Texas Instruments

Business Card™

Super slimline financial calculator
with Constant Memory™ feature

CONTENTS

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KEY INDEX

This indexed keyboard provides a quick page reference to the description of each key.

I. INTRODUCTION

Your super slimline *Business Card*™ calculator is designed for a variety of mathematical, profit margin and financial calculations. Here are a few of its functions and features.

Features

- APD™ automatic power down turns calculator off when not in use.
- *Constant Memory*™ feature saves data even when the calculator is off.
- Large LCD display shows up to eight digits with battery condition, memory content, and 2nd function indicators.
- Over 1000 hours of operation can be obtained from a fresh set of batteries.

Functions

- Mathematical functions include:
  - Arithmetic (+, −, ×, ÷)
  - Square (x^2) and square root ($\sqrt{x}$)
  - Reciprocal ($1/x$)
- Percent and percent change calculations
- Calculations with a constant
- Full Memory Arithmetic
- Profit margin functions involve cost, selling price and profit margin calculations.
- Financial functions can solve:

Simple Interest	Annuities
Compound Interest	Installment Loans
Rent Schedules	Bond Yields
Mortgages	

II. BASIC OPERATIONS

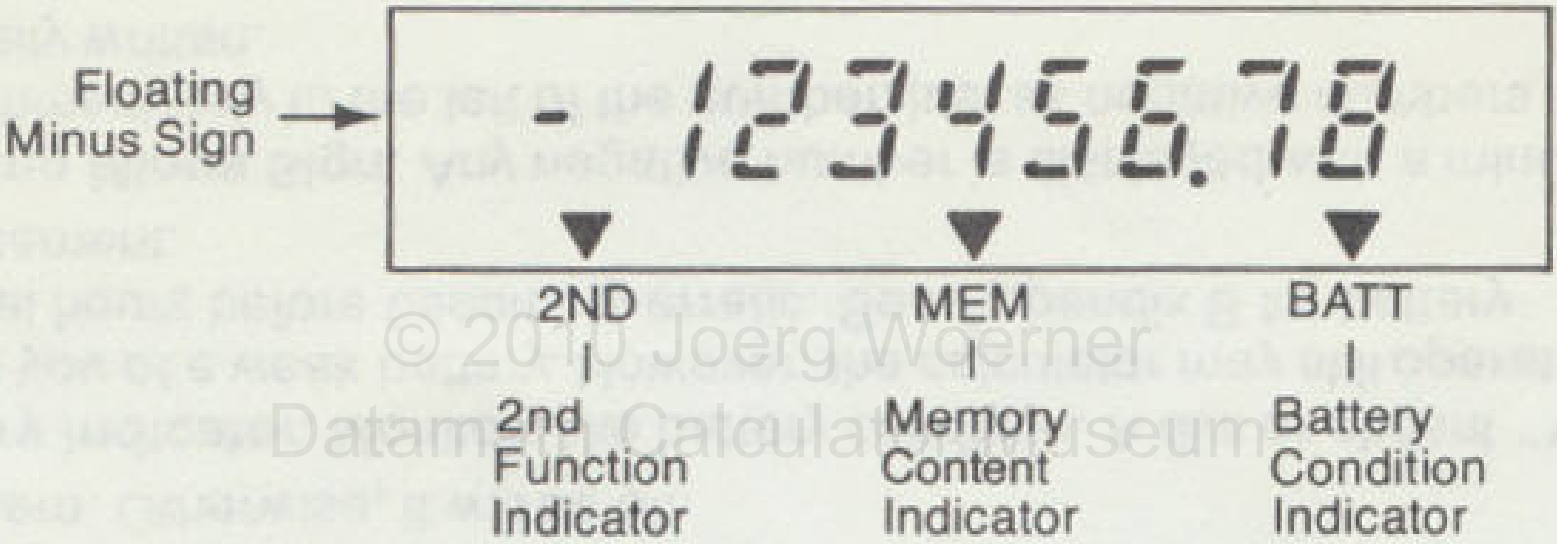
Turning the Calculator ON and OFF

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], [ON/C], [M], [ON/C], [2nd] [9].

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

NOTICE: The entire display, including the small "BATT" condition indicator, is blanked during key entries and calculations.

Display Indicators



The calculator display has three status indicators, as shown above — 2nd, Memory, and Battery. Some calculators may show "■" as display indicators instead of the "▼" shown above.

2nd Indicator. Comes on when [2nd] key is pressed meaning that a second function on a key will be used next. Completing the second function key sequence or pressing [2nd] again will turn off the indicator.

Memory Indicator. Shows when the stored value in the memory is other than zero. Otherwise, it will be off.

Battery Indicator. Monitors the battery condition. A dim or absent "▼" warns you of a weak battery. However, the calculator may still operate for several hours before becoming erratic. See Appendix B for battery replacement.

