – Completes all previously entered numbers and operations. This key is used to obtain both intermediate and final results. See page 13.

[(] [)] **Parentheses Keys** – Used to isolate particular numerical expressions for correct mathematical interpretation. See page 17.

[y^x] **y to the x Power Key** – Raises the displayed value y to the xth power. Order of entry is y [y^x] x. y cannot be negative, but both x and y can be fractional. See page 16.

[2nd] [$\sqrt[x]{y}$] **x Root of y Key** – Takes the xth root of the displayed value y. Order of entry is y [2nd] [$\sqrt[x]{y}$] x. y cannot be negative but both x and y can be fractional. See page 16.

[x^2] **Square Key** – Calculates the square of the number in the display. See page 15.

[2nd] [$\sqrt{x}$] **Square Root Key** – Calculates the square root of the number in the display ($x \geq 0$). See page 15.

[2nd] [1/x] **Reciprocal Key** – Divides the display value into 1 ($x \neq 0$). See page 15.

[%] **Percent Key** – Converts displayed number from a percentage to a decimal. Used with +, −, ×, ÷, this key can perform add-on, discount and percentage calculations. See page 25.

[2nd] [Δ%] **Percent Change Key** – Calculates the percentage change between two values. Press x_1 [2nd] [Δ%] x_2 and $\frac{x_2 - x_1}{x_1} \times 100$ is calculated. See page 26.

[lnx] **Natural Logarithm Key** – Calculates the natural logarithm (base e) of the number in the display ($x > 0$). See page 14.

[2nd] [e^x] **Natural Antilogarithm (e to the x Power) Key** Calculates the natural antilogarithm of the number in the display (raises e to the displayed power). See page 14.

[STO] **Store Key** – Stores the displayed quantity in the memory without removing it from the display. Any previously stored value is cleared. See page 21.

[RCL] **Recall Key** – Retrieves stored data from the memory to the display. Use of this key does not clear the memory. See page 21.

[SUM] **Sum to Memory Key** – Algebraically adds the display value to the memory content. This key does not affect the displayed number or calculations in progress. See page 22.

[EXC] **Exchange Key** – Exchanges the content of the memory with the display value. The display value is stored and the previously stored value is displayed. See page 23.

[N] **Number of Periods Key** – Enters number of compounding or payment periods for compound interest or annuity problems. [2nd] [N] computes number of periods when the other variables have been entered. See page 31.

[%i] **Interest Rate per Period Key** – Enters the interest rate in percent per compounding or payment period for compound interest or annuity problems. [2nd] [%i] computes the periodic interest rate when the other variables have been entered. See page 31.

[PMT] **Payment per Period Key** – Enters the payment per period for annuity problems. [2nd] [PMT] computes the periodic payment after the other variables have been entered. See page 31.

[PV] **Present Value Key** – Enters the present value in compound interest or annuity problems. [2nd] [PV] computes present value after the other variables have been entered. See page 31.

[FV] **Future Value Key** – Enters the future value in compound interest or annuity problems. [2nd] [FV] computes future value after the other variables have been entered. See page 31.

[2nd] [AN-CI] **Annuity or Compound Interest Mode Key** – Prepares the calculator for either annuity or compound interest calculations. Compound interest mode is indicated by quote marks in the upper left portion of the display. The calculator is in the annuity mode when first turned on (no display indication). See page 31.

[CST] **Cost Key** – Enters the cost of an item in profit margin calculations. [2nd] [CST] computes item cost when the selling price and profit margin have been entered. See page 24.

[SEL] **Sell Key** – Enters the selling price of an item in profit margin calculations. [2nd] [SEL] computes the selling price when the cost and profit margin have been entered. See page 24.

[MAR] **Profit Margin Key** – Enters the profit margin in percent for profit margin calculations. [2nd] [MAR] computes the profit margin when the item cost and selling price have been entered. See page 24.

[x:y] **x Exchange y Key** – Exchanges the last two numbers (not digits) entered. Used primarily to exchange divisor and dividend in division problems, x and y for y^x or $\sqrt[x]{y}$ calculations and for data entry and result display in linear regression. Must not be used when financial calculations are in progress. See page 58.

[Σ+] **Sum Plus Key** – Enters data points for linear regression calculations. See page 58.

[2nd] [Σ-] **Sum Minus Key** – Removes unwanted data entries from linear regression calculations. See page 58.

[2nd] [m] **Slope Key** – Computes the slope of the calculated linear regression curve. If the line is vertical, an error condition results. See page 58.

[2nd] [b] **Intercept Key** – Computes the y-intercept of the calculated linear regression curve. See page 58.

[2nd] [x'] **Compute x Key** – Calculates a new x value for a new y entry from the keyboard. See page 58.

[2nd] [y'] **Compute y Key** – Calculates a new y value for a new x entry from the keyboard. See page 58.

[2nd] [LR] **Linear Regression Mode Select Key** – Prepares calculator to work linear regression problems or trend-line analyses. See page 58.

III. BASIC INSTRUCTIONS

Your calculator has been specifically designed for straightforward operation with a minimum amount of preinstruction necessary before you can begin solving problems.

INITIAL OPERATION

The fast-charge, nickel-cadmium battery pack furnished with your calculator was charged at the factory before shipping. However, due to shelf-life discharging, it may require charging before initial operation. If initially or during portable operation, the display becomes dim or erratic, the calculator needs to be charged.

With the battery pack properly installed, charging is accomplished by plugging the AC Adapter/Charger AC9131 into a convenient 115 V/60 Hz outlet and connecting the attached cord to the calculator socket. About 4 hours of charging restores full charge with the power switch off or 12 hours if the calculator is in use.

Pressing [ON/C], the upper right most key on the keyboard, applies power and totally clears the calculator. Power-on condition is indicated by the presence of a lighted digit in the display. The [OFF] key, of course, removes power from the calculator. When a battery is first inserted and the display is not blank, press [OFF] to clear the calculator.

DATA ENTRY

For maximum versatility, your calculator operates with a floating decimal point. When entering numbers, the decimal remains to the right of the mantissa until [•] is pressed and the fractional part of the number is entered.

The [0] through [9] digit keys, [•] decimal point key and [+/-] change sign key enter data into the calculator. Numbers up to 8 digits in length can be entered directly from the keyboard.

CLEARING OPERATIONS

To remove an incorrect entry from the display before any function or operation key is used, press [ON/C]. When pressed after an operation or function key (including [=]), this key clears the display, the financial mode and all pending operations. Pressing [ON/C] twice always clears the display, the financial mode and pending operations. This key does not affect memory contents or the compound interest mode.

DUAL FUNCTION KEYS

Most of your calculator's keys have dual functions. The first function is printed on the key and its second function is written above that key. To execute a function shown on a key, simply press the desired key. To use the second function of a key, press the [2nd] key, then press the key immediately below the desired second function. For example, to find the natural logarithm of a number, press [lnx]. To find the antilogarithm (e^x) of a number, press [2nd] [lnx]. Since this key sequence is usually confusing, it will be shown as [2nd] [e^x]. First function operations, therefore, are indication by [ ]. Second functions are indicated by [2nd] [■]. When [2nd] is pressed twice in succession or pressed before a key that does not have a second function, the calculator performs the first function operation.

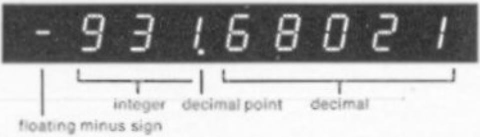
The [2nd] key is used with the financial operations to calculate unknowns. Entry of all known values for compound interest, annuity and profit margin calculations is accomplished through use of the appropriate first function keys. To calculate any of the variables, press [2nd], then the desired unknown key. Refer to the Financial Operations section of this manual for additional information.

DISPLAY FORMATS

The various display capabilities greatly increase the operating range and flexibility of your calculator.

Standard Display

In addition to power-on and numerical information, the display provides indication of a negative number, decimal point, financial mode and error. Numbers as large as 8 digits can be entered directly. All digit keys pressed after the 8th are ignored.

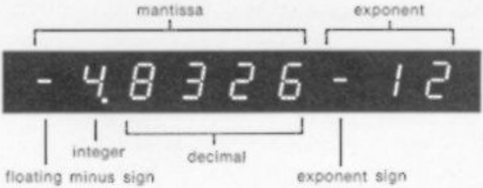


Any negative number displays a minus sign immediately to the left of the number. This is the way you normally write negative numbers, for instance:

Only the first 8 digits of calculated results are displayed. Internally, results are carried to 11 digits. This format displays all numbers from 99999999 to −99999999.

Scientific Notation

Calculated results that exceed eight digits (display limit) to the left of the decimal point are automatically displayed in scientific notation. This format consists of a number (mantissa) multiplied by ten raised to some power (exponent). The integer portion of the mantissa is always a single digit other than 0. For example: −.000000000048326 can be expressed as -4.8326×10^{-12} and would be displayed as shown.



This capability allows you to calculate numbers as small as $\pm 1 \times 10^{-99}$ and as large as $\pm 9.9999 \times 10^{99}$.

In scientific notation, a positive exponent indicates how many places the decimal point of the mantissa should be shifted to the right to produce the actual number. Conversely, if the exponent is negative, the decimal point should be moved to the left.

Because of display space, only 5 digits of the mantissa can be displayed. Internally, the mantissa is carried to 11 digits so that there is no accuracy loss due to this format.

All numbers between −99999999 and +99999999 inclusive are displayed in standard format. Even if larger numbers have been used during a calculation, whenever any results occur within the standard format range, that format is used for the display.

Financial Modes

When using your calculator to solve certain financial problems, two modes of operation are available: the Annuity mode and the Compound Interest mode (see page 31).

When in the Compound Interest mode, a set of quote marks (") appears in the upper left portion of the display, as shown below.

The other modes give no visual indication of their presence.

