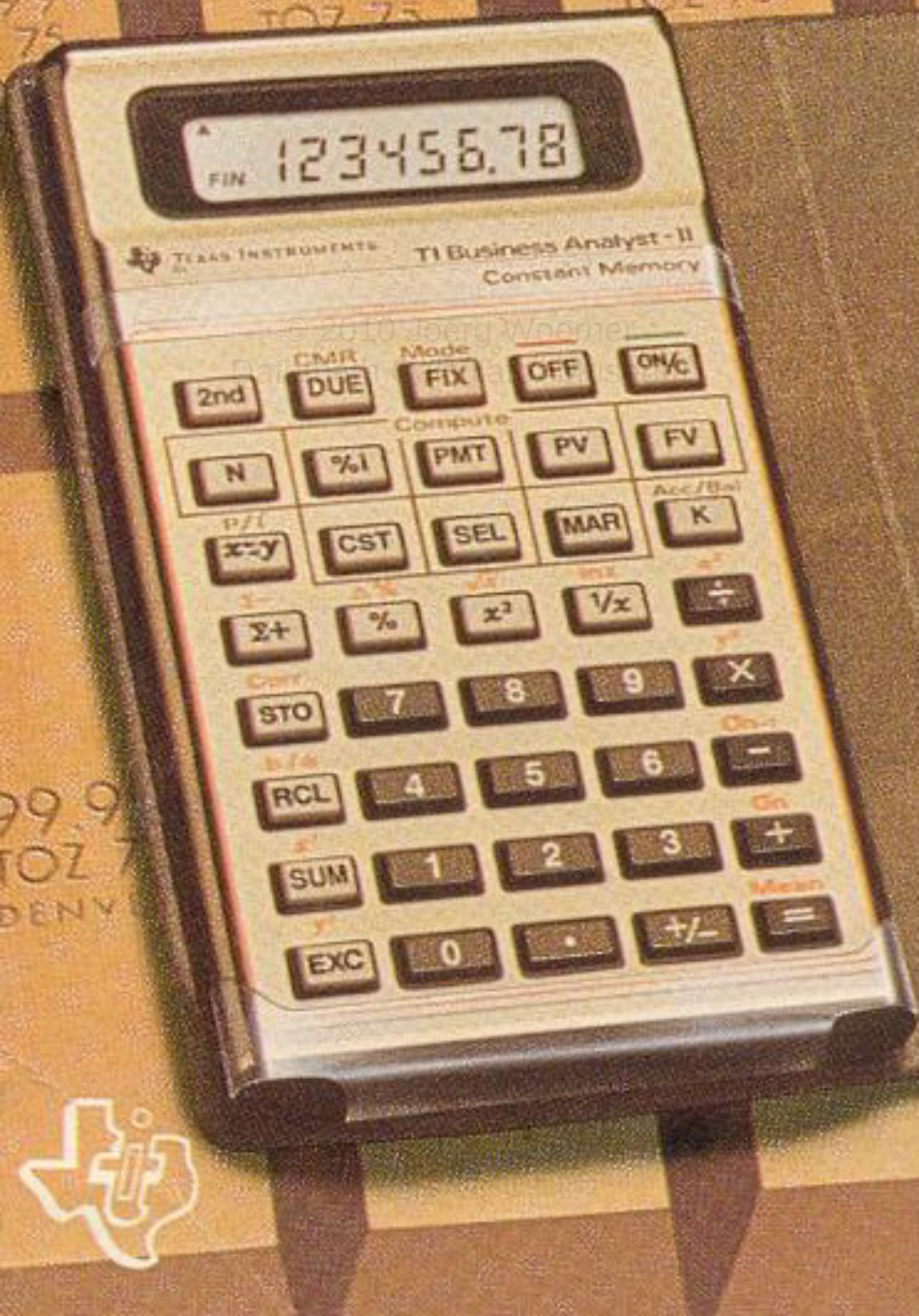
Texas Instruments
Slimline
Business Analyst-II™
financial calculator with statistics



A quick-reference Key Index is located on the inside back cover.

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IMPORTANT

Record the serial number from the bottom of the unit and purchase date in the space below. The serial number is identified by the words "SER. NO." on the bottom case. Always reference this information in any correspondence.

BA-II		
Model No.	**Serial No.**	**Purchase Date**

I. INTRODUCTION

Your slimline Business Analyst II calculator moves you into a new dimension of easy-to-use and powerful personal calculating.

The slim styling of your Business Analyst II calculator is matched only by its powerful financial, business and statistical calculating powers. The seemingly endless variations of annuity, percentage, compound interest, amortization, cost control and depreciation can be analyzed wherever you go. Add to this sophisticated statistical capabilities such as linear regression and trend line analysis and you have an extraordinarily powerful and useful tool. With the Business Analyst II calculator, you can say "goodbye" to the books of tables and charts that were once required in these sorts of calculations. Your answers will be more accurate too, up to 8 digits for most calculations. These features, combined with a flexible memory system, make the Business Analyst II calculator a worthwhile investment that will easily pay for itself in a very short time.

Features and Functions

- Easy to read Liquid Crystal Display (LCD).
- Constant Memory™ feature holds numbers in mode registers and user memory even while the calculator is turned off.
- APD™ Automatic Power Down provides for special power-saving features. The calculator turns itself off completely after typically 5 to 15 minutes of nonuse. You will never waste a set of batteries by forgetting to turn your calculator off or by having it turned on accidentally. This feature can increase the life of each set of batteries up to 50%.
- Battery indicator provides information on battery condition.
- Over 1000 hours of operation can normally be achieved from a fresh set of batteries.

• **Mathematical Functions** include:
Arithmetic (+, −, ×, ÷)
Square (x^2) and Square Root ($\sqrt{x}$)
Natural Logarithm (ln x) and Antilogarithm (e^x)
Universal Powers (y^x)
Reciprocal (1/x)
Percent (%)
Percent Change (Δ%)

• **Profit Margin Functions** for easy calculations involving cost, selling price and profit margin.

• **Financial Capabilities** solves problems involving:

Simple Interest	Annuities
Compound Interest	Add-On Interest
Rent Schedules	Amortization Schedules
Mortgages	Bond Yields
Savings Accounts	Bond Analyses (Discounting)
Installment Loans	Depreciation
Insurance Plans	

• **Statistical Functions** include:
Linear Regression routine for both immediate statistical analysis of data and projection of new points. Trend-Line Analysis is also available.

Mean, Standard Deviation and Correlation capabilities to analyze one or two-dimensional statistical data.

• **Accuracy** — The internal calculating capacity is 11 digits even though only 8 can be displayed. The 8-digit displayed number is generally rounded to within ± 1 in the 8th digit for all functions except where noted.

II. BASIC OPERATIONS

Turning the Calculator ON and OFF

Pressing [ON/C], the upper right most key on the keyboard, applies power and prepares the calculator for use. The first time you turn on the calculator, or after replacing the batteries, completely clear the calculator by pressing [ON/C], [ON/C], [2nd] [Mode], [FIX] [9] and [STO].

Power-on condition is indicated by the presence of a "▲" and a "0" in the display. The [OFF] key, of course, removes power from the calculator. When the calculator is turned off and then back on, the display and any uncompleted calculation are cleared.

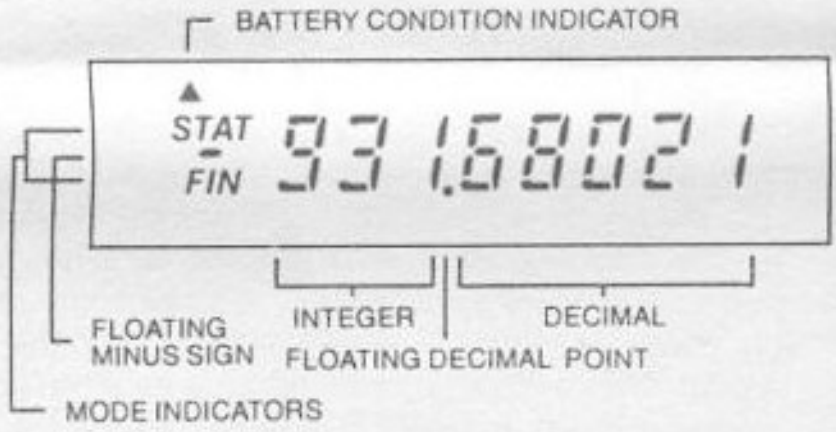
NOTICE: Depressing and holding down any key on the top row of your calculator will cause random segments to be displayed. These random segments do not affect normal operations of the calculator and will fade away or disappear when the key is released. **Also, the entire display, including the small "▲" battery condition indicator, is blanked during key entries and calculations.**

Constant Memory™ Feature

Even when your calculator is turned off, the Constant Memory feature saves the memory content, the decimal places selected, the last constant, the mode, and all data entered in the same mode prior to turning the calculator off.