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.

Data Entry

For maximum versatility, your calculator operates with a floating or fixed decimal point as described later in this section. When entering numbers, the decimal is assumed to the right of the number 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] **Digits**—Enter numbers 0 through 9.

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

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

Clearing Your Calculator

[ON/C] **Clear Entry/Clear** — Removes an incorrect number entry from the display when pressed before a function or an operation key. When pressed after an operation or a function key (including [=]), this key clears the display, the constant and any pending calculation. Pressing [ON/C] twice always clears the display, the constant (See Section III, *Calculations with a Constant.*) and any pending operation. Pressing [ON/C] also clears an "Error" condition. See Appendix A for specific "Error" conditions. The memory and profit margin and financial registers are not affected by this key.

[M] [ON/C] **Clear Memory** — Clears the memory and the "MEM" memory indicator will disappear.

[2nd] [ON/C] **Clear Profit Margin and Financial Registers** — Clears all data stored in these registers.

Dual Function Keys

Some of your calculator's keys have dual functions. The first function is printed right above the key and its second function is printed above that key in a brown box. The second function of a key can be accessed by pressing [2nd] key followed by the appropriate key. For example, to enter a present value (PV), press [2nd] and then the key below **PV**. However, to find the square root of a number, simply press [$\sqrt{x}$] key. In this book we'll indicate operations involving second functions with black key symbols like this: [2nd] **PV**.

Fixed Decimal Display

The calculator can be either used with a fixed number of digits to the right of the decimal point or with a floating decimal point. For fixed decimal display, press [2nd] 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, [2nd] [2] will show all results with two digits to the right of the decimal point—a convenient display for dollars and cents. Floating decimal display is restored by pressing [2nd] [8] or [2nd] [9] .

The fixed decimal display selection is retained even when the calculator is turned off.

IMPORTANT: The fixed decimal display shows only the rounded value of the internal number (up to 11 digits) in your calculator. For example, if [2nd] [3] is selected and the actual result to a problem is 6.15687, only 6.157 will be shown in the display. However, the calculator will internally retain 6.15687 for the next calculation, even if you store the number in memory.

Using the fixed decimal display does not affect the number of digits you can enter. Up to seven digits can be entered to the right of the decimal point. Pressing a function key then causes the display to show only the

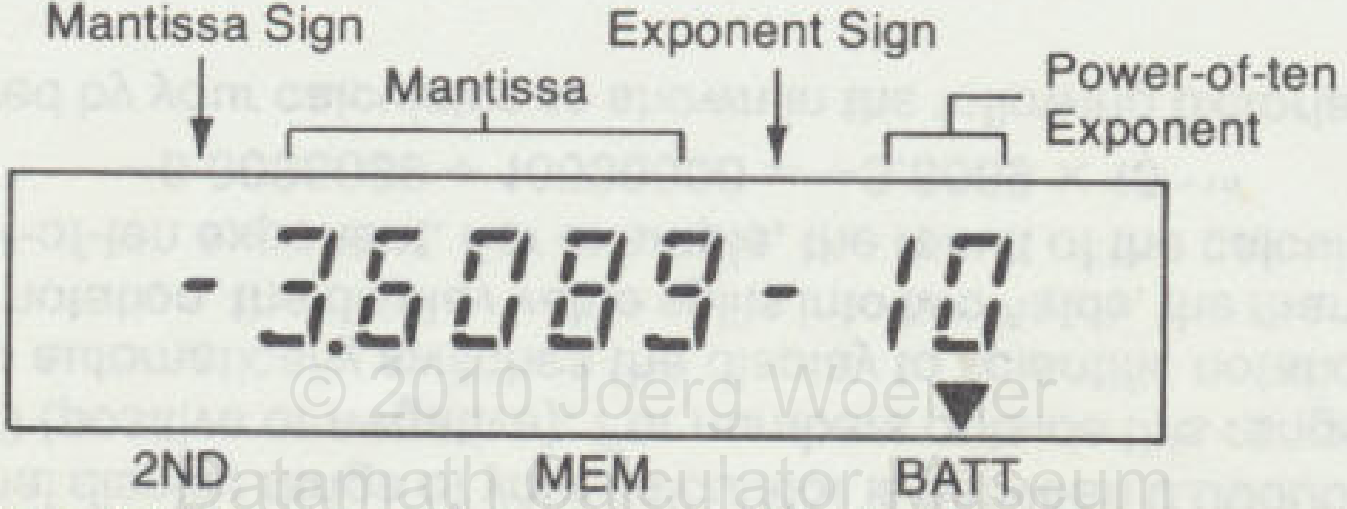
rounded value with the selected number of digits to the right of the decimal point. For example, press [2nd] [4] , key in 2.1234567 and press [=] . The display now shows 2.1235, however, the calculator still contains the complete 8-digit number. Press [2nd] [9] anytime you want to see the maximum number of digits (up to eight) in a result.