Error Indication

The display shows "Error" whenever the limits of the calculator are exceeded or when an improper operation is requested. Press [ON/C] to remove the "Error" message from the display. This also eliminates the number and operation that caused the error condition. Calculations or data entries up to that point are preserved when not in a financial mode. Pressing [ON/C] twice not only removes the error condition, but also clears the calculator entirely, except for the memory.

"Error" is produced in the display for the following reasons:

1. The calculation results (in display or memory) are outside the range of the calculator, $\pm 1 \times 10^{-99}$ to $\pm 9.9999 \times 10^{99}$.
2. Calculation of root or logarithm of a negative number.
3. Raising a negative number to any power with the [y^x] key.
4. Dividing a number by 0.
5. Attempting to calculate financial unknowns before enough known variables have been entered or when no valid solution exists.
6. Attempting to open more than 4 levels of processing or to have more than 15 open parentheses at any one level.
7. Linear regression calculations that deal with a vertical line.
8. Attempting to calculate x' for a horizontal line in linear regression.
9. Trying to use linear regression with less than two data points.
10. Key sequences 0 [2nd] [Δ%] 0 or 0 [2nd] [Δ%] number.
11. Multiplying a number greater than 1×10^{99} by another number (decimal or integer) may cause an error condition.

IV. CALCULATOR OPERATIONS

The keys have been selectively positioned on the keyboard for efficient calculator operation. Although many of the operations may be obvious, the following instructions and examples can help you develop skill and confidence in your problem solving routine.

ARITHMETIC OPERATIONS

To perform simple addition, subtraction, multiplication and division, just key in the problem as it is written. When each operation is keyed, it completes the previously entered operation. This includes +, −, ×, ÷, y^x and $\sqrt[x]{y}$ (the latter two will be discussed later).

It is a safe procedure to press [ON/C] at the start of each new problem to make sure the calculator is cleared. This is not required after an [=]. Following [=] with a number entry automatically clears the previous result.

Example: 37 + 16.9 − 11 = 42.9

Enter	Press	Display
	[ON/C]	0.
37	[+]	37.
16.9	[−]	53.9
11	[=]	42.9

Example: 4 × (−6.6) − (−17.1) = −9.3

Enter	Press	Display
4	[×]	4.
6.6	[+/−] [−]	−26.4
17.1	[+/−] [=]	−9.3

SINGLE-VARIABLE FUNCTIONS

The simplest operations to describe and understand are the single-variable functions. These functions operate on the displayed value immediately, replacing the displayed value with its function. These functions do not interfere with any calculations in progress and can therefore be used at any point in a calculation. Because of the complexity of some of these functions, be sure that each calculation has been completed before the next key is pressed.

Natural Logarithms (ln x and e^x)

The natural logarithm key [lnx] calculates the natural logarithm (base e) of the number x in the display for $x > 0$.

Example: ln (1.2) = .18232156

Enter	Press	Display
1.2	[lnx]	.18232156

The natural antilogarithm (e^x) sequence [2nd] [eˣ] calculates the natural antilogarithm of the number in the display (raises e to the power x shown in the display).

Example: $e^{1.25} = 3.490343$

Enter	Press	Display
1.25	[2nd] [eˣ]	3.490343

Example: $e^{(7.5 + \ln 1.4)} = 2531.2594$

Enter	Press	Display
7.5	[+]	7.5
1.4	[lnx]	.33647224
	[=]	7.8364722
	[2nd] [eˣ]	2531.2594

Note that the [=] key is not needed to produce the final result because the special function e^x produces the final result.

Reciprocal

The reciprocal sequence [2nd] [1/x] divides the display value x into 1 for $x \neq 0$.

Example: $\frac{1}{3.2} = 0.3125$

Enter	Press	Display
3.2	[2nd] [1/x]	0.3125

Example: $\frac{1}{-1 + \sqrt{7.4}} = .58129595$

Enter	Press	Display	Comments
1	[+/−] [+]	−1.	Enter −1
7.4	[2nd] [√x] [=]	1.7202941	Calculate $-1 + \sqrt{7.4}$
	[2nd] [1/x]	.58129595	Answer

Roots and Powers

The square key [x²] calculates the square of the number x in the display.

Example: $(4.235)^2 = 17.935225$

Enter	Press	Display
4.235	[x²]	17.935225

The square root sequence [2nd] [√x] calculates the square root of the number x in the display for $x \geq 0$.

Example: $\sqrt{6.25} = 2.5$

Enter	Press	Display
6.25	[2nd] [√x]	2.5

Example: $[\sqrt{3.1452} - 7 + (3.2)^2]^{1/2} = 2.2390782$

Enter	Press	Display
3.1452	[2nd] [√x] [−]	1.7734712
7	[+]	−5.2265288
3.2	[x²]	10.24
	[=]	5.0134712
	[2nd] [√x]	2.2390782

DOUBLE-VARIABLE FUNCTIONS

Your calculator provides two universal roots and powers keys that allow you to vary the value of the exponent as well as the value of the base. One is accessed by the [y^x] key. The other is accessed by the [2nd] [$\sqrt[x]{y}$] key sequence, providing $\sqrt[x]{y}$. These functions require a second value before the power or root can be realized. Use of these two keys is identical. Enter y, press [y^x] or [2nd] [$\sqrt[x]{y}$], enter x, and press [=] or an arithmetic function key to yield the answer.

Example: What would $3000 be worth in 3 years if invested at a 9% annual interest rate compounded monthly?

The relationship that applies here is $FV = PV (1 + i)^n$ where FV is future value, PV is present value ($3000), i is the interest rate of the compounding period in decimal (.09/12 = .0075) and n is the number of compounding periods (3 × 12 = 36).

$$FV = 3000(1 + .0075)^{36}$$

Enter	Press	Display
1	[+]	1.
.0075	[y^x]	1.0075
36	[×]	1.3086454
3000	[=]	3925.9361

The $3000 will be worth $3925.94 in 3 years.

Example: $\sqrt[3.12]{1460} = 10.332744$

Enter	Press	Display
1460	[2nd] [$\sqrt[x]{y}$]	1460.
3.12	[=]	10.332744

There are restrictions on these functions. The variable y must be non-negative. When y is negative, "Error" lights up in the display after x and an operation key is pressed. y cannot be negative because logarithms are used to perform these functions. Also, taking the 0th root of a number results in an error condition. In addition, any non-negative number taken to the zero power is 1.

Accuracy for these roots and powers is within ±1 in the 8th significant digit over all ranges except for values of y very near 1 with very large exponents or very small roots. For example, $1.00005^{2096124}$ has an error of 1 in the 7th digit. These errors increase as y approaches 1 and the exponent becomes extremely large or for extremely small roots.

The double-variable functions have the capability of completing operations.

Example: $(3 + 2)^3 + 6 = 131$

Enter	Press	Display	Comments
3	[+]	3.	Enter 3
2	[y^x]	5.	3 + 2 evaluated
3	[+]	125.	Evaluate $(3 + 2)^3$
6	[=]	131.	Answer

To obtain $3 + (2^3) + 6$, you can rearrange the problem $2^3 + 3 + 6$ or use parentheses to ensure proper interpretation of the problem.

PARENTHESES

Parentheses are available to designate the interpretative order of a problem, allowing you to enter the sequence just as it is stated. This is done by isolating an expression(s) with parentheses. These isolated expressions are evaluated before being combined with the rest of the problem.

The previous example, $3 + 2^3 + 6$, could have been worked in sequential order with parentheses $3 + (2^3) + 6$ as follows:

Enter	Press	Display	Comments
3	[+] [(]	3.	
2	[y^x]	2.	
3	[)] [+]	11.	$3 + 2^3$ evaluated
6	[=]	17.	Answer

With parentheses, as many as 4 numbers and their operations can be stored away, then blended into the problem when the parentheses indicate to do so.

Example: 5 + {8/[9 − (2/3)]} = 5.96

Enter	Press	Display	Comments
5	[+] [(]	5.	(5 +) stored
8	[÷] [(]	8.	(8 ÷) stored
9	[−] [(]	9.	(9 −) stored
2	[÷]	2.	(2 ÷) stored
3	[)]	.66666667	2/3 evaluated
	[)]	8.3333333	9 − (2/3)
	[)]	0.96	8/[9 − (2/3)]
	[=]	5.96	Answer

The [=] key has the additional capability of automatically supplying closed parentheses to match any open parentheses that have not been closed. In the previous example, [=] could have been pressed instead of the first [)] and the problem would still have been correctly completed. Try it and see.

Actually, you can have 15 open parentheses for each of the 4 levels of processing. This flexibility should allow you to enter the most complex problems in a straightforward manner. If you do attempt to progress to a fifth level of processing, an error message will result.

Parentheses cannot be used while in a financial mode.

COMBINING OPERATIONS

In review:

- Operations are normally completed in a sequential manner. Each time [+], [−], [X], [÷], [y^x] or [2nd] [$\sqrt[x]{y}$] is pressed, the previous operation is completed.
- Parentheses alter the interpretive order by completing the contents each set contains before being combined with the rest of the problem.
- Single-variable functions operate only on the displayed value, immediately replacing the displayed value with its function.

Example: $\frac{(7 \times 6 + 7 - 1)^4}{-18} = -294912$

Enter	Press	Display	Comments
7	[×]	7.	
6	[+]	42.	7 × 6
7	[−]	49.	42 + 7
1	[y^x]	48.	49 − 1
4	[÷]	5308416.	48^4
18	[+/−] [=]	−294912.	Answer

Example: $\ln \frac{1}{(3.2)^2 + \sqrt[3]{1.3}} = -2.4120008$

Enter	Press	Display
	[(]	0.
3.2	[x^2] [+] [(]	10.24
1.3	[2nd] [$\sqrt[x]{y}$]	1.3
3	[+/−] [)]	.91626033
	[)]	11.15626
	[2nd] [1/x]	.08963577
	[lnx]	−2.4120008

As each parentheses set is closed, all operations back to each corresponding open parenthesis are completed.