IMPORTANT: The Constant Memory feature is not maintained if the batteries are discharged or removed. Also, normal clearing functions are in effect when the calculator is turned back on. For example, pressing [ON/C] twice will clear the constant or pressing [2nd] [Mode] will clear all data entered in the previous mode.

Display Indicators



NOTE: Eight digits may be entered into the display. Any digit keys pressed after the eighth are ignored.

Battery Condition Indicator. The small "▲" in the upper left-hand portion of the display indicates a "good battery" condition. When "▲" becomes very dim or disappears, it means that the batteries are becoming weak and should be replaced. However, the batteries may still operate the calculator for several more hours before it begins to operate erratically. See the *Service Information* Appendix for battery replacement instructions.

Mode Indicators. "STAT" indicates statistical mode. "FIN" indicates financial mode. The absence of both "STAT" and "FIN" indicates profit-margin mode.

Floating Minus Sign. Any negative number is displayed with a minus sign immediately to the left of the number just as negative numbers are normally written.

APD™ Automatic Power Down

If no keys are pressed for a period of about 5 to 15 minutes, the APD feature will cause your calculator to automatically turn off. The Constant Memory feature functions in the same way as when [OFF] is pressed.

If the APD feature is not desired, it may be cancelled by pressing any keys in the second, fourth and fifth columns simultaneously (such as [0], [+/-] and [=]). The cancellation remains in effect until the calculator is turned off with [OFF].

Dual Function Keys

Most of your calculator's keys have dual functions. The first function is printed right on the key, and its second function is printed above that key. To perform a function shown on a key, simply press the desired key. To use the second function of a key, press [2nd] in the upper left corner of your keyboard, then press the key immediately below the desired second function. For example, to find the square of a number, simply press [x^2]. To find the square root ($\sqrt{x}$) of a number, press [2nd] and then [x^2]. In this book we'll indicate operations involving second functions with black key symbols like this: [2nd] [$\sqrt{}$].

Note that when [2nd] is pressed twice in succession, the calculator will perform the first function operation. When [2nd] is pressed before a digit key, the [2nd] operation is ignored and the digit is entered.

Mode Selection

Your calculator operates in three different modes: profit margin, financial or statistical. The calculator rotates through the modes by repeated use of [2nd] [Mode]. Remember that the profit margin mode is indicated by the absence of both the "STAT" and "FIN" indicators in the display.

The important thing to remember about modes is that the data entered and the unique keys used in one mode CANNOT be used in another mode. If the mode is changed, all previously entered data and intermediate results in the mode registers are cleared. However, the memory content is not affected. Also, pressing a unique key of one mode while the calculator is in another mode will cause "Error" to be displayed.

The mode registers are internal registers used by the calculator when you use key functions unique to the profit margin, financial or statistical modes. Details of the unique functions in each mode are described in separate sections of this manual.

Data Entry

For maximum versatility, your calculator operates with a floating decimal point. When entering numbers, the decimal is assumed to the right of the mantissa until [.] is pressed. Then the fractional part of the number is entered and the decimal point floats with the entered number. A maximum of 7 digits may be entered to the right of the decimal.

[0] **through** [9] **Digit Keys** — Enter numbers 0 through 9.

[.] **Decimal Point Key** — Enters a decimal point. A decimal point is not displayed for integer numbers.

[+/−] **Change Sign Key** — When pressed after number entry or a calculation, changes the sign of the displayed number.

[x:y] **x Exchange y Key** — Exchanges the displayed number with the content of the y register, and is used to exchange divisor and dividend in division problems and for data entry and result display in certain financial and statistical calculations. This will be discussed in more detail in later sections.

Fixed Decimal Display

[FIX] **Fixed Decimal Key** — Used to set a fixed number of digits to the right of the decimal point. Press [FIX], then a digit key ([0] through [7]) corresponding to the number of digits you want to see to the right of the decimal point. For example, [FIX] [2] will cause all results to show two digits to the right of the decimal point — a convenient display for dollars and cents. You can return to a floating decimal display at any time by pressing [FIX] [8] or [FIX] [9].

Using the fixed decimal display does not affect the accuracy of your calculations since the calculator uses all internal digits (up to 11) for subsequent calculations. For example, if [FIX] [2] has been selected and the actual result to a problem is 6.158, the calculator will display the rounded value of 6.16 as the result. However, the calculator internally carries the actual 6.158 value to the subsequent calculation or memory (if used).

Remember that the fixed decimal selection is retained by the Constant Memory feature. A fixed decimal selection remains in effect even when the calculator is turned off, and will stay in effect until you change it.

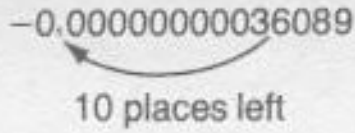
Extended Display Range (Scientific Notation)

The normal display range of your calculator is between 0.0000001 and 99999999 (positive or negative). If a result is smaller or larger than the normal display range, the calculator automatically switches the display to scientific notation. In scientific notation, the display value splits into two fields, the mantissa and the power-of-ten exponent. For example, the result of the calculation:

-0.0036089 [÷] 10000000 [=]

is expressed as -3.6089×10^{-10} by your calculator. The calculator display shows:

In scientific notation, a positive exponent indicates how many places the decimal point should be shifted to the right. If the exponent is negative, the decimal should be moved to the left. In the last example, you need to move the decimal point 10 places to the left to obtain the result in normal form:



Clearing Your Calculator

[ON/C] **Clear Entry/Clear Key** — Removes an incorrect number entry from the display when pressed before any function or operation key is pressed. When pressed after an operation or function key (including [=]), this key clears the display, the constant and any pending calculation. Pressing [ON/C] twice always clears the display, the constant and any pending operation. The memory and mode registers are not affected by this key.

[ON/C] [STO] **Clear Memory Key sequence** — Clears the memory by storing a zero.

[2nd] [CMR] **Clear Mode Registers Key Sequence** — Clears all data stored in the mode registers. Using [2nd] [Mode] to change modes also clears the mode registers.

Clear "Error" Condition. In general, pressing [ON/C] when "Error" is displayed clears the display and any pending arithmetic calculation. If the "Error" condition resulted from a user memory overflow or underflow, the user memory is also cleared. If the "Error" condition resulted from any mode register overflow or underflow, or from any computational error pertaining to the statistical or financial modes (Error Conditions 12 through 19 below), the mode registers are cleared. All other Error Conditions (2 through 11 below) which result from illegal key sequences (8 through 10 below), computation, or data entry can be cleared without affecting the user memory or mode registers.

Error Conditions

The display shows "Error" when an overflow or underflow occurs, or when an improper operation or key sequence is attempted. When the "Error" condition occurrs, no entry from the keyboard (except [OFF]) will be accepted until [ON/C] is pressed. This clears the "Error" condition and any pending calculation. You must now return to the first of your problem and start again or continue from the end of the last valid mode operation if you were doing mode calculations and were interrupted by one of Error Conditions 2 through 11.

"Error" appears for the following reasons:

1. Calculation resulting in number outside the range of the calculator (1.0×10^{-99} to 9.9999×10^{99}) in the display, user memory, or mode registers.
2. Dividing a number by zero.
3. Calculating [1/x] or [2nd] [ln x] of zero.
4. Calculating [2nd] [ln x], a power, or a root of a negative number.
5. Calculating $\Delta\%$ with x_2 equal to zero.
6. Multiplying a number greater than 1×10^{99} by another number may cause an error condition.
7. Setting up an add-on percent constant with x_1 (first entry) equal to zero.

8. Following the [FIX] key by a key other than the numbers [0] — [9] or [ON/C].
9. Following the [DUE] key by a key other than [N], [%i], [PMT], [PV], [FV], [2nd] or [ON/C].
10. Pressing a function key unique to one mode while in another mode. (For example, pressing [%i] when in the statistical "STAT" mode.)
11. Calculating profit margin with the selling price equal to zero.

The following "Error" conditions will cause the mode registers to be cleared:

12. Attempting to calculate financial unknowns before enough known variables have been entered or when no valid solution exists.
13. Entering statistical data points where the square of a data point, or the sum of the squares of a series of data points, exceeds the upper or lower limit of the calculator.
14. Calculating any statistical function with no data points.
15. Calculating standard deviation (n − 1 weighting) with only one data point.
16. Attempting linear regression calculations with less than two data points.
17. Attempting to calculate the y-intercept/slope or y' for a vertical line in linear regression.
18. Attempting to calculate x' for a horizontal line in linear regression.
19. Turning the calculator off while a statistical or financial mode calculation is in progress. The "Error" will appear when the calculator is turned back on.