Extended Display Range (Scientific Notation)

The normal display range of your calculator is between 0.0000001 and 99999999 (positive or negative). For numbers outside this 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:

$$-0.0036089 \div 10000000 = -3.6089 \times 10^{-10}$$

is displayed by your calculator as shown in the following pictorial.



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:

−0.00000000036089

10 places left

APD™ Automatic Power Down

If no keys are pressed for a period of about 10 minutes, the APD feature will automatically turn off your calculator. If APD feature is not desired, it may be cancelled by pressing any keys in the 1st, 3rd, and 4th columns simultaneously (such as [0] [+/-] and [=]). The cancellation remains in effect until the calculator is turned off with [OFF].

Constant Memory™ Feature

Even when your calculator is turned off, manually or automatically by APD feature, the *Constant Memory* feature saves the memory content, the decimal places selected, the last constant (See Section III, *Calculations with a Constant*), and all data entered in the financial and profit margin registers (See Sections V and VI.)

IMPORTANT: The *Constant Memory* feature is not maintained if the batteries are discharged or removed.

"Error" Conditions

The display shows "Error" when an overflow or underflow occurs, or when an improper operation or invalid key sequence is attempted. When "error" appears, the calculator must be cleared with ON/C or turned off with OFF . It is usually easier to start over after clearing an "Error" condition. However, if the "Error" condition repeats, the *Error Conditions and Parameters* in Appendix A may help you locate the problem.

Accuracy

Your calculator uses up to 11 digits internally to perform calculations even though only 8 digits can be displayed. The extra three digits that you cannot see are generally referred to as guard digits and their purpose is to increase the accuracy of the calculator. These guard digits allow you to obtain a result that is normally more accurate than ± 1 in the eighth digit. Accuracy may decrease when several functions are used successively.

III. MATHEMATICAL FUNCTIONS

Arithmetic Operations

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

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

[×] **Multiply**—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**—Instructs the calculator to divide the displayed number by the next entered quantity.

[=] **Equal**—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 [+], [−], [×], [÷], and [Δ%] ([Δ%] will be discussed later).

Example: 37 + 16.9 − 11 = 42.9

Press	Display/Comments
[ON/C]	**0**
37 [+]	**37***
16.9 [−]	**53.9** Completes addition.
11 [=]	**42.9** Completes all the operations.

*If one or more zeros appear, a fixed decimal display has been previously selected. Press [2nd] [9] and continue.

Following [=] with a number entry automatically clears the previous result, pressing [ON/C] is not required.

Example: $4 \times (-6.6) - (-17.1) = -9.3$

Press	Display/Comments
4 [×] 6.6 [+/−]	**−6.6**
[−] 17.1 [+/−] [=]	**−9.3**

Entry errors can be corrected by immediately pressing the correct arithmetic function key, [%] 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.

A result obtained in one calculation, can be used as the first number in a second calculation.

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

Press	Display/Comments
184 [+] 254 [=]	**438**
[÷] 365 [=]	**1.2**

Reciprocal

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

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

Press	Display/Comments
3.2 [1/x]	**0.3125**

Square and Square Root

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

Example: $(4.235)^2 = 17.935225$

Press	Display/Comments
4.235 [x²]	**17.935225**

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

Example: $\sqrt{6.25} = 2.5$

Press	Display/Comments
6.25 [√x]	**2.5**

Percent and Percent Change

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

The [%] key can be used with [+], [−], [×], and [÷] functions. Add-on, discount, straight and inverted percentages, and other problems can be solved by these functions:

The rules for [%] key are tabulated below.

- [+] n [%] [=] adds n% to the original number displayed.
- [−] n [%] [=] subtracts n% of the original number displayed.
- [×] n [%] [=] multiplies the original number in the display by the number (n% ÷ 100).
- [÷] n [%] [=] divides the original number in the display by the number (n% ÷ 100).

Add-on Example: How much is $15 with 5% tax added to it?

Press	Display/Comments
15 [+] 5 [%]	**0.75** Amount of tax
[=]	**15.75** Total amount

Discount Example: Discount $54.25 by 15%.

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

Straight Percentage Example: If 40% of your 12,000 unit order was shipped, how many units were received? (What is 40% of 12,000?)

Press	Display/Comments
12000 [X] 40 [%]	**0.4** Decimal equivalent of 40%.
[=]	**4800** Units received.

Inverted Percentage Example: 30 watches filled 15% of your order. How many were ordered? (30 is 15% of what?)

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

[2nd] [Δ%] **Percent Change**—The sequence x_1 [2nd] [Δ%] x_2 [=] 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: A shirt that cost $16 last year now costs $18. What is the percentage increase in the price?