Example: $3 \times 4^{[2^{(-\sqrt[4]{7})}]} = 4.7000434$

Enter	Press	Display
3	[×] [(]	3.
4	[y^x] [(]	4.
2	[y^x] [(]	2.
7	[2nd] [$\sqrt[x]{y}$]	7.
4	[)] [+/−]	−1.6265766
	[=]	4.7000434

Notice that the [=] key added the necessary closed parentheses.

INPUT ERROR CORRECTION

At any point in a calculation, [ON/C] can be pressed twice to clear all calculations, including any errors and start over. This is seldom necessary.

If an incorrect *number* entry is made, pressing the [ON/C] key before any non-number key clears the incorrect number without affecting any calculation in progress.

Special circuitry has been provided to facilitate the correction of a wrong operation entered while keying in your problem. When an *unwanted operation* key is entered ([+], [−], [÷], [×], [y^x] or [2nd] [$\sqrt[x]{y}$]), simply press the correct operation and continue. The only exception to this convenient system is that [2nd] [$\sqrt[x]{y}$] cannot replace another operation.

When two operations in a row are entered, the calculator performs only the last operation.

Example: 7 ~~−~~ × 6 ~~×~~ + ~~6~~ 5 = 47

Enter	Press	Display	Comments
7	[−] [×]	7.	Replace − with ×
6	[×] [+]	42.	7 × 6
6	[ON/C]	0.	6 erased
5	[=]	47.	7 × 6 + 5

Example: ~~$\sqrt[x]{y}$~~ 7 × 6 ~~y^x~~ ~~−~~ ~~×~~ + 5 = 47

Enter	Press	Display	Comments
7	[2nd] [$\sqrt[x]{y}$] [×]	7.	
6	[y^x] [−] [×] [+]	42.	7 × 6
5	[=]	47.	7 × 6 + 5

V. MEMORY USAGE

The memory keys allow data to be stored and retrieved at will for additional flexibility in calculations. Use of the memory does not affect any calculations in progress, so memory operations can be used wherever needed.

STORE AND RECALL

The Store key [STO] stores the displayed quantity in the memory without removing it from the display. Any previously stored value is cleared.

The Recall key [RCL] retrieves stored data from the memory to the display. Use of this key does not clear the memory.

Example: Store and recall 3.012

Enter	Press	Display
3.012	[STO]	3.012
	[ON/C]	0.
	[RCL]	3.012

Use of these keys allows you to store a long number that is to be used several times.

Example: If the monetary conversion rate between dollars and pesos is 8.6120894, convert the following dollars to pesos: 7, 15, 1266, 88 and 121.

Enter	Press	Display
7	[X]	7.
8.6120894	[STO] [=]	60.284626
15	[X] [RCL] [=]	129.18134
1266	[X] [RCL] [=]	10902.905
88	[X] [RCL] [=]	757.86387
121	[X] [RCL] [=]	1042.0628

You can see that by storing the conversion factor the first time it is entered saved you from having to key it in the other times it is needed. A single press of the [RCL] key brings the eight digit factor to the display each time. Notice also that the use of [STO] and [RCL] did not interfere with calculator operations.

SUM TO MEMORY

The Sum to Memory key [SUM] algebraically adds the display value to the memory content. This key does not affect the displayed number or calculations in progress.

Important: The clear key [ON/C] does not clear memory except when the calculator is first turned on. Therefore the first quantity should be stored using [STO] , or a zero should be stored to ensure the memory is empty before using [SUM].

This key is used to accumulate the results from a series of independent calculations. [SUM] replaces the arithmetic sequence [+] [RCL] [=] [STO] .

Example:

28.3 × 7 = 198.1
173 + 16 = 189
312 − 42 + 7.8 = 277.8
Total 664.9

Enter	Press	Display	Memory
28.3	[×]	28.3	0.
7	[=] [STO]	198.1	198.1
173	[+]	173.	198.1
16	[=] [SUM]	189.	387.1
312	[−]	3.12	387.1
42	[+]	270.	387.1
7.8	[=] [SUM]	277.8	664.9
	[RCL]	664.9	664.9

This example could have been performed continuously by linking each expression together and not using the memory. But if each of the three expressions had been far more complicated, then solving the entire problem sequentially could be risky. An uncorrectable mistake during calculations would mean starting over from the first. Summing to memory saves each completed expression making the calculation of each new series of terms independent from the previous ones.

MEMORY EXCHANGE

The Exchange key [EXC] exchanges the content of the memory with the display value. The display value is stored and the previously stored value is displayed.

This key combines the store and recall operations into a single key. Use of this key, like the other memory keys, does not disturb a sequence of calculations and can consequently be used anywhere in the solution of a problem.

The [EXC] key permits you to solve problem 1 and store the result. Then solve problem 2 and compare the results of the two problems while retaining both answers. Also, numbers can be temporarily stored and used as needed.

Example: Evaluate $A^2 + 2AB + B^2 =$ for A = .258963 and B = 1.25632

Enter	Press	Display	Comments
.258963	[STO] [x^2] [+] [(]	.06706184	Store A
1.25632	[×]	1.25632	Enter B
	[EXC]	0.258963	Store B, recall A
	[×]	0.3253404	A × B displayed
2	[)] [+] [(]	.71774263	$A^2 + 2AB$ displayed
	[RCL]	1.25632	Recall B
	[x^2]	1.5783399	B^2
	[=]	2.2960826	Answer

When A is recalled from memory for the last time it is needed, B is instantly stored in its place by the single keystroke [EXC].

VI. FINANCIAL OPERATIONS

The most often used and most frequently requested financial operations have been built into your Business Analyst. Calculator design has minimized keyboard effort so that calculations involving percentages, annuities, simple and compound interest and profit margins can be solved directly.

There are 5 different operating "modes" for this calculator. There is a mode for standard math, annuities, compound interest, cost-sell-margin and linear regression. Math calculations (without parentheses) are available for all modes. Beyond this, once you go from one mode to another, you **cannot** expect to return to the previous mode and find the associated values still present. There is essentially one set of work registers for all the modes except math. Each of these modes require the same space to perform its operations so the calculations of each new mode "writes over" the previous contents of these work registers.

Quantities can be stored and recalled in memory as needed in most of the calculations. Only the complexity of linear regression and the iterative process of computing the interest rate for annuities requires internal use of the memory. For these situations the memory cannot be used and any previously stored quantity is altered by these calculations.

While in a particular financial mode, you only need to reenter variables that change from problem to problem. This is true even when solving for a new unknown.

PROFIT MARGIN

Knowing any two of the following three variables — item cost, item selling price, profit margin — the remaining variable can be calculated.

The [CST], [SEL] or [MAR] keys are used to enter 2 of the variables (cost, sell or margin). Preceding the third key with [2nd], signals the calculator to compute that variable.

Calculations are based on **Profit Margin (%) =** $\frac{\textbf{Sell-Cost}}{\textbf{Sell}}$ × **100** which is percentage profit margin based on the selling price.

Example: You need to determine the selling price for a number of new books in your bookstore. You require a 28% profit margin. What should be the selling prices for the books that cost you $4.50, $9.90 and $15.30?

Enter	Press	Display
28	[MAR]	28.
4.5	[CST]	4.5
	[2nd] [SEL]	6.25
9.9	[CST] [2nd] [SEL]	13.75
15.3	[CST] [2nd] [SEL]	21.25

The selling prices are $6.25, $13.75 and $21.25 respectively.

PERCENT

The percent key [%] converts the displayed number from a percentage to a decimal.

Example: 43.9% = .439

Enter	Press	Display
43.9	[%]	.439

When [%] is pressed after an arithmetic operation, add-on, discount, and percentage can be computed.

[+] n [%] [=] adds n% to the number displayed.

Example: What is the total cost of a $15 compass when there is a 5% sales tax?

Enter	Press	Display
15	[+]	15.
5	[%] [=]	15.75

[−] n [%] [=] subtracts n% from the number displayed.

Example: How much is paid for a $5 hat that has been discounted 10%?

Enter	Press	Display
5	[−]	5.
10	[%] [=]	4.5

In add-on and discount sequences, parentheses may not immediately precede [%].

[×] n [%] [=] multiplies the number in the display by n%.

Example: A watch company has shipped 40% of your 12000 unit order. How many watches are on the way? In other words, what is 40% of 12000?

Enter	Press	Display
12000	[×]	12000.
40	[%] [=]	4800.

[÷] n [%] [=] divides the displayed number by n%.

Example: 30 deliveries have satisfied 15% of your customers. How many deliveries are needed to satisfy all your customers? 30 is 15% of what number?

Enter	Press	Display
30	[÷]	30.
15	[%] [=]	200.

The percent change sequence, X_1 [2nd] [Δ%] X_2 [=], calculates the percentage of change between two values X_1 and X_2 where:

$$\Delta\% = \frac{X_2 - X_1}{X_1} \times 100$$

Example: What is the percentage increase of the cost of a raw material formerly costing $814.75 per lot that now costs $906.25?

Enter	Press	Display
814.75	[2nd] [Δ%]	814.75
906.25	[=]	11.230439

The cost per lot has increased over 11%.

INTEREST

The occurrence of interest is found throughout the financial world. Interest is the rent paid for the use of someone else's money. Interest can be the money your savings account earns, paid by the bank that is using your money, or money that you pay for a car loan.

Interest is also a factor when looking at investments. Money is worth more in the future because of the accrued interest it can accumulate along the way. Today's money will have a different value at some future date because of its interest drawing potential. Conversely, some future sum of money must be discounted when considering its value today.

The charge for using money is based on an interest rate which is a certain percent per time period (day, week, month, year, etc.). Usually this percentage is set at a yearly rate, called an annual percentage rate (APR). The other two factors controlling the amount of interest paid are the amount of money being used and the length of time it is used.

The two basic ways of charging interest are termed simple and compound.

SIMPLE INTEREST

Interest earned is based on the use of a certain amount of money for some time at an agreed interest rate. When simple interest is applied, only the initial amount of money earns the interest. No additional capital is added to the account by deposit or by retaining any interest earned previously. Simple interest is the product of three variables.