III. MATHEMATICAL FUNCTIONS

All mathematical functions on your calculator can be performed in any of the three modes. However, the constant operation has some limitations in the financial and statistical modes which are described in the *Calculations with a Constant* section.

Arithmetic Operations

[+] **Add Key** — Instructs the calculator to add the next entered quantity to the displayed number.

[−] **Subtract Key** — Instructs the calculator to subtract the next entered quantity from the displayed number.

[×] **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.

[÷] **Divide Key** — Instructs the calculator to divide the displayed number by the next entered quantity.

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

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 Δ% (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

Press	Display
ON/C	0
37 +	37
16.9 −	53.9
11 =	42.9

Example: 4 × (−6.6) − (−17.1) = −9.3

Press	Display
4 ×	4
6.6 +/− −	−26.4
17.1 +/− =	− 9.3

Entry errors can be corrected very easily on your calculator by immediately pressing the correct arithmetic function, y^x or Δ% key, or by using the clear-entry function.

Example: 6 ✗ × 7 ✗ + ✗3 = 45

Press	Display/Comments
6 + ×	6 + changed to ×.
7 − +	42 6 × 7 completed and − changed to +.
4 ON/C	0 4 entry cleared.
3 =	45 Answer.

After a result is obtained in one calculation, it may be used as the first number in a second calculation.

Example: 184 + 254 = 438, then 438 ÷ 365 = 1.2

Press	Display
184 + 254 =	438
÷ 365 =	1.2

If the second part of the last example is changed to 365 ÷ 438, the x:y key can be used to reverse the numerator and denominator.

Press	Display
184 + 254 =	438
÷ 365 x:y =	0.8333333

Reciprocal

[1/x] The Reciprocal Key — Divides the displayed number (x) into 1. (x cannot be zero.)

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

Press	Display
3.2 [1/x]	0.3125

Powers and Roots

[x²] The Square Key — Calculates the square of the displayed number (x).

Example: $(4.235)^2 = 17.935225$

Press	Display
4.235 [x²]	17.935225

[2nd] [√] Square Root Key Sequence — Calculates the square root of the displayed number (x). (x cannot be negative.)

Example: $\sqrt{6.25} = 2.5$

Press	Display
6.25 [2nd] [√]	2.5

[2nd] [y^x] Universal Powers and roots — Used to compute y^x or $\sqrt[x]{y}$ as follows.

To raise y to the xth power (y^x) simply:

- Enter the number, y
- Press [2nd] [y^x]
- Enter the power, x
- Press [=] (or any arithmetic, y^x or Δ% key).

To take the "xth" root of any number y ($\sqrt[x]{y}$):

- Enter the number, y
- Press [2nd] [y^x]
- Enter the root, x
- Press [1/x]
- Press [=] (or any arithmetic, y^x or Δ% key).

Note that in either case the variable y should be a positive number and that attempting to take the 0th root of a number results in an error condition.

Here are a few examples illustrating the use of these key sequences:

Example: $2^3 + 6 = 14$

Press	Display
2 [2nd] [y^x] 3 [+] * 6 [=]	14

*Be certain to allow a moment for your calculator to complete calculations involving y^x before making the next entry.

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

Press	Display
1460 [2nd] [y^x] 3.12 [1/x] [=]	10.332744

Natural Logarithms and Antilogarithms

[2nd] [ln x] **Natural Logarithm Key Sequence** — Calculates the natural logarithm (base e) of the displayed number (x). (x cannot be negative or zero).

Example: ln 1.2 = 0.1823216

Press	Display
1.2 [2nd] [ln x]	0.1823216

[2nd] [e^x] **Natural Antilogarithm Key Sequence** — Calculates the natural antilogarithm (raises e to the xth power) of the displayed number (x).

Example: $e^{1.25} = 3.490343$

Press	Display
1.25 [2nd] [e^x]	3.490343

Percent and Percent Change

[%] **Percent Key** — Converts a displayed percent value to its decimal equivalent (percent ÷ 100 = decimal percent). For example if you enter 43.9 and press [%], 0.439 is displayed.

The real power of the [%] key is turned on for you when you use it in combination with an operation key. This allows "add-on" and "discount" as well as straight and inverted percentage problems to be solved. The rules for using the [%] key in these situations are tabulated below. Simply press the brief sequences shown to perform the desired operation on the number in the display.

- [+] n [%] [=] adds n% to the original number displayed.
- [−] n [%] [=] subtracts n% from the original number displayed.
- [×] n [%] [=] multiplies the original number in the display by n%.
- [÷] n [%] [=] divides the original number in the display by n%.

When the [%] key is used with the [+] and [−] operations add-on and discount percentages are easily calculated.

Add-on Example: How much will you pay for an item costing $15 when a 5% sales tax is added?

Press	Display/Comments
15 [+] 5 [%]	0.75 Amount of tax.
[=]	15.75 Total amount you'll pay.

Discount Example: The retail price of an item is $54.25. What is the sale price if it's to be discounted 15%?

Press	Display/Comments
54.25 [−] 15 [%]	8.1375 Amount of discount.
[=]	46.1125 Sale price is $46.11.

When the [%] key is used with the [×] and [÷] key, "straight" and "inverted" percentage problems often encountered in business can be easily solved.

Straight Percentage 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?

Press	Display/Comments
12000 [X]	12000
40 [%]	0.4 Decimal equivalent of 40%.
[=]	4800 Number of watches on the way.

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

Press	Display/Comments
30 [÷] 15 [%]	0.15 Decimal equivalent of 15%.
[=]	200 Total deliveries needed.

x_1 [2nd] [Δ%] x_2 [=] **Percent Change Key Sequence** — Calculates the percentage of change between the two values x_1 and x_2, where:

$$\Delta\% = \frac{x_1 - x_2}{x_2} \times 100$$

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

Press	Display/Comments
906.25 [2nd] [Δ%]	906.25
814.75 [=]	11.230439 Percent increase in cost.

The cost has increased over 11%.

Calculations with a Constant

[K] **Constant Key** — Used to store a number and an operation (+, −, ×, ÷, Δ% or %) for use in repetitive calculations.

The constant operation and number can be established as part of a normal calculation.

Pressing [K] after a math operation key sets the repetitive operation, and the operand in the display when [=] is pressed is stored as the constant number. (Pressing another operation key or [ON/C] after [K] changes or clears the constant.) Now you just enter a new number and press [=]. The calculator performs the repetitive operation with your new number and the constant number and gives you the answer.

The following listing shows how to input the constant for each math operation where M is the constant number:

[+] [K] M [=] adds M to each subsequent entry.

[−] [K] M [=] subtracts M from each subsequent entry.

[×] [K] M [=] multiplies each subsequent entry by M.

[÷] [K] M [=] divides each subsequent entry by M.

[2nd] [Δ%] [K] M [=] calculates the percentage change (Δ%) between each subsequent entry x_1 and M, where:

$$\Delta\% = \frac{x_1 - M}{M} \times 100$$

(First entry) [+] [K] M [%] [=] adds M% of the subsequent entry to the entry.

(First entry) [−] [K] M [%] [=] subtracts M% of the subsequent entry from the entry.

The constant function will also be enabled if you press [K] after entering M. The only restriction is that [K] must be pressed after the math operation

and before [=]. The constant operation and number are also maintained by the Constant Memory feature, but be careful to press [ON/C] only one time when turning the calculator on.

IMPORTANT: The constant function is functional in all modes, however, there are some limitations. The constant is cleared in the financial mode when any financial computation is performed. The constant is also cleared in the statistical mode when any variable is entered. Since the constant number is stored in the y register, using [x:y] can cause erroneous results.

Note in the following examples that the constant can be entered as part of a normal problem sequence.

Example: Multiply 2, 4, 6 and 7 by 3.1416.

Press	Display/Comments	
2 [X] [K]	2	
3.1416 [=]	6.2832	First problem solved and "× 3.1416" is stored.
4 [=]	12.5664	Second problem with constant.
6 [=]	18.8496	Third problem.
7 [=]	21.9912	Fourth problem.

Example: Add 5% tax to each of the following prices with the answer rounded to the nearest penny: $5.95, $19.98, $54.50 and $129.75.