Press	Display/Comments
18 [2nd] [Δ%]	**18**
16 [=]	**12.5** Percent increase.

Note that [+], [−], [×], [÷] or another [2nd] [Δ%] will complete the percent change function.

Calculations with a Constant

[2nd] [K] **Constant**—Used to store a number and an operation(+, −, ×, ÷, Δ% or %) for use in repetitive calculations

Pressing [2nd] [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 [2nd] [K] changes or clears the constant.) Now 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 key sequences show how to enter a constant with different math operations where n is a constant number:

- [+] [2nd] [K] n [=] Adds n to each subsequent entry.
- [−] [2nd] [K] n [=] Subtracts n from each subsequent entry.
- [×] [2nd] [K] n [=] Multiplies each subsequent entry by n.
- [÷] [2nd] [K] n [=] Divides each subsequent entry by n.
- [2nd] [Δ%] [2nd] [K] n [=] Calculates the percentage change (Δ%) between each subsequent entry x_i and n where:

$$\Delta\% = \frac{x_i - n}{n} \times 100$$

- *First entry* [+] [2nd] [K] n [%] [=] Adds n% of each subsequent entry to that entry.
- *First entry* [−] [2nd] [K] n [%] [=] Subtracts n% of each subsequent entry from that entry.

The constant function will also be enabled if you press [2nd] [K] after entering n. The only restriction is that [2nd] [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, otherwise the constant will be cleared.

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

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

Press	Display/Comments	
2 [×] [2nd] [K] 3.1416 [=]	**6.2832**	First problem is solved and "× 3.1416" is stored.
4 [=]	**12.5664**	(4 × 3.1416)
6 [=]	**18.8496**	Third problem.

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

Press	Display/Comments	
ON/C 2nd 2	**0.00**	Fix decimal at 2 places.
5.95 + 2nd K 5 % =	**6.25**	$5.95 + 5%
19.98 =	**20.98**	$19.98 + 5%
129.75 =	**136.24**	$129.75 + 5%
2nd 9	**136.2375**	Return to floating decimal.

IV. MEMORY FUNCTIONS

Arithmetic memory provides for easy storage and retrieval of a value and is not affected by any non-memory calculations. The *Constant Memory* feature retains the stored value even when the calculator is turned off.

The following key descriptions specifically cover the user memory. The [M] key can also be used to recall profit margin and financial values as described in Sections V and VI.

[M] [ON/C] **Memory Clear**—Clears the memory of previously stored numbers and should always be used before a new calculation. A cleared memory is signaled by the absence of "MEM" indicator in the display.

[M] [ON/C] [M] [+] **Memory Store**—Duplicates the displayed value in the memory without affecting the display. A non-zero value will turn on the "MEM" display indicator. The previously stored value is erased. If memory is already clear, only [M] [+] needs to be pressed.

[M] [=] **Memory Recall**—Copies the previously stored value in the display, without changing memory.

Example: Store and recall 3.012.

Press	Display/Comments
3.012 [M] [ON/C] [M] [+]	**3.012** Store value
[OFF]	(Blank)
[ON/C] [M] [=]	**3.012** Recall value

[M] [M] **Memory Exchange**—Exchanges the memory value with the displayed value. The displayed value is stored and the previously stored value is displayed.

With this sequence two numbers can be easily compared without writing 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 economical size.

Press	Display	Memory	Comments
ON/C M ON/C	**0**	0	Clear
.39 ÷ 482 =			
M +	**0.0008091**	0.0008091	Calculate and store first value per gram.
.24 ÷ 248 =	**0.0009677**	0.0008091	Second value per gram.
M M	**0.0008091**	0.0009677	Large can more economical.
− M = =	**−0.0001586**	0.0009677	Difference per gram.
X 482 =	**−0.0764516**	0.0009677	Save over 7¢ on large can.

In each of the following four memory operations, the calculation results are stored back in the memory. The displayed number or other calculations in progress are not affected.

[M] [+] **Memory Sum**—Algebraically sums the displayed number to the memory contents.

[M] [−] **Memory Subtract**—Algebraically subtracts the displayed value from the memory contents.

Example: $(28.3 \times 7) + (173 + 16) - (312 - 42 + 7.8) = 109.3$

Press	Display	Memory	Comments
[ON/C] [M] [ON/C]	**0**	0	Clear memory.
28.3 [×] 7 [=]	**198.1**	0	Calculate first bracket.

M +	**198.1**	198.1	Store in memory.
173 + 16 = M +	**189**	387.1	Calculate second bracket and memory add.
312 − 42 + 7.8 = M −	**277.8**	109.3	Solve third bracket and memory subtract.
M =	**109.3**	109.3	Recall memory.