Interest earned (I) = Principal (P) × interest rate(r) × number of periods (t)

$$I = Prt$$

Example: If you deposited $2000 in a fund that guarantees 12% simple interest per year, how much interest would you draw in 3 years?

Enter	Press	Display
2000	[×]	2000.
12	[%] [×]	240.
3	[=]	720.

Your $2000 investment will return $720 in interest—$240 per year.

	Principal	Interest Earned
1st year	$2000	$240
2nd year	2000	240
3rd year	2000	240
		$720 Total

The total amount (S) is now the principal (P) plus the interest (I).

$$S = P + I$$

The total amount for the above problem is P + I or 2000 + 720 = $2720.

Discount (Present Value vs Future Value)

The principal amount is actually a present value and the total amount is a future value because time has passed and interest has been generated. Anticipating some future value, the present value can be determined for a simple interest situation by

$$S = P + I \text{ where } I = Prt$$

$$\text{substituting, } S = P + Prt \text{ or } S = P(1 + rt)$$

$$\text{and } P = \frac{S}{1 + rt}$$

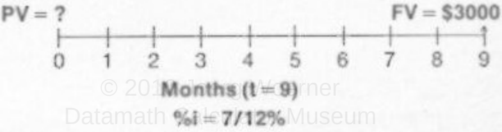
which represents some future value(s) discounted at r interest rate for some time t.

Example: What is the present value of a $3000 bond at 7% simple interest that matures in 9 months? The face value of the bond ($3000) must be discounted to the present.

$$P = \frac{3000}{1 + \frac{7\%}{12}(9)}$$

Enter	Press	Display
3000	[÷] [(]	3000.
1	[+] [(]	1.
7	[%] [÷]	0.07
12	[×]	.00583333
9	[=]	2850.3563

Graphically, the problem can be represented as shown below.



This problem could have been rephrased to read "How much should you invest now at 7% simple interest to accumulate $3000 in 9 months?"

Exact and Ordinary Simple Interest

When computing simple interest, you should be aware of several different methods of measuring time and how they affect your calculations. Exact simple interest is based on the exact number of days in a year, whereas ordinary simple interest uses a fixed 360 day year. The interest earned for part of a period in any simple interest situation is based directly on the part of the period that is used.

Example: Calculate the exact and ordinary simple interest on $3000 for 60 days at an APR of 7%.

For exact: **Interest = Prt** = $3000(7\%)\left(\frac{60}{365}\right)$

Enter	Press	Display
3000	[X]	3000.
7	[%] [X]	210.
60	[÷]	12600.
365	[=]	34.520548

For ordinary interest = $3000(7\%)\left(\frac{60}{360}\right)$

Enter	Press	Display
3000	[X]	3000.
7	[%] [X]	210.
60	[÷]	12600.
360	[=]	35.

In the same manner, the number of days per month used in calculations can be exact or fixed at 30.

COMPOUND INTEREST

Most investment situations involving interest compound the interest earned to the principal for each interest period. Now, the interest earned in one period will itself become principal and earn interest during the following period.

In the first example under Simple Interest where $2000 is invested for 3 years at 12%, if the interest were compounded annually, the total investment gain would be significantly increased because the interest earned during one year would be drawing interest the next.

		Principal	Interest earned
1st year		$2000.00	$240.00
2nd year	2000 + 240.00 =	2240.00	268.80
3rd year	2240 + 268.80 =	2508.80	301.06
			$809.86 Total

The mathematical relationship that gives you a future value (FV) based on a present value (PV) or principal amount compounded for N periods at an interest rate of i% per period is:

$$FV = PV \times (1+i)^N$$

Knowing any three of these four variables, the other can be computed by simply pressing [2nd] followed by the key representing the fourth variable. Your calculator provides a series of keys for computing these variables.

The Annuity/Compound Interest Mode Key [2nd] [AN-CI] selects the financial mode of the calculator. Compound Interest mode is indicated by quote marks (") in the upper left portion of display. The calculator powers up in the Annuity mode (no display indication of this mode). Each time [2nd] [AN-CI] is pressed the mode changes from the current mode to the other, annuity to compound interest to annuity, etc.

The [N], [%i], [PV], [FV] keys are used to enter the values for number of periods, periodic interest rate, present value and future value, respectively. Having entered any three of these values, pressing the [2nd] key followed by the key representing the unknown value signals the calculator to compute that unknown value. [2nd] [%i] utilizes an iterative process to obtain the interest rate. This process can require 30 seconds of computing time.

The case of investing $2000 for 3 years at 12% compounded annual interest rate would be solved as follows:

Enter	Press	Display	Comments
	[2nd] [AN-CI]	" 0.	Select Compound Interest Mode
2000	[PV]	" 2000.	Enter present value
3	[N]	" 3.	Enter number of periods
12	[%i]	" 12.	Enter periodic interest rate
	[2nd] [FV]	" 2809.856	Compute future value

If the interest were compounded monthly under the same conditions, what would the value be at the end of the same 3 years?

Select Compound Interest Mode

Enter	Press	Display	Comments
12	[÷]	" 12.	Annual percentage rate
12	[=] [%i]	" 1.	Periodic rate
3	[×]	" 3.	Years
12	[=] [N]	" 36.	Number of periods
	[2nd] [FV]	" 2861.5375	Future value

Note that it was not necessary to reenter the present value.

By more frequently compounding the earned interest, more money is made. Notice that the interest rate per periods must be adjusted to correspond to the time interval in which the compounding occurs.

NOMINAL AND EFFECTIVE INTEREST RATES

The nominal interest rate is the given annual percentage rate for interest that is compounded more often than once a year. The rate of interest actually earned per year is the effective rate.

Example: What is the effective rate of interest on $100 if the 12% nominal rate is compounded quarterly?

Select Compound Interest Mode

Enter	Press	Display	Comments
100	[PV]	" 100.	Present value
12	[÷]	" 12.	Nominal rate
4	[=] [%i]	" 3.	Interest per quarter
4	[N]	" 4.	Number of periods
	[2nd] [FV]	"112.55088	Value after 1 year
	[−]	"112.55088	Less present value
100	[=]	"12.550881	Effective rate

The nominal interest rate of 12% on $100 effectively draws $12.55 in interest if it is compounded quarterly.

Compounded annually the 12% rate would, of course, draw only $12.00 per hundred.

Likewise, the nominal rate can be calculated if you know that your $100 has earned $12.55 interest resulting from quarterly compounding.

Enter	Press	Display
100	[PV] [+]	" 100.
12.55	[=] [FV]	" 112.55
4	[N]	" 4.
	[2nd] [%i] [×]	" 2.9997984
4	[=]	" 11.999194

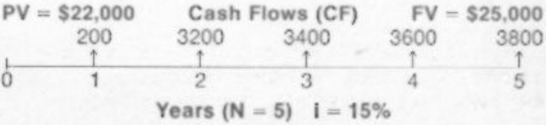
DISCOUNTED CASH FLOWS

Many times you are confronted with a choice of investments. A good procedure for analyzing these situations is to discount all anticipated cash flows from an investment to a present day equivalent. There are several methods available to analyze the results.

Net Present Value

By requiring a certain minimum rate of return and estimating the cash flows for each period, the discounted cash flows can be added to see if the investment is worthwhile. If the sum or net present value of all discounted cash flows is positive, then the investment exceeds your minimum rate of return. If negative, it does not.

Example: C.B. Sweetooth has the opportunity to purchase a small ice cream shoppe for $22,000. He desires a 15% annual return rate on his investment. Will the following anticipated annual end of year net incomes (cash flows) shown below meet his expectations if he sells the shoppe for $25,000 in five years?



Using the compound interest mode, discount each of these cash flows and sum them to memory.

Select Compound Interest Mode

Enter	Press	Display	Comments
22000	+/- STO	″ -22000.	Store initial expense
15	%i	″ 15.	Expected rate of return
200	FV	″ 200.	CF_1
1	N	″ 1.	Period 1
	2nd PV SUM	″ 173.91304	Present value of CF_1
3200	FV	″ 3200.	CF_2
2	N	″ 2.	Period 2
	2nd PV SUM	″ 2419.6597	Present value of CF_2
3400	FV	″ 3400.	CF_3
3	N	″ 3.	Period 3
	2nd PV SUM	″ 2235.5552	Present value of CF_3
3600	FV	″ 3600.	CF_4
4	N	″ 4.	Period 4
	2nd PV SUM	″ 2058.3117	Present value of CF_4
3800	FV	″ 4000.	CF_5
5	N	″ 5.	Period 5
	2nd PV SUM	″ 1889.2716	Present value of CF_5
25000	FV	″ 25000.	CF_5 (selling price)
	2nd PV SUM	″ 12429.418	Present value of selling price
	RCL	″-793.87045	Net present value at 15%

The result is negative, so the investment does not return 15% per year.

Internal Rate of Return

To determine the interest rate associated with a series of cash flows requires an iterative process. The process is the same as for net present value except that the interest rate is unknown. Simply choose a rate of return that looks reasonable and run through the calculations as before. A zero present value means that your assumed rate of return is correct. Then analyze the net present value to see how far off you are one way or the other and make a second rate of return estimate and discount the future values again.

Example: What was the actual rate of return from the ice cream shoppe in the previous example?

From the previous example we see that the cash flows did not produce as much as a 15% return, so try 13%.