Press	Display/Comments	
[ON/C] [FIX] 2	0.00	Fix decimal at 2 places.
5.95 [+] [K]	5.95	
5 [%] [=]	6.25	$5.95 + 5%
19.98 [=]	20.98	$19.98 + 5%
54.50 [=]	57.23	$54.50 + 5%
129.75 [=]	136.24	$129.75 + 5%
[FIX] 9	136.2375	All digits of last problem.

IV. MEMORY FUNCTIONS

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. Also, the memory content can only be changed with the STO, SUM or EXC keys and is NOT affected by ON/C, 2nd Mode, 2nd CMR or OFF.

Memory Store and Recall

STO **Store Key** — Stores the displayed quantity in the memory without removing it from the display. Any previously stored value is discarded.

RCL **Recall Key** — Recalls a copy of the quantity in the memory to the display.

Example: Store and recall 3.012

Press	Display
3.012 STO	3.012
OFF	(blank)
ON/C RCL	3.012

Sum to Memory

SUM **Sum to Memory Key** — Algebraically sums the displayed number to the memory content. The displayed number and calculation in progress are not affected.

NOTE: To ensure that the previous memory content does not affect your calculation, always use STO to store the first quantity of a new problem or use ON/C STO to clear memory.

Example:

$$173 + 16 = 189.$$
$$28.3 \times 7 = 198.1$$
$$312 - 42 + 7.8 = 277.8$$
$$\text{Total} \quad 664.9$$

Press	Display	Memory
173 + 16 = STO	189	189
28.3 X 7 = SUM	198.1	387.1
312 − 42 + 7.8 = SUM	277.8	664.9
RCL	664.9	664.9

Memory/Display Exchange

[EXC] **Exchange Key** — Exchanges the memory content with the displayed number. The displayed number is stored and the previous memory content is displayed.

The exchange key is very useful when you want to compare the results of two problems without writing one of them down.

Example: A grocery sells canned corn in two sizes. The 482-gram can sells for 39 cents and a 248-gram can sells for 24 cents. Compute the price per gram for each can and use memory exchange to compare the results. Then compute the amount saved if you buy the most economical size.

Press	Display/Comments	
.39 [÷] 482 [=] [STO]	0.0008091	Store first value per gram.
.24 [÷] 248 [=]	0.0009677	Second value per gram.
[EXC]	0.0008091	Large can more economical.
[−] [RCL] [=]	−0.0001586	Difference per gram.
[×] 482 [=]	−0.0764516	Save over 7 cents on large can.

V. PROFIT MARGIN FUNCTIONS

The profit margin mode of your calculator provides for easy handling of cost, selling price and profit margin problems. The profit margin mode is selected by repeatedly pressing 2nd Mode until neither "STAT" nor "FIN" appear in the display. Any data entered with the CST, SEL or MAR keys is cleared if the mode is changed or if the mode registers are cleared with 2nd CMR.

CST, SEL, MAR **Cost, Sell, Margin Keys** — Used to enter two of the three variables (cost, sell or margin). The third variable is computed by preceding the key for the third variable with 2nd. For example, enter cost and press CST, enter profit margin in percent and press MAR, then press 2nd SEL to compute selling price.

Calculations are based on

$$\text{Profit Margin (\%)} = \frac{\text{Sell} - \text{Cost}}{\text{Sell}} \times 100$$

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?

Press	Display/Comments
2nd Mode	Repeat until "FIN" or "STAT" do NOT show in display.
28 MAR	28 Enter profit margin %.
4.5 CST	4.5 Enter 1st book cost.
2nd SEL	6.25 1st book selling price.
9.9 CST 2nd SEL	13.75 2nd book selling price.
15.3 CST 2nd SEL	21.25 3rd book selling price.

The mode and the data in the mode registers is preserved by the Constant Memory feature until changed or cleared.

VI. FINANCIAL FUNCTIONS

All financial calculations in this section involving the keys: [N], [%i], [PMT], [PV], [FV], [DUE], [2nd] [P/I] and [2nd] [AMORT], require the calculator to be in the financial mode. The financial mode is accessed by pressing the sequence [2nd] [Mode] until "FIN" appears on the left side of the display. Remember that [2nd] [CMR] or [2nd] [Mode] clears all mode registers and should only be used when you are finished with the data entered for financial calculations.

Financial Key Tour

Since the financial keys are functionally related, the following tour of the financial keys provides a preview of the calculators capability and a quick reference for future use.

[N], [%i], [PV], [FV] **Compound Interest Keys** — These keys are used to enter values for number of periods, periodic interest rate, present value and future value, respectively. To enter any of these values, simply enter the number in the display and press the appropriate key. For example, a period of five years can be entered by pressing [5] and then pressing [N]. 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 value. The calculator recognizes the difference between a compound interest problem and an annuity problem by the fact that the payment is zero. To ensure proper operation when working compound interest problems, be sure to begin the problem with [2nd] [CMR] (clear mode registers) or use the sequence [ON/C] [PMT] to make the payment zero. If you have just pressed [2nd] [Mode], this is not necessary, since [2nd] [Mode] automatically clears the mode registers.

[PMT] **Payment Key** — Used with the other financial keys, [N], [%i], [PV], and [FV], to enter or calculate the payments for an annuity.

DUE **Annuity Due Key** — Used as a prefix to N, %i, PV, FV, or PMT when computing the unknown value in an annuity-due problem.

The following two key descriptions cover special amortization functions. The information that must be in place before using these functions is the percent interest %i, the payment amount PMT, the present value PV or loan amount, and the number of periods N. **Enter three variables, then compute the fourth before using the following functions.**

2nd P/I **Principal and Interest Key Sequence** — For any payment number entered in the display, this key sequence determines the principal amount of that payment for a fully amortized, direct-reduction loan. Then pressing x:y displays the amount of interest paid by that payment.

2nd AccBal **Accumulated Interest and Loan Balance Key Sequence** — For any payment number entered in the display, this key sequence determines the accumulated interest paid from the first payment through the payment specified (inclusive). Then pressing x:y displays the balance remaining on the principal of the loan after the payment specified.

To find the accumulated interest paid after the Mth through the Nth payments (inclusive):

- Enter Nth payment number, press 2nd AccBal, wait for result, then STO.
- Enter Mth payment number, press 2nd AccBal, wait for result, then +/- SUM.
- Press RCL to display accumulated interest.

IMPORTANT — The calculator blanks the display while performing calculations. Keyboard entries are ignored when the display is blanked even though symbols or digits may appear while some keys are pressed. The computation for %i may typically take 5 to 30 seconds. If unrealistic values are entered for

computation of %i, the calculating time may be minutes or even hours. If this occurs, press [OFF] then [ON/C] twice to go on to another calculation.

Compound Interest

The four variables involved in compound interest calculations are: the number of compound periods (N), the periodic interest rate (%i), the present value (PV) and the future value (FV). Once you have entered any three of these four variables into your calculator, you can determine the fourth by pressing [2nd], followed by the key representing the unknown fourth variable. For compound interest calculations, unlike annuity problems, payments are not involved. **Your calculator recognizes the difference between a compound interest problem and an annuity problem by the fact that the payment is zero.** To ensure proper operation when working compound interest problems, be sure to begin the problem by entering zero as payment or by clearing the mode registers with [2nd] [CMR]. If you have just pressed [2nd] [Mode] to get to the financial mode, the clearing operation is not necessary, since [2nd] [Mode] automatically clears the mode registers.

Example: $2000 is invested for 3 years at 12% compounded annually. What is the future value of the investment?

Press	Display/Comments		
[2nd] [Mode]			Repeat until "FIN" appears.
[2nd] [CMR]			
[ON/C] [FIX] 2	FIN	0.00	Clears registers & selects 2-place decimal.
2000 [PV]	FIN	2000.00	Enters present value.
3 [N]	FIN	3.00	Enters number of years.
12 [%i]	FIN	12.00	Enters rate of return.
[2nd] [FV]	FIN	2809.86	Future value.

Example: If the interest were compounded monthly (12%÷ 12= 1% monthly interest), what would the value be at the end of the same 3 years? If you did not change modes or clear the mode registers, you won't have to enter the $2000 present value for this example.

Press	Display/Comments		
12 ÷ 12 = %i	FIN	1.00	Computes and enters monthly interest rate.
3 X 12 = N	FIN	36.00	Computes and enters the number of months.
2nd FV	FIN	2861.54	Future value.

By compounding the earned interest more frequently, more money is made.

Notice that the interest rate per period must be adjusted to correspond to the time interval in which the compounding occurs, when handling any financial calculation.

Example: The house you bought for $37075 in 1972 was appraised at $52000 in 1977. What was the average annual appreciation rate?.