M × **Memory Multiply**—Algebraically multiplies the memory contents by the displayed value.

M ÷ **Memory Divide**—Algebraically divides the memory contents by the displayed number.

Example: $\dfrac{(2.1 - 0.6) \times (5 + 2.1)}{(2 - 0.75)} = 8.52$

Press	Display	Memory	Comments
ON/C M ON/C	**0**	0	Clear memory.
2.1 − .6 = M +	**1.5**	1.5	Calculate first bracket and store the value.
5 + 2.1 = M ×	**7.1**	10.65	Calculate second bracket and memory multiply.
2 − .75 = M ÷	**1.25**	8.52	Calculate denominator and memory divide.
M =	**8.52**	8.52	Recall memory.

V. PROFIT MARGIN FUNCTIONS

Cost, selling price, and profit margin problems can be solved by using these functions.

CST , SEL , MAR **Cost, Sell, Margin**—Used to enter any two of the three values (Cost, Selling Price, or Profit Margin) in any order. The third variable is computed by preceding that key with 2nd CPT .

Profit margin percentage is based on the selling price:

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

2nd ON/C **Clear Registers**—Used to clear profit margin and financial registers.

Example: If a book costs $4.50, what should the selling price be to realize 28% profit?

Press	Display/Comments	
ON/C 2nd ON/C	**0**	Clear registers.
28 MAR	**28**	Enter profit margin %.
4.5 CST	**4.5**	Enter book cost.
2nd CPT SEL	**6.25**	Book selling price.

Since the profit margin registers are preserved by the "constant" memory until changed, start a new problem with 2nd ON/C to clear the registers.

The memory M key can be used to recall current profit margin values. M CST , M SEL , M MAR **Register Recall**—Recalls current value of cost, selling price and profit margin respectively without affecting the registers.

VI. FINANCIAL FUNCTIONS

A variety of financial problems such as compound interest, installment loans, annuities, rent schedules, etc., can be solved by using the 7 financial keys—N, %i, PMT, PV, FV, CPT, and DUE.

Financial Key Tour

The following tour of the financial keys provides a preview of the calculator's capability and a quick reference for future use.

2nd PV **Present Value**—Enters the present value of a debt or an account.

2nd FV **Future Value**—Enters the future value of a debt or an account.

2nd N **Number of Periods**—Enters the number of time periods. Length of a time period should be the same as used for periodic interest rate. In annuity problems, N is the payment period while in compound interest problems, N is the number of compounding periods.

[2nd] [%i] **Periodic Interest Rate**—Enters the periodic interest rate. Interest rate per period (%i) must be adjusted for the same time period length as used in the number of periods (N). Time period can be a day, a month, or a year or any other time period selected.

[2nd] [PMT] **Payment**—Enters the amount of regular and equal payments for an annuity. In a compound interest problem, payment amount is zero.

[2nd] [CPT] **Compute**—Used as a prefix to [N], [%i], [PV], [FV], or [PMT] when computing the unknown value in a financial problem except for annuity-due problems.

[2nd] [DUE] **Annuity Due**—Used as a prefix to [N], [%i], [PV], [FV], or [PMT] when computing the unknown value in an annuity-due problem.

Note that the "2ND" display indicator remains on after pressing [2nd] [CPT] or [2nd] [DUE] as a reminder that [N], [%i], [PV], [FV] or [PMT] is to be pressed next. Pressing [2nd] again is not necessary.

2nd ON/C **Clears Registers**—Used to clear profit margin and financial registers.

The memory M key can be used to recall current financial values.

M 2nd PV —Recalls current present value.
M 2nd FV —Recalls current future value.
M 2nd N —Recalls current number of time periods.
M 2nd %i —Recalls current periodic interest rate in decimal percentage form. For example, if you enter 5 2nd %i, then M 2nd %i will produce 0.05 in the display.

M 2nd PMT —Recalls current payment amount.

IMPORTANT: The calculator blanks the display while performing calculations and keyboard entries are ignored. 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 , ON/C and 2nd ON/C to start a new problem.

IMPORTANT: Any financial calculation where 2nd CPT or 2nd DUE are used will clear the three profit margin registers.

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, you can determine the fourth by pressing 2nd CPT , followed by the key representing the unknown fourth variable. Your calculator recognizes the difference between a compound interest problem and an annuity problem by the fact that the payment is zero in a compound interest problem. **For proper operation when working compound interest problems, be sure to begin the problem by entering zero as payment or by clearing the financial registers with 2nd ON/C .**

Example: $2000 is invested for 3 years at 11% compounded annually. What is the future value of the investment?