Select Compound Interest Mode

Enter	Press	Display	Comments
22000	+/- STO	" −22000.	Store initial expense
13	%i	" 13.	Rate of return guess
200	FV	" 200.	CF_1
1	N	" 1.	Period 1
	2nd PV SUM	" 176.99115	Present value CF_1
3200	FV	" 3200.	CF_2
2	N	" 2.	Period 2
	2nd PV SUM	" 2506.0694	Present value CF_2
3400	FV	" 3400.	CF_3
3	N	" 3.	Period 3
	2nd PV SUM	" 2356.3705	Present value CF_3
3600	FV	" 3600.	CF_4
4	N	" 4.	Period 4
	2nd PV SUM	" 2207.9474	Present value CF_4
3800	FV	" 3800.	CF_5
5	N	" 5.	Period 5
	2nd PV SUM	" 2062.4878	Present value CF_5
25000	FV	" 25000.	CF_5
	2nd PV SUM	" 13568.998	Present value of selling price
	RCL	" 878.86463	Net present value at 13%

We now have two net present values for the investment and can approximate the actual rate of return, about 14%.

ANNUITIES

An annuity is any series of equal payments made at regular intervals of time. The time intervals between payments are called payment periods. An annuity is a compound interest situation with periodic payments. This definition covers a wide variety of financial situations from the paycheck you receive to the regular payments you make for rent on an apartment or mortgage for a house, installments on various loans and premiums on insurance policies. There are basically two types of annuities differentiated by payments being made at the beginning or end of each period.

An *ordinary annuity*, sometimes called payments in arrears, involves payments made at the end of each payment period. Most loans fall into this category. You take out a loan, receive the money now, but don't start paying on it until the end of the first period, usually at the end of the first month.

Insurance premiums and rent payments are examples of *annuity due* situations, also called payments in advance. Here, payments are made at the beginning of each period in anticipation of services to be received during the coming period. Regular deposits made at the beginning of each period into a savings account form an annuity due type of investment.

ORDINARY ANNUITIES

When payments occur at the ends of the periods, the following relationship applies.

$$PV = PMT\left(\frac{1-(1+i)^{-N}}{i}\right) \qquad FV = PMT\left(\frac{(1+i)^{N}-1}{i}\right)$$

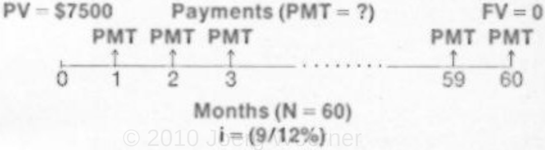
where: **PV** = Present value of a debt or an account
PMT = Payment per period
i = Interest rate for payment period
N = Number of periods
FV = Future value of a debt or an account

There is a separate key for each of these variables on your calculator. Enter any 3 of these unknowns by pressing the proper key after each value. Then press [2nd] and the key for the unknown and that unknown is calculated.

Loans

When you take out a loan, you establish a debt of some present value to be repaid with interest by certain payments for a fixed number of periods.

Example: The super ski boat Don couldn't live without required him to borrow $7500 at 9% per annum compounded monthly. He decides to repay the loan in 5 years by 60 monthly payments. What are his monthly payments?

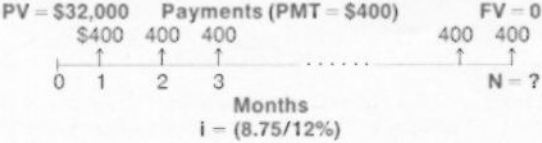


Select Annuity Mode

Enter	Press	Display
7500	[PV]	7500.
9	[÷]	9.
12	[=] [%i]	0.75
60	[N]	60.
	[2nd] [PMT]	155.68766

Don's payments are $155.69 per month.

Example: How long will it take to pay off a $32,000 loan at 8.75% if your monthly payments are $400? How long if monthly payments are $300?



Select Annuity Mode

Enter	Press	Display
32000	[PV]	32000.
8.75	[÷]	8.75
12	[=] [%i]	.72916667
400	[PMT]	400.
	[2nd] [N]	120.50149
300	[PMT]	300.
	[2nd] [N]	207.0246

120 monthly payments are required at $400 per month, 207 payments are needed at $300 per month. Notice that only the PMT need be entered for the second problem. The previously entered values are retained.

Reducing a Loan

These calculations involve checking on a loan situation before its termination to determine how long it takes to reduce the loan to a certain level or to find out how much has been paid after a certain length of time.

First, determine the parameters for the duration of the loan. Next, calculate the parameters from the intermediate point to termination, then find the difference between the two.

Example: At what point in time is the $32,000, 8.5% loan on your lake place reduced to $15,000? Your monthly payments are $300.

Select Annuity Mode

Enter	Press	Display	Comments
32000	[PV]	32000.	
8.5	[÷]	8.5	
12	[=] [%i]	.70833333	% per period
300	[PMT]	300.	
	[2nd] [N] [÷]	199.58834	Periods to pay out $32000
12	[=] [STO]	16.632361	Years to pay out $32000

Now determine the time needed to pay out $15,000 and take the difference.

Enter	Press	Display	Comments
15000	[PV]	15000.	Enter present value
	[2nd] [N] [÷]	61.942651	Periods to pay out $15,000
12	[=] [+/−] [+]	−5.1618876	Years to pay out $15,000
	[RCL] [=]	11.470474	Years to reduce $32,000 loan to $15,000.

Note that interest rate and payment do not need to be reentered as the calculator saves the values from the previous problem.

Example: How much of the loan in the previous example will be paid off after 10 years?

It takes about 16.63 (value stored in memory) years to pay off the entire loan, so first find out how much of the loan is paid off in 16.63 − 10 = 6.63 years, then subtract it from 32000.

Enter	Press	Display	Comments
	[RCL] [−]	16.632361	
10	[=] [X]	6.6323615	
12	[=] [N]	79.588337	Months to payout
	[2nd] [PV]	18203.182	Amount paid off in last 6.63...years
	[+/−] [+]	−18203.182	
32000	[=]	13796.818	Amount paid in 10 years

Throughout these examples, the amounts referred to are only the principal. Analyzing the results, we see that reducing the debt to about half ($15000) requires over 2/3 of the payout time. This means that a large portion of each payment made in the early payoff periods goes to interest.

Balloon Payments

There are many money situations that involve not only a series of payments, but also a payment at termination that is larger or smaller than the regular payments. These balloon payments or balloons can be for a loan you decide to pay off before its normal duration is complete or for situations like the ownership of property, from which you have received a steady flow of rent, then decided to sell, producing a large impulse of income at the end of the investment. For either type, equal payments are made at regular time intervals with a different payment, usually larger, made to terminate the transaction.

Some problems of this type can be solved using the method discussed under "Reducing a Loan".

Example: Good old dad has agreed to pay the last $600 on the loan for his son's first automobile. (A little incentive to help the lad keep up his payments.) The boy has agreed to meet $85.50 monthly payments on the $2100 automobile to repay the 9.6% loan. How many payments does the son have to make?

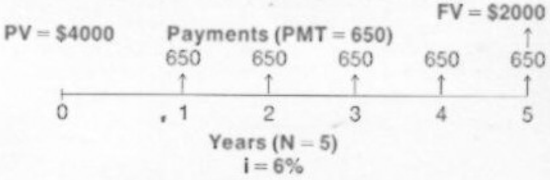
First, solve for the total number of payments to pay off the loan without the $600 balloon.

Enter	Press	Display	Comments
2100	[PV]	2100.	Enter present value of loan
9.6	[÷]	9.6	APR
12	[=] [%i]	0.8	Enter monthly interest rate
85.5	[PMT]	85.5	Enter payment
	[2nd] [N] [STO]	27.455134	Number of payments

Next, find out how many payments are eliminated by the balloon and take the difference.

Enter	Press	Display	Comments
600	[PV]	600.	New present value
	[2nd] [N]	7.2510751	Payments to pay off $600
	[+/−] [+] [RCL] [=]	20.204059	Number of payments the son has to make

Example: Joe Birtchwood has just inherited $4000 and needs someplace to invest it. If he buys 15 canoes and makes $650 per year for 5 years from their rental, then sells them for $2000, will his profit rate be greater than the 6% he can get in a savings account?



For this type you must first discount the $2000 back to present time using the compound interest keys and solving for present value.

Select Compound Interest Mode

Enter	Press	Display
2000	FV	" 2000.
6	%i	" 6.
5	N	" 5.
	2nd PV	" 1494.5163

Now his initial investment is actually 4000 – 1494.52 = 2505.48 and a simple ordinary annuity problem remains.

Enter	Press	Display	Comments
	2nd ANCI	1494.5163	Annuity Mode
	+/– +	–1494.5163	
4000	= PV	2505.4837	New present value
650	PMT	650.	
	2nd %i	9.3499283	Annual percent return

This investment is better than savings. (Assuming Joe carries enough insurance to cover canoes lost in the rapids.)

Amortization

A debt is termed *amortized* when all principal and interest have been repaid, usually by equal payments at regular intervals. For most loans an amortization schedule can be created to show at each payment period just what part of each payment is going for interest and how much is for principal.

In looking at your lake place again, consider the first payment period. You must first pay interest on the full $32,000 which is 8.5%/12 × 32000 = $226.67. Now you make a $300 payment. After the first payment period, the balance is 32000 + 226.67 – 300 = $31926.67. Of your first payment, $226.67 went for interest while only

$73.33 went toward paying off the principal. This procedure can be repeated for each payment period throughout the life of the mortgage.

Select Compound Interest Mode

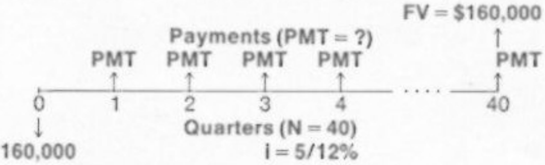
Enter	Press	Display	Comments
32000	[PV] [STO]	" 32000.	Enter and store PV
1	[N]	" 1.	Enter number of payments
8.5	[÷]	" 8.5	
12	[=] [%i]	" .70833333	Enter periodic interest rate
	[2nd] [FV] [−]	" 32226.667	Principal plus interest
300	[=] [PV]	" 31926.667	Balance after first period
	[EXC]	" 32000.	
	[−] [RCL] [=]	" 73.333335	Amount paid for principal
	[+/−] [+]	"-73.333335	
300	[=]	" 226.66667	Amount paid for interest
	[2nd] [FV] [−]	" 32152.814	Principal plus interest
300	[=] [PV]	" 31852.814	Balance after 2nd period
	[EXC]	" 31926.667	
	[−] [RCL] [=]	" 73.852797	Principal paid
	[+/−] [+]	"-73.852797	
300	[=]	" 226.1472	Interest paid

A repetitive calculation of this nature may accumulate some error due to continual rounding, but the error is confined to insignificant digits.