Press	Display/Comments		
ON/C 2nd CMR	FIN	0.00	Clears registers.
37075 PV	FIN	37075.00	Enters present value.
52000 FV	FIN	52000.00	Enters future value.
5 N	FIN	5.00	Enters number of years.
2nd %i	FIN	7.00	Computes annual appreciation.

The average annual appreciation in the value of your house is about 7%.

Example: You plan to travel to Europe in two years. How much do you need to invest today at 7.5% annual interest compounded daily to have $3500 in two years? (In this example you know the future value, and are solving for the present value.)

Press	Display	Comments
ON/C 2nd CMR	FIN 0.00	Clears registers.
3500 FV	FIN 3500.00	Enters future value.
7.5 ÷ 365 = %i	FIN 0.02	Calculates and enters daily i (rounds to 2 places in the display).
365 X 2 = N	FIN 730.00	Calculates and enters the number of compounding periods.
2nd PV	FIN 3012.52	Computes the present value.

You need to invest $3012.52 today to have $3500 in 2 years.

Annuities

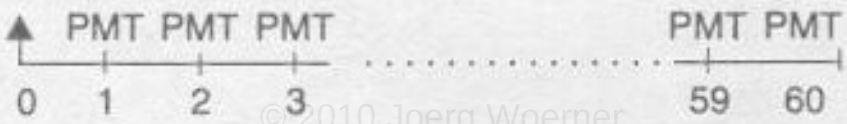
An annuity is any series of equal payments made at regular intervals of time. The time intervals between payments are called payment periods. An annuity is a compound interest situation with periodic payments. This definition covers a wide variety of financial situations such as the regular payments you make for rent or an apartment or mortgage for a house, installments on various loans and premiums on insurance policies. There are basically two types of annuities, ordinary annuities and annuities due, differentiated by payments being made at the beginning or end of each payment period. The variables involved in annuity calculations are: the present value of a debt or an account (PV), the payment per payment period (PMT), the interest rate for the payment period (%i), the number of payments (N), and the future value of a debt or an account (FV). Your calculator is capable of directly solving annuity problems involving either a present value or a future value, but not both. You enter three of the variables and your calculator will solve for the fourth unknown variable automatically. Your calculator is also capable of determining whether it is a present value or a future value annuity problem depending on which of those two keys was pressed last. For example, if the future value variable is the only or the last variable entered of PV and FV, your calculator will ignore the content in the present value data register and proceed to solve the problem as a future value annuity problem.

Ordinary Annuities

An ordinary annuity, sometimes called payments in arrears, involves payments made at the end of each payment period. Most loans fall into this category. 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. Problem situations such as this are often visualized on a time-line diagram of the sort shown below. In these diagrams, a horizontal time line is used to illustrate the time period of a given financial problem or situation, with all appropriate variables indicated.

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

PV= $7500 Payments (PMT= ?)



Months (N = 60) Monthly interest rate $\left(i = \frac{9\%}{12} \right)$

Press	Display/Comments)	
2nd Mode		Repeat until "FIN" appears.
ON/C 2nd CMR		
FIX 2	FIN 0.00	Clears and sets fixed-2 display.
7500 PV	FIN 7500.00	Enter present value.
9 ÷ 12 = %i	FIN 0.75	Computes and enters monthly interest.
60 N	FIN 60.00	Enters numbers in months.
2nd PMT	FIN 155.69	

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 the monthly payments are $300?

Press		Display	Comments
ON/C 2nd CMR	FIN	0.00	Clears mode registers.
32000 PV	FIN	32000.00	Enters loan amount.
8.75 ÷ 12 = %i	FIN	0.73	Calculates and enters monthly interest.
400 PMT	FIN	400.00	Enters payment amount.
2nd N	FIN	120.50	

You'll have to make $400 payments for over 120 months. To find how much you'll owe after the 120th payment:

120	FIN	120	Enters the number of complete payment periods.
2nd AccInt x:y	FIN	199.50	The remaining balance.

You'll pay the loan off completely if your 120th payment is $400.00 + $199.50 or $599.50. If $599.50 is too large a payment, you can recalculate for 121 payments.

121 2nd AccInt x:y FIN −199.04

In this case the 121st payment would be $400.00 −$199.04 = $200.96.

Now find out how long it will take to pay off the loan if you make $300 payments.

300 PMT	FIN	300.00	
2nd N	FIN	207.02	

You'll have to make $300 payments for 207 months and then you'll still owe some on the loan. To find out how much you'll still owe after the 207th payment:

207 2nd AccInt x:y FIN 7.35

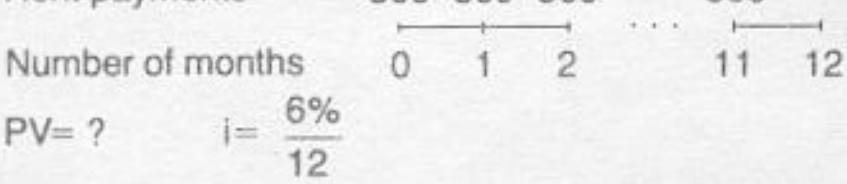
Your 207th payment will be $300+ $7.35 or $307.35 in order to retire the entire loan amount.

Notice that only the $300 payment needed to be reentered for the second part of the problem solution. The previously entered values were retained.

Annuities Due

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. When making calculations involving annuities due, press [DUE], followed by the key representing the fourth unknown variable, instead of [2nd] to compute the result.

Example: Present value for annuity due. You can lease a feed store for $350 per month with the lease payment due at the first of each month. What is the present value of the equivalent yearly cost of the lease, figuring that you could earn 6% annual interest compounded monthly if you put the payments into a bank?



PV= ? $i = \frac{6\%}{12}$

Press	Display/Comments	
2nd Mode		Repeat until "FIN" appears.
ON/C 2nd CMR		Clears Mode
FIX 2	FIN 0.00	registers & selects 2-place decimal.
350 PMT	FIN 350.00	Enters payment amount.
12 N	FIN 12.00	Enters number of periods.
6 ÷ 12 = %i	FIN 0.50	Computes and enters monthly interest.
DUE PV	FIN 4086.96	The present value of equivalent yearly lease (if your money can earn 6% annual interest compounded monthly.)

Example: Future Value for Annuity Due (Savings). You plan to deposit $20 per month beginning this month in a savings account which pays 5% interest compounded monthly. If you make no withdrawals, what will the balance be after one year?

Press	Display/Comments	
ON/C 2nd CMR	FIN 0.00	Clears mode registers.
20 PMT	FIN 20.00	Enters payment (deposit).
12 N	FIN 12.00	Enters periods.
5 ÷ 12 = %i	FIN 0.42	Calculates and enters monthly interest.
DUE FV	FIN 246.60	Future value for annuity due.

Example: Payment for Annuity Due. You are the beneficiary of a $10,000 insurance policy. You elect to receive this amount in 60 equal monthly payments with the first to be made immediately. What will the amount of each payment be if 5% interest compounded monthly is paid on the proceeds of the policy?

Press		Display/Comments	
ON/C 2nd CMR	FIN	0.00	Clears mode registers.
60 N	FIN	60.00	Enters number of payments.
5 ÷ 12 = %i	FIN	0.42	Calculates and enters monthly. interest rate.
10000 PV	FIN	10000.00	Enters present value.
DUE PMT	FIN	187.93	Monthly payments.

In a similar manner, the interest rate for an annuity due can be determined. Remember, if the interest is compounded monthly, you must multiply the results for % i by 12 to obtain the nominal yearly rate compounded monthly. Note that DUE %i utilizes an iterative process to obtain the interest rate. In some calculations this process can require several seconds to complete.

Amortization

A debt is termed amortized when all principal and interest have been repaid, usually by equal payments at regular intervals. The principal and interest key sequence and the accumulated interest and loan balance key sequence, discussed earlier in the *Financial Key Tour* section, allow you to solve amortization problems with great ease.

Example: You want to borrow $10,000 and repay it over a period of five years with the payments due at the end of each year. The yearly interest rate is 8%. Calculate your payment amount and determine the principal and interest paid by each payment for five years.

Press		Display/Comments
2nd Mode		Repeat until "FIN" appears.
ON/C 2nd CMR		Clears mode
FIX 2	FIN 0.00	registers & sets 2-place decimal.
10000 PV	FIN 10000.00	Enters loan amount.
8 %i	FIN 8.00	Enters interest rate.
5 N	FIN 5.00	Enters number of payments.
2nd PMT	FIN 2504.56	Computes payment.
1 2nd P/I	FIN 1704.56	Principal paid with first payment.
x:y	FIN 800.00	Interest paid with first payment.
2 2nd P/I	FIN 1840.93	Principal paid with second payment.
x:y	FIN 663.63	Interest paid with second payment.
3 2nd P/I	FIN 1988.20	Principal paid with third payment.
x:y	FIN 516.36	Interest paid with third payment.
4 2nd P/I	FIN 2147.26	Principal paid with fourth payment.
x:y	FIN 357.30	Interest paid with fourth payment.
5 2nd P/I	FIN 2319.04	Principal paid with fifth payment.
x:y	FIN 185.52	Interest paid with fifth payment.