Press	Display/Comments	
ON/C 2nd ON/C 2nd 2	**0.00**	Clear registers and select 2-place decimal.
2000 2nd PV	**2000.00**	Enter present value.
3 2nd N	**3.00**	Enter number of years.
11 2nd %i	**11.00**	Enter interest rate.
2nd CPT FV	**2735.26**	Future value.

Example: Compute the previous example with monthly compounding instead of annual compounding

Press	Display/Comments	
3 [X] 12 [=] [2nd] [N]	**36.00**	Number of months.
11 [÷] 12 [=] [2nd] [%i]	**0.92**	Enter interest rate.
[2nd] [CPT] [FV]	**2777.76**	Future value.

Note that the present value did not have to be entered again since it is the same as entered for the previous example.

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

Press	Display/Comments	
ON/C 2nd ON/C	**0.00**	Clear register.
3500 2nd FV	**3500.00**	Enter future value.
7.5 ÷ 365 = 2nd %i	**0.02**	Calculate and enter daily %i (rounds to 2 places in the display).
365 × 2 = 2nd N	**730.00**	Calculate and enter the number of compounding periods.
2nd CPT PV	**3012.52**	Compute the present value.

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

Notice that the interest rate per period must be adjusted to correspond to the time interval in which the compounding occurs.

Annuities

An annuity is a compound interest situation with equal payments made at regular intervals of time. This definition covers financial situations such as 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—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 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). You enter three of the variables and your calculator can solve for the fourth unknown variable.

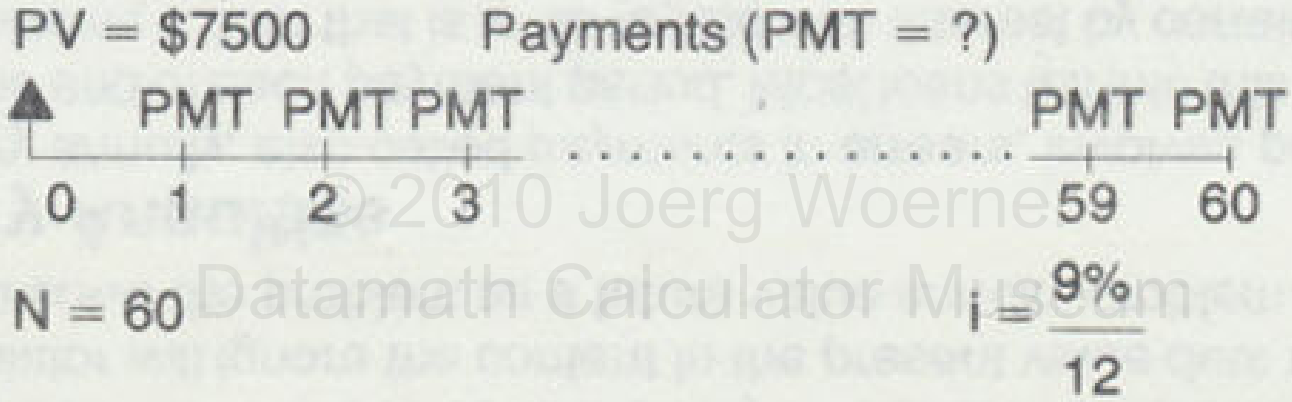
Your calculator is capable of directly solving annuity problems involving either a present value or a future value, but not both.

The calculator determines 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 is the only or the last 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, also called payments in arrears, involves payments made at the end of each payment period. Most loans fall into this category. A loan establishes a debt that is to be repaid with interest by certain payments for a fixed number of periods. A simple visualization of such financial problems can be made with a time-line diagram. A time-line diagram shows the value of money as time goes on.

Example: Don borrowed $7500 at 9% per year compounded monthly. He wants to repay it in 5 years by 60 equal monthly payments. What are his monthly payments?



Press	Display/Comments	
ON/C 2nd ON/C 2nd 2	**0.00**	Clear and select 2-place decimal.
7500 2nd PV	**7500.00**	Enter present value.
9 ÷ 12 = 2nd %i	**0.75**	Compute and enter monthly interest.
60 2nd N	**60.00**	Enter numbers in months.
2nd CPT PMT	**155.69**	

Don's payments are $155.69 per month.

Example: You are buying equity in a home that has loan balance of $39,427.81. The monthly payments are $321.85 and the remaining loan period is 28 years. What is the annual percentage rate on the loan?

Press	Display/Comments	
ON/C 2nd ON/C	0.00	Clear
39427.81 2nd PV	39427.81	Enter present value.
321.85 2nd PMT	321.85	Enter payment.
28 × 12 = 2nd N	336.00	Enter number of payments.
2nd CPT %i	0.75	Monthly interest rate.
× 12 =	9.00	It is a 9% loan.

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 for services to be received during the coming period. When making annuity due calculations, press 2nd DUE, followed by the key representing the fourth unknown variable.