Sinking Funds

To accumulate money to meet some anticipated debt, you can establish a sinking fund that will produce the necessary amount of money at the time of need. This type of ordinary annuity also applies to situations such as bonds where an initial amount of money received is to be paid back at some future date.

Example: A $160,000 bond to build 20 tennis courts in the cities' parks is due to be repaid in 10 years. A fund is established where quarterly payments will accumulate at 5% interest. How large is each payment?



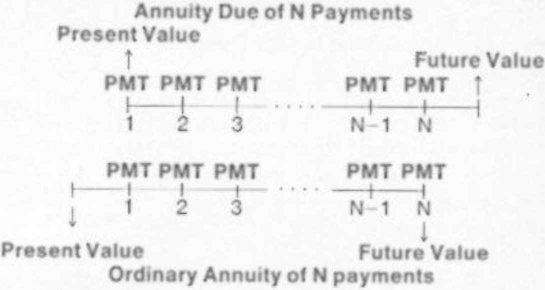
Select Annuity Mode

Enter	Press	Display	Comments
160000	[FV]	160000.	Future Value
10	[×]	10.	
4	[=] [N]	40.	Number of periods
5	[÷]	5.	
4	[=] [%i]	1.25	Quarterly interest rate
	[2nd] [PMT]	3107.4263	Amount of each payment

You can solve for any of these unknowns to design the best sinking fund to fit your needs. In summary, a sinking fund is like a savings account, except that payments are made at the end of each period.

ANNUITIES DUE

An annuity due is one in which the payments are made at the beginning of the payment interval, the first payment being due at once. The difference can be seen from the following time diagram.



Note that the annuity due ends one period after the last payment. Insurance premiums and property rentals are examples of annuities due.

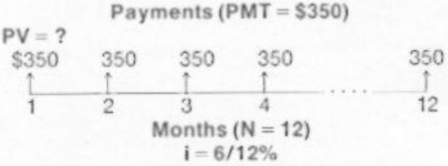
The solution for an annuity due problem is accomplished by transforming the problem into an ordinary annuity. This may be done by inspection of the time diagram or use of the factor (1+i) as shown in the table below:

TO CALCULATE	METHOD
PV or FV	Calculate PV or FV in the ordinary annuity mode and then multiply the answer by (1+i). Note: i in this factor is the periodic rate as a decimal fraction, i.e., 1% = .01.
PMT or n	Divide whichever is known, PV or FV, by (1+i) and then use that value with the other known values to calculate the answer in ordinary annuity mode.

i	If PV is known, enter (n−1) for n and use (PV−PMT) for PV, then calculate %i in the annuity mode. When FV is known, enter (n+1) for n and use (FV+PMT) for FV, then calculate %i in the annuity mode.

Present Value for Annuity Due

Example: Tom Bean can rent a feed store for $350 per month, payable each month in advance. What would be the cost of a year's lease, in advance, if the owner requires 6% interest compounded monthly?



Enter	Press	Display	Comments
350	[PMT]	350.	Enter payment
12	[N]	12.	Enter periods
6	[÷]	6.	
12	[=] [%i]	0.5	Enter periodic rate
	[2nd] [PV] [STO]	4066.6259	PV for ordinary annuity
.06	[÷]	0.06	Multiply by (1+i)
12	[+]	0.005	
1	[×] [RCL] [=]	4086.9591	PV for annuity due

Inspection of the time diagram shows that the situation would be an ordinary annuity if the PV occurred one month before the first payment. Moving the time value for this ordinary annuity PV one month later (to correspond with the time diagram of an annuity due), using the compound interest mode, is equivalent to multiplying by (1+i) as was done above.

Enter	Press	Display	Comments
350	PMT	350.	Enter payment
12	N	12.	Enter periods
6	÷	6.	
12	= %i	0.5	Enter periodic rate
	2nd PV	4066.6259	PV for ordinary annuity
	2nd AN-CI	" 4066.6259	Select compound interest mode
1	N 2nd FV	" 4086.9591	PV moved 1 month to yield annuity due

Future Value for Annuity Due

Example: John Jones plans to deposit $20 per month beginning this month in a savings account which pays 5% interest compounded monthly. If he makes no withdrawals, what will the balance in his account be after one year?

Select Annuity Mode

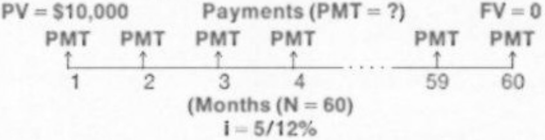
Enter	Press	Display	Comments
20	PMT	20.	Enter payment
12	N	12.	Enter periods
5	÷	5.	APR
12	= %i	.41666667	Enter periodic rate
	2nd FV STO	245.57707	FV for ordinary annuity
.05	÷	0.05	Multiply by (1+i)
12	+	.00416667	
1	× RCL =	246.60031	FV for annuity due

Instead of the last three lines for conversion to annuity due, the same results can be obtained in the compound interest mode

Enter	Press	Display
	RCL PV 2nd AN-CI	" 245.57707
1	N 2nd FV	" 246.60031

Payment for Annuity Due

Example: Henry Williams is the beneficiary of a $10,000 insurance policy. He elects to receive this amount in 60 equal monthly payments with the first to be made immediately. What will be the amount of each payment if 5% interest compounded monthly is paid on the proceeds of the policy?



Select Annuity Mode

Enter	Press	Display	Comments
60	[N]	60.	Enter number of payments
5	[÷]	5.	APR
12	[=] [%i] [÷]	.41666667	Enter periodic rate
100	[+]	.00416667	Decimal rate
1	[÷]	1.0041667	1+i
10000	[=] [2nd] [1/x] [PV]	9958.5062	Enter present value $\left(\frac{10000}{1+i}\right)$
	[2nd] [PMT]	187.92932	Monthly payments

Conversion of PV to an annuity due using the compound interest mode consists of moving the $10,000 one period ahead in time to make the time diagram equivalent to an ordinary annuity.

Enter	Press	Display	Comments
	2nd AN-CI	" 187.92932	Compound interest mode
1	N	" 1.	Enter number of periods
10000	FV	" 10000.	Enter future value
	2nd PV	" 9958.5062	Enter present value
	2nd AN-CI	9958.5062	Annuity mode
60	N	60.	Enter new N
	2nd PMT	187.92932	Monthly payments

Interest Rate for Annuity Due

An insurance agent can offer Paul Johnson a choice of two $20,000 insurance policies. One is an endowment policy which will have a cash value after 10 years of $2000. The premium for this policy will be $18.00 per month payable in advance. The second policy is term insurance which has no cash value in the future. Paul calculates his average premium for the next 10 years for this policy would be $4.20 per month. If Paul paid for the term policy and invested the premium difference in a savings account that compounded interest monthly, what interest rate would he require to have a $2000 balance in his savings account at the end of the ten years?

Select Annuity Mode

Enter	Press	Display	Comments
18	[−]	18.	
4.2	[=] [PMT] [+]	13.8	Premium difference
2000	[=] [FV]	2013.8	FV+PMT
12	[X]	12.	
10	[+]	120.	
1	[=] [N]	121.	Enter number of periods + 1
	[2nd] [%i] [X]	.30334264	Calculate periodic rate
12	[=]	3.6401117	Rate at 4% estimate

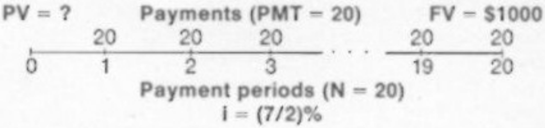
BONDS

A bond is a financial obligation made by a corporation or government agency which pays the owner a periodic amount and also has a redemption value at some future date or maturity. The amount of each periodic payment or coupon is equal to the face value of the bond times the bond interest rate per period. The yield or investor rate of return per period is computed using the compound interest and annuity formulas programmed into your calculator. For the examples that follow it will be assumed that the redemption price is equal to the face value as is usually the case.

Present Value of a Bond

The present value of a bond can be determined simply by summing the present value of the redemption price and the present value of the coupon payments. The investor's desired rate of return (yield) must be used in this type of calculation for [%i] since the nominal interest rate on the bond only determines the amount of the periodic payment.

Example: Jim Edwards wants to buy a bond to yield a 7% annual return. How much should he pay for a $1000 face value 4% bond which matures in 10 years. It has a semiannual coupon payment of $20.



Select Compound Interest Mode

Enter	Press	Display	Comments
10	[X]	″ 10.	
2	[=] [N]	″ 20.	Enter number of semiannual periods
7	[÷]	″ 7.	
2	[=] [%i]	″ 3.5	Enter semiannual yield as %i
1000	[FV]	″ 1000.	Redemption price
	[2nd] [PV] [STO]	″502.56588	Calculate present value of bond redemption value
	[2nd] [ANC]	502.56588	Annuity mode
20	[PMT]	20.	Enter semiannual payment
	[2nd] [PV] [SUM]	284.24807	Value of coupon payments
	[RCL]	786.81395	Total present value

In financial journals the quoted price of a bond is usually based on 10% of the bond face value. In the above example a bond quoted at $78.68 would fit the conditions given. You could have calculated this answer by using 100 for the redemption price and 2 for the payment in the key sequence above. Generally, for any maturity period convert the time to years (i.e. 7 years, 3 months = 7.25 years) and then use in the sequence above. For calculating the yield of calls, use the call price for [FV] in the compound interest part of the computation.