Example: Continuing the above example, determine the accumulated interest between the first and third payments and the balance remaining after the third payment.

Press		Display/Comments	
3 2nd AccBal	FIN	1980.00	Accumulated interest for 3 years.
STO	FIN	1980.00	Store in memory.
x:y	FIN	4466.30	Balance at end of 3 years.
1 2nd AccBal	FIN	800.00	Accumulated interest for 1 year.
+/−	FIN	−800.00	Change sign.
SUM	FIN	−800.00	Subtract first year's interest.
RCL	FIN	1180.00	Interest accumulated between the first and third years.

The interest accumulated between the first and third years is $1180.00 and the balance remaining after the third payment is $4466.30. You can see that the interest is the sum of the second and third years' interest from the previous example detailing principal and interest for each year of the loan: $663.63 + 516.36 = $1179.99 (about $1180.00).

Remember that the calculator displays results rounded to the nearest cent when operating with 2-place decimal. Pressing FIX 9 will show that the displayed $1180.00 is actually $1179.9953 rounded to the nearest cent.

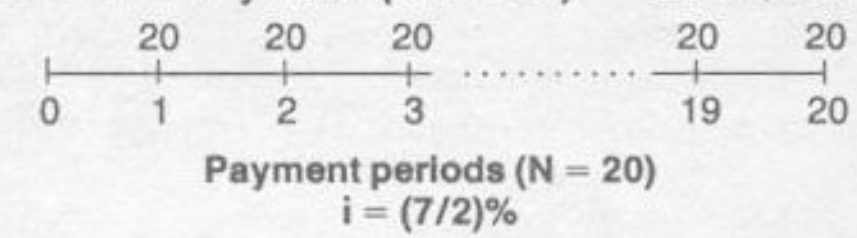
Bonds

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.



Press		Display	Comments
2nd Mode			Repeat until "FIN" appears.
ON/C 2nd CMR			Clears mode
FIX 2	FIN	0.00	registers & sets 2-place decimal.
10 ×	FIN	10.00	
2 = N	FIN	20.00	Enter number of semiannual periods.
7 ÷	FIN	7.00	
2 = %i	FIN	3.50	Enter semi-annual yield as %i.
1000 FV	FIN	1000.00	Redemption price.
2nd PV STO	FIN	502.57	Calculate present value of bond redemption value.
20 PMT	FIN	20.00	Enter semiannual payment.
2nd PV SUM	FIN	284.25	Value of coupon payments.
RCL	FIN	786.81	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 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.

Example: 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.

Press		Display	Comments
ON/C 2nd CMR	FIN	0.00	Clears mode registers.
10 ×	FIN	10.00	
2 = N	FIN	20.00	Enter number of semiannual periods.
9 ÷	FIN	9.00	
2 = %i	FIN	4.50	Enter semiannual yield as %i.
1000 FV	FIN	1000.00	Enter redemption price.
2nd PV STO	FIN	414.64	Discounted redemption price.
20 PMT	FIN	20.00	Enter semiannual coupon payment.
2nd PV SUM	FIN	260.16	PV of coupon payments.
RCL	FIN	674.80	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

Example: Try 8%.

Press		Display	Comments
ON/C PMT	FIN	0.00	Sets PMT = 0
8 ÷	FIN	8.00	
2 = %i	FIN	4.00	Enter semiannual yield.
2nd PV STO	FIN	456.39	Discounted redemption price.
20 PMT	FIN	20.00	Semiannual coupon payment.
2nd PV SUM	FIN	271.81	PV of coupon payments.
RCL	FIN	728.19	Total PV of bond at 8% yield.

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

Notes concerning bond calculations. The approaches shown in this section to compute bond price and bond yield are precise theoretical solutions. Historically, bond transactions have incorporated various approximations that are still in common use today. Because of this, the answers using the theoretical method may not agree exactly with all other sources.

VII. STATISTICAL FUNCTIONS

In many situations in your business (and everyday) life, you may find yourself making decisions based on a set of data points. This data could be test scores, sales figures, weights of an incoming shipment, etc. An effective way to evaluate this data is to use statistical methods. The statistical functions, available in the statistical mode, are accessed by repeatedly pressing [2nd] [Mode] until "STAT" appears in the display.

Remember that [2nd] [CMR] or [2nd] [Mode] clears all mode registers and should only be used when you are finished with the data entered for statistical calculations.

Statistical Data Entry and Removal

[Σ+] **Data Point Entry Key** — Enters data points for statistical calculations. After a data point is entered, the current total number (n) of data points entered is displayed.

[2nd] [Σ−] **Data Point Removal Key Sequence** — Removes unwanted data points from the stored data array. After a data point is removed, the current total number (n) of data points stored is displayed.

The procedures to enter and remove an array of data are provided in the following chart.

SINGLE-VARIABLE DATA	TWO-VARIABLE DATA
1. To Enter Data Points:	
• Enter first data point • Press [Σ+] • Repeat for all data points	• Enter first "x" data point • Press [x:y] • Enter first "y" data point • Press [Σ+] • Repeat for all points
2. To Remove Last Data Point Entered*:	
• Press [2nd] [Σ-]	• Press [2nd] [Σ-]
3. To Remove Any Other Data Point Entered:	
• Press [ON/C] [x:y] • Enter unwanted data point • Press [2nd] [Σ-] • Repeat for other unwanted data points	• Enter first unwanted "x" data point • Press [x:y] • Enter first unwanted "y" data point • Press [2nd] [Σ-] • Repeat for other unwanted "x" and "y" data points

*If any statistical computation has been performed, you must use the third procedure.

Once entered, the data can be used to calculate the mean, variance and standard deviation by simply pressing the necessary keys.

IMPORTANT: Since this calculator can hold statistical data in the mode registers even when turned off, always clear the registers with [2nd] [CMR] before entering a new set of statistical data.

Mean, Standard Deviation, and Variance

The most common statistical calculations used in "boiling down" a set of data points are the mean, standard deviation, and the variance. (The *mean* value represents the "central" tendency of your data, the *standard deviation* and *variance* are parameters that indicate how "spread out" or variable the data is.) You can also simultaneously analyze two sets of data, allowing you to examine relationships between them. Because of your calculator's Constant Memory™ feature, the mode registers retain all entered data even after the calculator is turned off. This feature allows you to enter additional data to a previously entered data array without having to reenter the old data. This time saving feature is especially useful whenever you're working with a large data array.

[2nd] [Math] **Mean Key Sequence** — Calculates the mean of the data entered.

[2nd] [σn-1] **Sample Standard Deviation Key Sequence** — Calculates standard deviation using n-1 weighting (for sample data).

[2nd] [σn] **Population Standard Deviation Key Sequence** — Calculates standard deviation using n weighting (for population data).

NOTE: A population is usually a large set of items, and a sample is a smaller portion selected from the population. The difference between the Sample Standard Deviation and the Population Standard Deviation calculations becomes very small for over 30 data points.

[2nd] [σn-1] [x²] **Sample Variance Key Sequence** — Calculates variance using n-1 weighting (for sample data).

[2nd] [σn] [x²] **Population Variance Key Sequence** — Calculates variance using n weighting (for population data).

The various key sequences that may be used to analyze an array of statistical data is provided in the following chart.

SINGLE-VARIABLE DATA	TWO-VARIABLE DATA
• Enter first data point. • Press [Σ+]. • Repeat for all data points. --- • Press [2nd] [Mean] to calculate the mean of the data. • Press [2nd] [σn-1] to calculate the standard deviation of the data using n-1 weighting (normally used for *sample* data). • Press [2nd] [σn] to calculate the standard deviation of the data using n weighting. • Press [2nd] [σn-1] [x²] to calculate the variance of the data (with n-1 weighting.) • Press [2nd] [σn] [x²] to calculate variance of the data with n weighting.	Call the two sets of data "x" (independent) and "y" (dependent) arrays of data. • Enter first "x" data point. • Press [x:y]. • Enter first "y" data point. • Press [Σ+]. • Repeat for all points. --- • Press [2nd] [Mean] to calculate the mean of the "y" data points. Then press [x:y] to display the mean of the "x" data points. • Press [2nd] [σn-1] to calculate the standard deviation of the "y" data using n-1 weighting. Then press [x:y] to display the standard deviation of the "x" data using n-1 weighting. • Press [2nd] [σn-1] [x²] to calculate the variance of the "y" data points with n-1 weighting. Then press [x:y] [x²] to display the variance of the "x" data points with n-1 weighting. *continued*

two variable (continued)

- Press [2nd] [σn] to calculate the standard deviation of the "y" data points using n weighting. Then press [x:y] to display the standard deviation of the "x" data points using n weighting.
- Press [2nd] [σn] [x²] to calculate the variance of the "y" data points with n weighting. Then press [x:y] [x²] to calculate the variance of the "x" data points with n weighting.