Example: Future Value for Annuity Due (Savings). If you deposit $20 per month beginning this month in a savings account which pays 5% interest compounded monthly, what will the balance be after one year?

Press	Display/Comments	
ON/C 2nd ON/C 2nd 2	**0.00**	Clear and select 2-place decimal.
20 2nd PMT	**20.00**	Enter payment (deposit).
12 2nd N	**12.00**	Enter periods.
5 ÷ 12 = 2nd %i	**0.42**	Enter monthly interest.
2nd DUE FV	**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 ON/C	**0.00**	Clear
60 2nd N	**60.00**	Enter number of payments.
5 ÷ 12 = 2nd %i	**0.42**	Calculate and enter monthly interest rate.
10000 2nd PV	**10000.00**	Enter present value
2nd DUE PMT	**187.93**	Monthly payments.

Calculations for present value and interest rate for an annuity due problem can be similarly made. Remember, if the interest is compounded monthly, you must multiply the results for %i by 12 to obtain the nominal yearly rate compounded monthly.

Bonds

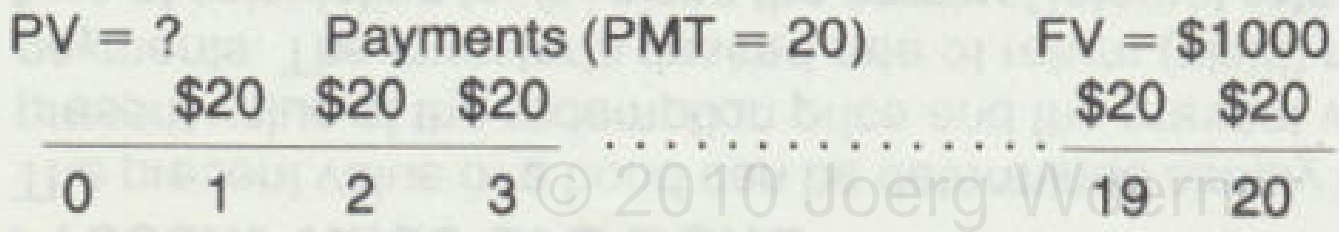
A bond is a financial obligation usually made by a corporation or government

agency which pays the owner a periodic amount and also has a redemption value at some future date of maturity. The amount of each periodic payment or coupon value 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 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	
ON/C 2nd ON/C 2nd 2	**0.00**	Clear registers and select 2-place decimal.
10 × 2 = 2nd **N**	**20.00**	Enter number of semiannual periods.
7 ÷ 2 = 2nd **%i**	**3.50**	Enter semiannual yield as %i.
1000 2nd **FV**	**1000.00**	Redemption price.

2nd CPT PV	**502.57**	Calculate present value of bond redemption value.
M ON/C M +	**502.57**	Save in memory.
20 2nd PMT	**20.00**	Enter semiannual payment.
2nd CPT PV	**284.25**	Value of coupon payments.
M + M =	**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 2nd 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 Jim's 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 ON/C	**0.00**	Clear
10 × 2 = 2nd N	**20.00**	Enter number of semiannual periods.
9 ÷ 2 = 2nd %i	**4.50**	Enter semiannual yield as %i.
1000 2nd FV	**1000.00**	Enter redemption price.
2nd CPT PV	**414.64**	Discounted redemption price.
M ON/C M +	**414.64**	Save in memory.
20 2nd PMT	**20.00**	Enter semiannual coupon payment.
2nd CPT PV	**260.16**	PV of coupon payments.
M + M =	**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 2nd PMT	**0.00**	Set PMT = 0.
8 ÷ 2 = 2nd %i	**4.00**	Enter semiannual yield.
2nd CPT PV M ON/C M +	**456.39**	Discounted redemption price.

20 2nd PMT	**20.00**	Semiannual coupon payment.
2nd CPT PV M +	**271.81**	PV of coupon payments.
M =	**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.

APPENDIX A
ERROR CONDITIONS AND PARAMETERS

The display shows "Error" when an overflow or underflow occurs, or when an improper operation or key sequence is attempted. When the "Error" condition occurs, no entry from the keyboard (except [OFF]) will be accepted until [ON/C] is pressed. This clears the "Error" condition and any pending calculation.

"Error" appears for the following reasons:

1. Calculation resulting in number outside the range of the calculator ($\pm 1.0 \times 10^{-99}$ to $\pm 9.9999 \times 10^{99}$) in the display or any memory register. If the "Error" resulted from a user memory overflow or underflow, the user memory is cleared. If the "Error" resulted from any financial computation overflow or underflow, all profit margin and financial registers are cleared.

The following 10 "Error" conditions (2 through 11) do not affect the user memory, profit margin or financial registers.