Yield to Maturity of a Bond

The interest rate which makes the present value of the redemption price plus the present value of the coupon payments equal to the cost or quoted price of the bond is known as the yield to maturity. This is the true rate of return which an investor receives on his invested capital.

If the quoted price was $728.20, what would be Mr. Edwards' yield to maturity?

The present value of this bond at 7% is known to be $786.81. Now try 9% since a higher rate must be used to discount the bond to a lower present value.

Select Compound Interest Mode

Enter	Press	Display	Comments
10	[X]	″ 10.	
2	[=] [N]	″ 20.	Enter number of semiannual periods
9	[÷]	″ 9.	
2	[=] [%i]	″ 4.5	Enter semiannual yield as %i
1000	[FV]	″ 1000.	Enter redemption price
	[2nd] [PV] [STO]	″414.64285	Discounted redemption price
	[2nd] [AN-CI]	414.64285	Select annuity mode
20	[PMT]	20.	Enter semiannual coupon payment
	[2nd] [PV] [SUM]	260.15873	PV of coupon payments
	[RCL]	674.80159	Total PV of bond at 9% yield

Using this yield to discount the bond results in a present value lower than the quoted price, so try a lower rate.

Yield	PV
7%	786.81
?	728.20
9%	674.80

Try 8%.

Enter	Press	Display	Comments
	[2nd] [AN CI]	"674.80159	Compount Interest Mode
8	[÷]	" 8.	
2	[=] [%i]	" 4.	Enter semiannual yield
1000	[FV]	" 1000.	Enter redemption price
	[2nd] [PV] [STO]	"456.38695	Discounted redemption price
	[2nd] [AN CI]	456.38695	Annuity mode
20	[PMT]	20.	Semiannual coupon payment
	[2nd] [PV] [SUM]	271.80658	PV of coupon payments
	[RCL]	728.19347	Total PV of bond at 8% yield

Since this is almost equal to the quoted price, 8% is the approximate yield to maturity.

DEPRECIATION

Almost all tangible assets of a business lose value or wear out as time goes by. The government makes allowances in taxes of businesses to permit them to set aside funds to eventually replace worn out assets. First, the decreasing value or depreciation of an asset must be determined.

There are three different methods for calculating depreciation. These three methods will be applied to show the depreciation differences when discounting an $18,000 computer over a 5-year time span. The computer can be sold in five years for $3500. The depreciable value thus becomes $18000 − 3500 = $14500.

Straight-Line Method

This method depreciates items a fixed amount each year. The computer is depreciated $14500 ÷ 5 = $2900 per year for 5 years. A depreciation schedule can be established as follows:

Enter	Press	Display	Comments
18000	[−]	18000.	Purchase price
3500	[÷]	14500.	Depreciable value
5	[=] [STO]	2900.	Annual depreciation
18000	[−] [RCL] [=]	15100.	Value after 1 year
	[−] [RCL] [=]	12200.	Value after 2 years
	[−] [RCL] [=]	9300.	↓
	[−] [RCL] [=]	6400.	↓
	[−] [RCL] [=]	3500.	Value after 5 years

The straight-line method is simple and straightforward, but most assets really lose most of their value in the first few years.

Sum-of-the-Year's-Digits Method

The annual depreciation for this method is based on the sum of digits representing each year of the life of the asset. For the computer, sum the digits 1 through 5 (for years 1 through 5) to get 15. Now to compute the first year's depreciation take 5/15 of the depreciable value, then 4/15 of the depreciable value for the next year, etc.

Enter	Press	Display	Comments
14500	[STO] [×]	14500.	Store depreciable value
5	[÷]	5.	
15	[=]	4833.3333	First year's depreciation
	[RCL] [×]	14500.	
4	[÷]	4.	
15	[=]	3866.6667	Second year's depreciation
	[RCL] [×]	14500.	
3	[÷]	3.	
15	[=]	2900.	Third year's depreciation
	[RCL] [×]	14500.	
2	[÷]	2.	
15	[=]	1933.3333	Fourth year's depreciation
	[RCL] [×]	14500.	
1	[÷]	1.	
15	[=]	966.66667	Fifth year's depreciation

This method decreases the depreciation a fixed percentage (1/15 or 6 2/3%) each year.

Declining Balance Method

Here, a fixed percentage (declining balance factor) is applied to the remaining value of the asset, not to the depreciable value as in the previous method. The salvage value cannot be taken into account, so the initial value is your starting point. The remaining value of the asset cannot, by law, go below the salvage value. The factor for straight declining balance is 100%. For double declining balance, the factor is 200%. Other depreciation rates are generally referred to in terms of the declining balance factor such as 150% declining balance.

For our computer problem, choose 125% as the declining balance factor.

Enter	Press	Display	Comments
125	[÷]	125.	Declining balance factor
5	[=] [STO]	25.	Store % annual depreciation
18000	[−] [RCL] [%]	4500.	First year depreciation
	[=]	13500.	Depreciated value
	[−] [RCL] [%]	3375.	Second year depreciation
	[=]	10125.	Depreciated value
	[−] [RCL] [%]	2531.25	Third year depreciation
	[=]	7593.75	Depreciated value
	[−] [RCL] [%]	1898.4375	Fourth year depreciation
	[=]	5695.3125	Depreciated value
	[−] [RCL] [%]	1423.8281	Fifth year depreciation
	[=]	4271.4844	Depreciated value

The computer can now be sold after being fully depreciated by the next year.

VII. STATISTICAL APPLICATIONS

In addition to offering a wide range of financial capabilities, your calculator also provides keys for linear regression and trend-line analyses.

LINEAR REGRESSION

Linear regression allows you to express one variable in terms of another even though they may not be analytical functions of each other. These can be represented as a scatter of points on a two-dimensional graph. A straight line can then be drawn to best approximate the pattern formed by this array of points. Placement of the line is determined by a least-squares linear regression that minimizes the sum of the squares of the deviations of the actual data points from the straight line of best fit. The linear equation of the form y = mx + b is determined for the line.

$$m = \text{slope} = \frac{\dfrac{\sum_{i=1}^{n} x_i y_i}{N} - \bar{x}\,\bar{y}}{\sigma_x^2}$$

$$b = \text{y-intercept} = \bar{y} - m\bar{x}$$

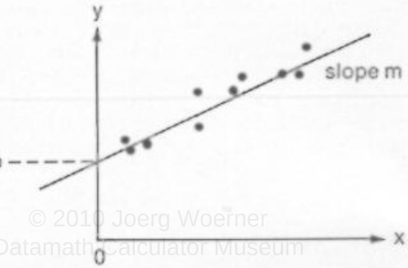
$$\bar{x} = \text{average of x values} = \frac{\sum_{i=1}^{N} x_i}{N}$$

$$\bar{y} = \text{average of y values} = \frac{\sum_{x=i}^{N} y_i}{N}$$

Linear regression is extremely useful for analyzing historical data and using the results to project future information. The data points are entered by their x–y coordinates using the following keys.

The [2nd] [LR] sequence initializes the calculator to perform linear regression types of problems and must be pressed first to enter this mode. The [x⇄y] and [Σ+] keys enter the x and y values respectively for linear regression type of problem. The data entry key sequence is x [x⇄y] y [Σ+]. The [2nd] [Σ-] sequence is used to remove invalid entries.

The remainder of the keys are used to compute results. Press [2nd] [m] to compute the slope of the line fitted to the input points and [2nd] [b] calculates the point of intersection of the line with the y-axis.



If the line is vertical, no y-intercept exists and the slope is undefinable. Calculating the slope will yield an error condition and additional x points cannot be predicted. If the line is horizontal, the slope is 0 and new y values cannot be predicted.

The [2nd] [x'] and [2nd] [y'] sequences are used to predict new points on the line that has been derived from preceding data.

Example: NoDie Life Insurance Company has found that the volume of sales varies according to the number of sales people employed.

Number of sales people	7	12	3	5	11	8
Sales in thousands/mo.	99	152	81	98	151	112

How many sales people does this company need for $200,000 monthly sales? What monthly sales should 15 sales people generate?

Enter	Press	Display	Comments
	[2nd] [LR]	0.	Initialize
7	[x⇌y]	0.	First x value
99	[Σ+]	1.	Data point 1
12	[x⇌y]	8.	Second x
152	[Σ+]	2.	Data point 2
3	[x⇌y]	13.	etc.
81	[Σ+]	3.	
5	[x⇌y]	4.	
98	[Σ+]	4.	
22	[x⇌y]	6.	Incorrect entry
151	[Σ+]	5.	
22	[x⇌y]	23.	Remove incorrect entry
151	[2nd] [Σ-]	4.	
11	[x⇌y]	22.	
151	[Σ+]	5.	
8	[x⇌y]	12.	
112	[Σ+]	6.	
200	[2nd] [x']	17.815789	People for $200,000
15	[2nd] [y']	176.55618	Sales for 15 people
	[2nd] [m]	8.3258427	Slope of line
	[2nd] [b]	51.668539	Y-intercept of line

The slope and y-intercept have been calculated so that the line can be plotted, if desired. The slope is incremental sales per person. The y-intercept is independent sales.

Due to the complexity of the linear regression calculations, the memory cannot be used. Consequently, any stored value is lost when [2nd] [LR] is pressed. Simple arithmetic can be performed where each operation completes the previous operation. The math functions can still be used, but parentheses are ignored.

Of special interest is that by performing any of the math functions on one or both elements of the random-variable pair, other types of regression are available. For example, by taking the logarithm of one of the variables before entering it as a data point, you can obtain a semi-logarithmic curve fit. These variations can be achieved by using natural logarithms, exponentials, roots and powers and reciprocal.

When initially analyzing your data, you must select the type of curve that characterizes your particular situation. Actually you can try several types of curves to see which best fits your needs.

Example: A city published the following census data. Predict the population in the year 2000 and predict the year the population will be 50,000 inhabitants.

Year	1930	1940	1950	1960	1970
Population	3591	5116	8507	15410	28612

Population data characteristically follows an exponential curve.