Example: You're teaching a course, and the first set of test scores is in. You'd like to see how well the class is doing. The scores are tabulated below.

96	65	81
85	76	86
57	98	75
78	100	72
81	70	80

Press		Display/Comments	
[2nd] [Mode]			Repeat until "STAT" appears in display.
[2nd] [CMR] [ON/C]			
[FIX] 9	STAT	0	Clears mode registers & selects floating decimal.
96 [Σ+]	STAT	1	
86 [Σ+]	STAT	2	
[2nd] [Σ−]	STAT	1	Remove incorrect data point.
85 [Σ+]	STAT	2	Reenter correct data point.
⋮ (Continue for all points)			
72 [Σ+]	STAT	14	Display shows total number of data points entered.
80 [Σ+]	STAT	15	
[2nd] [Mean]	STAT	80	Class average.
[2nd] [σn-1]	STAT	11.970201	Standard deviation (n-1 weighting).
[x²]	STAT	143.28571	Variance (n-1 weighting).

If your data represents an entire population and not a small sample taken from a large population, n weighting is usually used to compute the standard deviation. This is easily calculated by

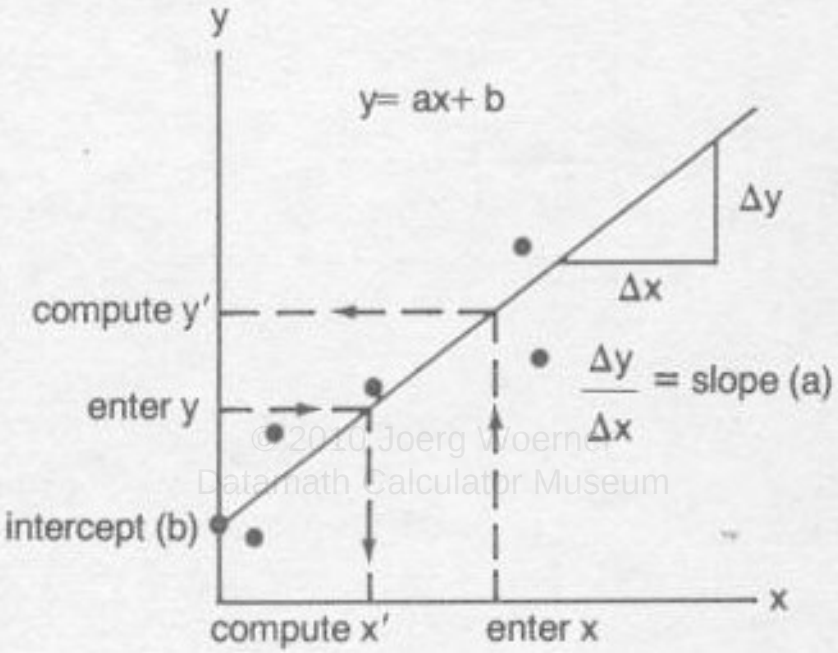
2nd σn STAT 11.564313

If an entry error is made and discovered before another entry is made, the incorrect number may be deleted by pressing 2nd Σ−. The correct number may then be entered and Σ+ pressed.

If an entry error is made and ***not*** discovered until after other entries have been made, the error may be corrected by pressing ON/C x:y, enter incorrect point, press 2nd Σ−, enter correct point, press Σ+.

Linear Regression and Trend Line Analysis

In both "linear regression" and "trend line analysis" situations, your calculator is mathematically drawing a straight line graph through a series of data points you know and can enter into the machine. The actual 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= ax+ b is determined for the line.



With the calculated linear regression line, you can then make projections using this line, or analyze data in regions you're unsure of. We'll briefly describe the needed key strokes, and then go through a couple of examples to show you situations where linear regression and trend line analysis may be useful.

[2nd] [b/a] **Intercept and Slope Key Sequence** — Calculates the y-intercept (b) of the calculated linear regression line. Then pressing [x:y] displays the slope (a) of the line.

[2nd] [x'] **Compute x' Key Sequence** — Calculates the x' value for a given y value on the calculated linear regression line.

[2nd] [y'] **Compute y'** Key Sequence — Calculates the y' value for a given x value on the calculated linear regression line.

[2nd] [Corr] **Correlation Coefficient Key Sequence** — Calculates the correlation coefficient of the data entered in the linear regression routine. The value will be between ± 1, with ± 1 being perfect correlations and a zero value means no correlation.

After using the two-variable data entry procedure described in the beginning of this section, the following chart can be used as a guide to solve linear regression or trend line analysis problems.

INFORMATION WANTED	KEY SEQUENCE
• y-intercept (b) • slope of line (a) • y′ value for a given x value • x′ value for a given y value • Correlation coefficient	• Press 2nd b/a • Press 2nd b/a x:y • Enter x and press 2nd y′ • Enter y and press 2nd x′ • Press 2nd Corr

NOTE: 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.

Linear Regression Example

Linear regression is extremely useful for analyzing historical data and using the results to project future information. The data points you know are entered by their "x" and "y" coordinates using the two-variable data entry procedure described at the beginning of this section.

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 ("x" data)	7	12	3	5	11	8
Sales in thousands/mo. ("y" data)	99	152	81	98	151	112

Based on the present trend, how many sales people does this company need for $200 thousand in monthly sales? What monthly sales would 15 sales people generate?

Press		Display/Comments	
2nd Mode			Repeat until "STAT" appears.
ON/C 2nd CMR			
FIX 9	STAT	0	Clears mode registers & selects floating decimal.
7 x:y 99 Σ+	STAT	1	1st data point (7,99) entered.
12 x:y 152 Σ+	STAT	2	2nd data point (12,152) entered.
3 x:y 81 Σ+	STAT	3	3rd data point (3,81) entered.
5 x:y 98 Σ+	STAT	4	4th data point (5,98) entered.
22 x:y 151 Σ+	STAT	5	5th data point (11,151) entered incorrectly.

To remove the incorrect entry, press 2nd Σ−

2nd Σ−	STAT	4	Removes incorrect entry.
11 x:y 151 Σ+	STAT	5	5th data point entered correctly.
8 x:y 112 Σ+	STAT	6	6th data point entered correctly.

200 2nd x′ STAT 17.815789

The number of people (x) needed for $200 thousand in sales.

15 2nd y′ STAT 176.55618

The number of thousands of dollars in sales which would result from 15 people.

2nd b/a	STAT	51.668539	y-intercept.
x:y	STAT	8.3258427	Slope.
2nd Corr	STAT	0.9697572	Correlation coefficient.

The correlation coefficient indicates the degree of correlation between two sets of numbers, such as the number of sales people and the amount of sales in our example. A value close to one indicates a high *positive* correlation and a value close to minus one indicates a high *negative* correlation. A value of zero indicates that the two sets of numbers are not related.

At this point you can go on to perform additional statistical calculations on the mean, standard deviation and variance of the data you still have stored in your calculator.

Example: In the previous example, compute the average number of sales people (mean value of "x") and the average amount of sales (mean value of "y").

Press		Display/Comments	
2nd Mean	STAT	115.5	Average amount of sales.
x:y	STAT	7.6666667	Average number of people.

Example: Continuing with the same example, calculate the standard deviation for the number of sales people and for the amount of sales.

Press		Display/Comments	
2nd σn	STAT	26.998457	Standard deviation for amount of sales.
x:y	STAT	3.1446604	Standard deviation for sales people.

Example: Determine the variance of "x" (the number of sales people) and the variance of "y" (the amount of sales) for the NoDie Life Insurance Company. Note that it is not necessary to reenter the data points; simply press the appropriate key sequences.

Press		Display/Comments	
2nd σn * x^2	STAT	728.91667	Variance for the amount of sales.
x:y x^2	STAT	9.8888889	Variance for the number of sales people.

*Be certain to allow the calculator to complete the standard deviation calculation before pressing x^2 .