2. Dividing a number by zero.
3. Calculating 1/x of zero.
4. Calculating the square root of a negative number.
5. Calculating Δ% 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 the *first entry* equal to zero.
8. Following [2nd] [DUE] by a key other than [N], [%i], [PMT], [PV], [FV], [OFF], [2nd], or [ON/C].

9. Memory key [M] followed by a key other than [+], [−], [×], [÷], [=], [2nd], [ON/C], [CST], [SEL], [MAR], [M], [2nd] [PV], [2nd] [PMT], [2nd] [%i], [2nd] [FV], [2nd] [N] or [OFF].
10. Following [2nd] [CPT] by a key other than [N], [%i], [PMT], [PV], [FV], [2nd], [OFF], [ON/C], [CST], [SEL], or [MAR].
11. Calculating profit margin with the selling price equal to zero.

The following "Error" conditions will cause the financial and profit margin registers to be cleared:

12. Attempting to calculate financial unknowns before enough known variables have been entered or when no valid solutions exists.
13. Turning the calculator off while a financial calculation is in progress. The "Error" will appear when the calculator is turned back on.

APPENDIX B
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 in this section.
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 with the *Warranty* in this appendix.

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

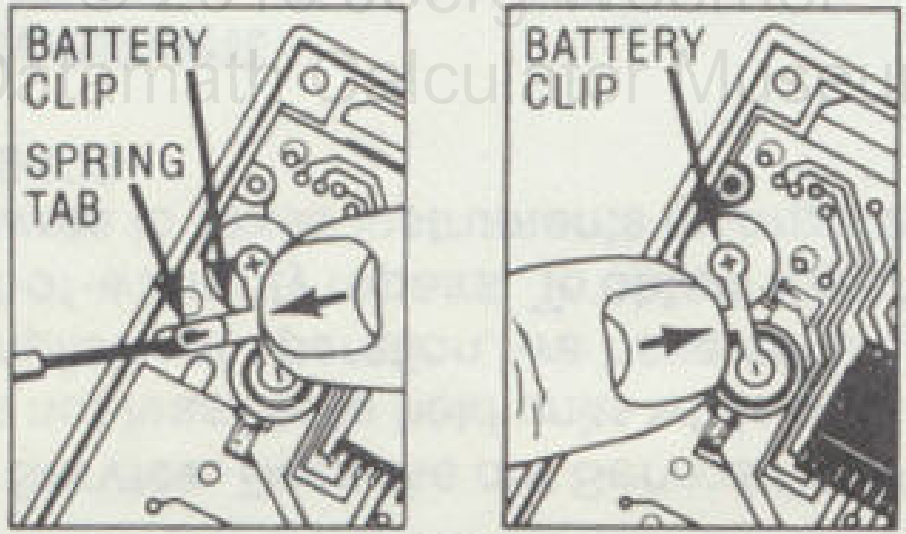
Battery Replacement

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

Your calculator uses two Mallory L-122 batteries.

1. Turn the calculator off. Place the calculator face down on a soft cloth and remove the two screws from the back case.

2. Lift the top edge of the metal back case and swing away from the calculator until the bottom tabs are free to remove the back case. It may be necessary to hold the calculator face up and gently jar the back case loose in your hand.
3. Gently pull up on the spring tab of the battery clip and slide the battery clip toward the edge of the calculator as shown in the left pictorial.



4. Remove the old batteries by turning the calculator face up and allowing the batteries to fall in your hand.
5. Insert new batteries as shown. Then firmly press the battery clip against the batteries while sliding the battery clip back into position over the batteries. Note that the circular tabs on the battery clip should be nearly in the center of the batteries when the battery clip is in the proper position.
6. Replace the metal back case, bottom end first, then replace the two screws.
7. Clear calculator with the sequence [ON/C] , [ON/C] , [2nd] , [ON/C] , [M] , [ON/C] , [2nd] [9] .

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. For further details, refer to other literature that may be supplied with your calculator or write to Consumer Relations as listed in the following paragraph.

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

ONE-YEAR LIMITED WARRANTY

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

WARRANTY DURATION: This calculator is warranted to the original consumer purchaser for a period of one (1) 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 PRODUCT 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 (1) year warranty period, your TI calculator will either be repaired or replaced with a reconditioned comparable model (at TI's option) when the product is returned postage prepaid to a Texas Instruments Service Facility listed on the following page.

In the event of replacement with a reconditioned model, the replacement product will continue the warranty of the original calculator or 6 months, whichever is longer. Other than the postage requirement, no charge will be made for such repair, adjustment, and/or replacement.

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

TEXAS INSTRUMENTS CONSUMER SERVICE FACILITIES

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

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 office 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

APPENDIX C
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**
grammes	ounces	28.349523
kilogrammes	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.

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INCORPORATED
DALLAS, TEXAS

Printed in U.S.A.

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