Enter	Press	Display
	[2nd] [L.R.]	0.
1930	[x⇄y]	0.
3591	[lnx] [Σ+]	1.
1940	[x⇄y]	1931.
5116	[lnx] [Σ+]	2.
1950	[x⇄y]	1941.
8507	[lnx] [Σ+]	3.
1960	[x⇄y]	1951.
15410	[lnx] [Σ+]	4.
1970	[x⇄y]	1961.
28612	[lnx] [Σ+]	5.
1980	[2nd] [y'] [2nd] [e^x]	44886.488
50000	[lnx] [2nd] [x']	1982.0536

The population in 1980 should be about 44886 and the town should have 50,000 residents by early 1982.

TREND-LINE ANALYSIS

For this type of linear regression, the calculator automatically increments the x values by 1 for each data point. The calculator initially assigns a 0 for the x value of the first data point, 1 for the second, etc. All data points are entered by pressing [Σ+] only. The starting x value can be set to any number other than 0 by entering the first x value, then letting the calculator increment from there: x_1 [x:y], y_1 [Σ+], y_2 [Σ+], y_3 [Σ+], etc.

Example: Dates Unlimited, a computer dating service, has the following annual profits:

Year	1962	1963	1964	1965-1970
Profit in millions	−2.1	−0.3	0.8	inactive

Year	1971	1972	1973	1974
Profit in millions	2.9	2.8	3.6	4.0

What profit can be expected in 1980 and when will the company break the $10 million mark?

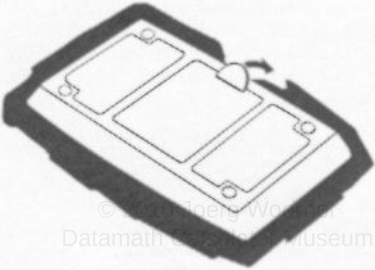
Enter	Press	Display	Comments
	[2nd] [LR]	0.	Enter linear regression mode
1962	[x:y]	0.	Initialize x
2.1	[+/−] [Σ+]	1.	1962 loss
.3	[+/−] [Σ+]	2.	1963 loss
.8	[Σ+]	3.	1964 gain
1971	[x:y]	1965.	Reinitialize x
2.9	[Σ+]	4.	1971 gain
2.8	[Σ+]	5.	1972 gain
3.6	[Σ+]	6.	1973 gain
4	[Σ+]	7.	1974 gain
1980	[2nd] [y']	6.521649	
10	[2nd] [x']	1988.2985	

In 1980 the company can expect over $6.52 million profit and to reach the $10 million mark in early second quarter of 1988.

VIII. SERVICE INFORMATION

BATTERY PACK REPLACEMENT

The battery pack can be quickly and simply removed from the calculator. Hold the calculator with the keys facing down. Place a small coin (penny, dime) in the slot in the bottom of the calculator. A slight prying motion with the coin will pop the slotted end of the pack out of the calculator. Disconnect the calculator wires from the battery terminals. The pack can then be removed entirely from the calculator.



The exposed metal contacts on the battery pack are the battery terminals. Care should always be taken to prevent any metal object from coming into contact with the terminals and shorting the batteries.

To re-insert the battery pack, first, attach the connecting wires to the terminals of the battery pack. (Do not force, it will fit easily when properly oriented.) Then, place the pack into the compartment so that the small step on the end of the pack fits under the edge of the calculator bottom. A small amount of pressure on the battery pack will snap it properly into position. Again, it should fit in easily.

Spare and replacement battery packs can be purchased directly from a Texas Instruments Consumer Service Facility as listed on the back cover.

AC ADAPTER/CHARGER

Battery pack recharge or direct operation from standard voltage outlets is easily accomplished with the AC Adapter/Charger model AC9131 included with the Business Analyst. The calculator cannot be overcharged; it can be operated indefinitely with the adapter/charger connected.

BATTERY OPERATION

Recharge the battery pack when the display flashes erratically or fades out.

The "fast-charge" nickel-cadmium battery pack BP-5 furnished with the calculator was charged at the factory before shipping. However, due to shelf-life discharging, it may require charging before initial operation.

With the battery pack properly installed, charging is accomplished by plugging the AC Adapter/Charger AC9131 into a convenient 115 volt/60 Hz electrical outlet and plugging the attached cord into the battery pack socket. The battery can be recharged while inside or outside of the calculator. A full charge will take approximately 4 hours with the calculator off, 12 hours if the calculator is in use.

If the calculator is left on for an extended period of time after the battery becomes discharged, the battery may be driven into deep discharge. This condition is indicated by failure of the calculator to operate after being recharged for a few minutes. The battery can usually be restored to operating condition by charging the calculator overnight. Repeated deep discharging will permanently damage battery.

IN CASE OF DIFFICULTY

1. Check to be sure the battery pack is properly connected to the calculator and that the adapter/charger is connected to a live electrical outlet.

CAUTION: Use of other than the AC9131 Adapter/Charger may apply improper voltage to your calculator and will cause damage.

2. Press [OFF], then the [ON/C] key. This should reset the calculator and produce a single digit in display.
3. If display fails to light on battery operation, recharge battery. The calculator should operate properly after several minutes of recharging.
4. If the battery has completely discharged, charge the battery overnight.
5. Review operating instructions to be certain calculations are performed correctly.

If none of the above procedures corrects the difficulty, return the **calculator and charger** PREPAID and INSURED to the applicable SERVICE FACILITY listed on the back cover.

NOTE: The P.O. box number listed for the Texas Service Facility is for United States parcel post shipments only. If you desire to use another carrier, please call the Consumer Relations Department for the proper shipping address.

For your protection, the calculator must be sent insured; Texas Instruments cannot assume any responsibility for loss of or damage to uninsured shipments. **A copy of the sales receipt or other proof of purchase date MUST be enclosed with the calculator to establish the warranty status of the unit (please do not send the original document).** If proof of purchase date is not enclosed, service rates in effect at time of return will be charged. Please include information on the difficulty experienced with the calculator, as well as return address information including name, address, city, state, and zip code. The shipment should be carefully packaged and adequately protected against shock and rough handling.

CALCULATOR EXCHANGE CENTERS

If your calculator requires service, instead of returning the unit to a service facility for repair, you may elect to exchange the calculator for a factory-rebuilt calculator of the SAME MODEL at one of the exchange centers which have been established across the United States. Please call the Consumer Relations Department for further details and the location of the nearest exchange center.

IF YOU HAVE QUESTIONS OR NEED ASSISTANCE

If you have questions or need assistance with your calculator, write the Consumer Relations Department at:

Texas Instruments Incorporated
P. O. Box 22283
Dallas, Texas 75222

or call Consumer Relations at 800-~~527-4980~~ 858-1802 (toll-free within all contiguous United States except Texas) or 800-492-4298 (toll-free within Texas). If outside contiguous United States call 214-238-5461. (We regret that we cannot accept collect calls at this number.)

For repair-related inquiries only, you may also call our Service Facility toll-free at 800-858-1802 (800-692-1353 within Texas).

ONE-YEAR LIMITED WARRANTY

WARRANTEE

This Texas Instruments electronic calculator warranty extends to the original purchaser of the calculator.

WARRANTY DURATION

This Texas Instruments electronic calculator is warranted to the original purchaser for a period of one (1) year from the original purchase date.

WARRANTY COVERAGE

This Texas Instruments electronic calculator is warranted against defective materials or workmanship. **THIS WARRANTY IS VOID IF: (i) THE CALCULATOR HAS BEEN DAMAGED BY ACCIDENT OR UNREASONABLE USE, NEGLECT, IMPROPER SERVICE OR OTHER CAUSES NOT ARISING OUT OF DEFECTS IN MATERIAL OR WORKMANSHIP, (ii) THE SERIAL NUMBER HAS BEEN ALTERED OR DEFACED.**

WARRANTY PERFORMANCE

During the above one (1) year warranty period your calculator will either be repaired or replaced with a reconditioned model of an equivalent quality (at TI's option) when the calculator is returned, postage prepaid and insured, to a Texas Instruments Service facility listed below. In the event of replacement with a reconditioned model, the replacement unit will continue the warranty of the original calculator or 90 days, whichever is longer. Other than the postage and insurance requirement, no charge will be made for such repair, adjustment, and/or replacement.

WARRANTY DISCLAIMERS

ANY IMPLIED WARRANTIES ARISING OUT OF THIS SALE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE ABOVE ONE (1) YEAR PERIOD. TEXAS INSTRUMENTS SHALL NOT BE LIABLE FOR LOSS OF USE OF THE CALCULATOR OR OTHER INCIDENTAL OR CONSEQUENTIAL COSTS, EXPENSES, OR DAMAGES INCURRED BY THE PURCHASER.

Some states do not allow the exclusion or limitation of implied warranties or consequential damages, so the above limitations or exclusions may not apply to you.

LEGAL REMEDIES

This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

TEXAS INSTRUMENTS CONSUMER SERVICE FACILITIES

Texas Instruments Service Facility
P.O. Box 2500
Lubbock, Texas 79408

Texas Instruments Service Facility
41 Shelley Road
Richmond Hill, Ontario, Canada

Consumers in California and Oregon may contact the following Texas Instruments offices for additional assistance or information:

Texas Instruments Consumer Service
78 Town and Country
Orange, California 92668
(714) 547-2556

Texas Instruments Consumer Service
10700 Southwest Beaverton Highway
Park Plaza West, Suite 111
Beaverton, Oregon 97005
(503) 643-6758

CONSUMER RELATIONS DEPARTMENT

If you have questions or need assistance with your calculator, write the Consumer Relations Department at: **Texas Instruments Incorporated, P.O. Box 22283, Dallas, Texas 75222.** Or, call Consumer Relations at 800-527-4980 (toll-free within all contiguous United States except Texas) or 800-492-4298 (toll-free within Texas). If outside contiguous United States call 214-238-5461. (We regret that we cannot accept collect calls at this number.)

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