Trend Line Analysis Example

Trend line analysis is a variation of linear regression that's very handy in making predictions based on trends or growth. There are special features in your calculator that provide for easy and rapid trend line predictions.

The only thing that makes trend line analysis different from linear regression is that the "x" values are automatically increased by 1 for each data point. Your calculator does this for you all by itself — all you need to do is enter the first "x" value with the [x:y] key, and then enter consecutive "y" values with the [Σ+] key. Your machine will automatically increment the "x" variable by one for each "y" value you enter. If an error is made in data entry, simply press [2nd] [Σ−] to remove the incorrect entry before making another entry.

Once all your data is entered, you've got all of the information at your fingertips that was available in the linear regression calculation. Your calculator draws the "best fitting line" through the data.

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

Year (x values)	1962	1963	1964	1965-1970
Profit in millions (y values)	−2.1	−0.3	0.8	inactive

Year (x values)	1971	1972	1973	1974
Profit in millions (y values)	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? Note: There is no guarantee that the actual profits will follow the pattern; business conditions may change. Your predictions assume that current trends will continue.

Press		Display/Comments	
2nd Mode			Repeat until "STAT" appears.
ON/C 2nd CMR			
FIX 9	STAT	0	Clears mode registers & selects floating decimal.
1962 x:y	STAT	0	Enter the first "x" value.
2.1 +/- Σ+	STAT	1	Enters the 1962 loss.

Since the next "x" value is to be incremented by 1 (to 1963) you won't need to enter it.

.3 +/- Σ+	STAT	2	1963 loss.
.8 Σ+	STAT	3	1964 gain.

You don't want the next x value to be 1965, so enter the value you want (1971).

1971 x:y	STAT	1964	Display shows the last x value used.
2.9 Σ+	STAT	4	1971 gain.
2.8 Σ+	STAT	5	1972 gain.
3.6 Σ+	STAT	6	1973 gain.
4 Σ+	STAT	7	1974 gain.
1980 2nd y'	STAT	6.5217984	Millions of profits expected in 1980.
10 2nd x'	STAT	1988.2979	Year when profits are predicted to be $10 million.

In 1980 the company is projected to earn $6.52 million and to reach the $10 million mark early in the second quarter of 1989.

APPENDIX A
SERVICE INFORMATION

In Case Of Difficulty

1. If the battery indicator fails to appear on the display, check for improperly inserted or discharged batteries. See Battery Replacement instructions on the following page.
2. Review operating instructions to be certain that calculations were performed correctly.
3. When batteries are inserted into the calculator and the display does not reset, pressing [OFF] then [ON/C] should reset the display and prepare the calculator for use.

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

NOTE: The P.O. box number listed for the Lubbock Service Facility is for United States parcel post shipments only. If you desire to use another carrier, the street address is:

Texas Instruments Incorporated
2305 University Ave.
Lubbock, Texas 79415

For your protection, the calculator must be sent insured; Texas Instruments cannot assume any responsibility for loss of or damage to uninsured shipments.

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.

Out-of-Warranty Service. Because our Service Facility serves the entire United States, it is not feasible to hold units while providing repair estimates. For simplicity of operation, we have

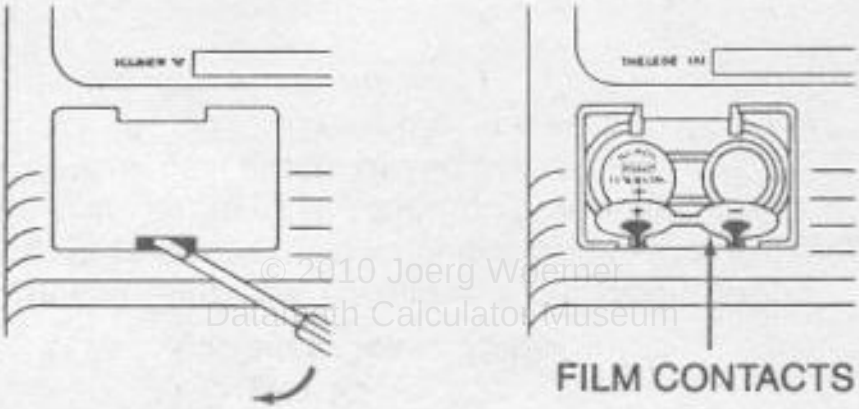
established flat-rate charges for all out-of-warranty repairs. To obtain the correct charges for a particular model, call our toll-free number listed in this section.

Battery Replacement

NOTE: Your calculator cannot hold data in its user memory or mode registers if the batteries are removed or become discharged.

Your calculator uses 2 of any of the following batteries: Mallory 10L14, Union Carbide 357, or Panasonic WL-14.

1. Turn the calculator off. Place a small screwdriver, paper clip, or other similar instrument into the slot and gently lift the battery cover.



FILM CONTACTS

2. Remove the discharged batteries and install new ones as shown. Be careful not to crease the film contacts while installing the new batteries. Be sure the film contacts are positioned to lay on top of the batteries after the batteries are installed.
3. Replace the cover top edge first, then gently press until the bottom of the cover snaps into place.
4. Press [ON/C], [ON/C], [2nd] [Mode], [FIX] [9] and [STO] to completely clear calculator.

Caution: Do not incinerate old batteries.

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. A $3.00 charge will be made by the exchange center for in-warranty exchanges. Out-of-warranty exchanges will be charged at the rates in effect at the time of the exchange. Please call the Consumer Relations Department for further details and the location of the nearest exchange center.

If You Need Service Information

If you need service information for your calculator, write Consumer Relations at:

Texas Instruments Incorporated
P.O. Box 53
Lubbock, Texas 79408

or call Consumer Relations at 800-858-1802 (toll-free within all contiguous United States except Texas) or 800-692-1353 (toll-free within Texas). If outside contiguous United States call 806-747-3841. (We regret that we cannot accept collect calls at this number.)

APPENDIX B
CONVERSION FACTORS

English to Metric

To Find	Multiply	By
microns	mils	**25.4**
centimetres	inches	**2.54**
metres	feet	**0.3048**
metres	yards	**0.9144**
kilometres	miles	**1.609344**
gramme	ounces	28.349523
kilogramme	pounds	0.4535924
litres	gallons (U.S.)	3.7854118
litres	gallons (Imp.)	4.546090
millilitres (cc)	fl. ounces	29.573530
sq. centimetres	sq. inches	**6.4516**
sq. metres	sq. feet	0.0929030
sq. metres	sq. yards	0.8361274
millilitres (cc)	cu. inches	**16.387064**
cu. metres	cu. feet	0.0283168
cu. metres	cu. yards	0.7645549

Temperature Conversions

$$°F = \frac{9}{5}(°C) + 32$$

$$°C = \frac{5}{9}(°F - 32)$$

Boldface numbers are exact; others are rounded.

Key Index

ONE-YEAR LIMITED WARRANTY

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

WARRANTY DURATION: This calculator is warranted to the original consumer purchaser for a period of one year from the original purchase date.

WARRANTY COVERAGE: This calculator is warranted against defective materials or workmanship. **THIS WARRANTY DOES NOT COVER BATTERIES AND IS VOID IF THE CALCULATOR HAS BEEN DAMAGED BY ACCIDENT, UNREASONABLE USE, NEGLECT, IMPROPER SERVICE OR OTHER CAUSES NOT ARISING OUT OF DEFECTS IN MATERIAL OR WORKMANSHIP.**

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 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 CONSUMER OR ANY OTHER USER.

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.

WARRANTY PERFORMANCE: During the above one year warranty period, your TI calculator will either be repaired or replaced with a reconditioned comparable model (at TI's option) when the calculator is returned postage prepaid to a Texas Instruments Service Facility listed below.

In the event of replacement with a reconditioned model, the replacement calculator will continue the warranty of the original calculator or six months, whichever is longer. For alternative remedies for either in- or out-of-warranty service, please refer to the service information section in this manual. Other than the postage requirement, no charge will be made for such repair or replacement of in-warranty calculators unless one of the alternative remedies is chosen.

TI strongly recommends that you insure the product for value, prior to mailing.

TEXAS INSTRUMENTS CONSUMER SERVICE FACILITIES

For U. S. residents:
Texas Instruments Service Facility
P.O. Box 2500
Lubbock, Texas 79408

For Canadian residents only:
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
831 South Douglas Street
El Segundo, California 90245
(213) 973-1803

Texas Instruments Consumer Service
10700 Southwest Beaverton Highway
Park Plaza West, Suite 565
Beaverton, Oregon 97005
(503) 643-6758

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Printed in U.S.A. 1033226-2