TEXAS INSTRUMENTS

BA II PLUS™
Calculator

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• Increase the separation between the equipment and receiver.

• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

• Consult the dealer or an experienced radio/television technician for help.

Caution: Any changes or modifications to this equipment not expressly approved by Texas Instruments may void your authority to operate the equipment.

Contents

Overview of Calculator Operations

This chapter describes the basic operation of your BA II PLUS™ calculator, including how to:

- Turn on and turn off the calculator

- Select second functions

- Read the display and set calculator formats

- Clear the calculator and correct entry errors

- Perform math and memory operations

- Use the Last Answer feature

- Use worksheets

Turning On the Calculator

Press $\boxed{\text{ON/OFF}}$.

- If you turned off the calculator by pressing $\boxed{\text{ON/OFF}}$, the calculator returns to the standard-calculator mode with a displayed value of zero.

  All worksheets and formats for numbers, angle units, dates, separators, and calculation method retain previous values and configurations.

- If the Automatic Power Down™ (APD™) feature turned off the calculator, the calculator turns on exactly as you left it, saving display settings, stored memory, pending operations, and error conditions.

Turning Off the Calculator

Press $\boxed{\text{ON/OFF}}$.

- The displayed value and any error condition clear.

- Any unfinished standard-calculator operation and worksheet calculation in progress cancel.

- The Constant Memory™ feature retains all worksheet values and settings, including the contents of the 10 memories and all format settings.

Automatic Power Down™ (APD™) Feature

To prolong battery life, the Automatic Power Down (APD) feature turns off the calculator automatically after about five minutes of inactivity.

The next time you press $\boxed{\text{ON/OFF}}$, the calculator turns on exactly as you left it, saving display settings and stored memory and any pending operations or error conditions.

Selecting 2nd Functions

The primary function of a key is printed on the key itself. For example, the primary function of the ON/OFF key is to turn on or turn off the calculator.

Most keys include a second function printed above the key. To select a second function, press 2nd and the corresponding key. (When you press 2nd, the 2nd indicator appears in the upper left corner of the display.)

For example, pressing 2nd [QUIT] exits the selected worksheet and returns the calculator to the standard-calculator mode.

Note: To cancel after pressing 2nd, press 2nd again.

Reading the Display

The display shows the selected variable labels with values up to 10 digits. (The calculator displays values exceeding 10 digits in scientific notation.)

```
2nd INV HYP COMPUTE ENTER SET ↑↓ DEL INS BGN RAD
ABC=-12,345,678.90
```

The indicators along the top of the display tell you which keys are active and offer information about the status of the calculator.

Indicator	Meaning
2nd	Press a key to select its second function. (2nd To cancel, press 2nd again.
INV	Press a key to select its inverse trigonometric function.
HYP	Press a key to select its hyperbolic function.
COMPUTE	Press CPT to compute a value for the displayed variable.
ENTER	Press ENTER to assign the displayed value to the displayed variable.
SET	Press 2nd [SET]to change the setting of the displayed variable.
↑↓	Press ↓ or ↑ to display the previous or next variable in the worksheet. **Note:** To easily scroll up or down through a range of variables, press and hold ↓ or ↑.

Indicator	Meaning
DEL	Press [2nd] [DEL] to delete a cash flow or statistical data point.
INS	Press [2nd] [INS] to insert a cash flow or statistical data point.
BGN	TVM calculations use beginning-of-period payments. When **BGN** is not displayed, TVM calculations use end-of-period payments (**END**).
RAD	Angle values appear in radians. When **RAD** is not displayed, angle values appear and must be entered in degrees.
◁	The displayed value is entered in the selected worksheet. The indicator clears following a computation.
∗	The displayed value is computed in the selected worksheet. When a value changes and invalidates a computed value, the indicator clears.
=	The displayed variable is assigned the displayed value.
−	The displayed value is negative.

Setting Calculator Formats

You can change these calculator formats:

To Select	Press	Display	Default
Number of decimal places	[2nd] [FORMAT]	**DEC** 0–9 (Press 9 for floating-decimal)	**2**
Angle units	[↓]	**DEG** (degrees) **RAD (**radians)	**DEG**
Dates	[↓]	**US** (mm-dd-yyyy) **Eur** (dd-mm-yyyy)	**US**
Number separators	[↓]	**US** (1,000.00) **Eur** (1.000,00)	**US**
Calculation method	[↓]	**Chn** (chain) **AOS**™ (algebraic operating system)	**Chn**

1. To access format options, press [2nd] [FORMAT]. The **DEC** indicator appears with the selected number of decimal places.

2. To change the number of decimal places displayed, key in a value and press [ENTER].

3. To access another calculator format, press [↓] or [↑] once for each format.

    For example, to access the angle unit format, press [↓]. To access the number-separator format, press [↑] [↑] [↑] or [↓] [↓] [↓].

4. To change the selected format, press [2nd] [SET].

5. To change another calculator format, repeat step 3 and step 4.
    — or —
    To return to the standard-calculator mode, press [2nd] [QUIT].
    — or —
    To access a worksheet, press a worksheet key or key sequence.

Choosing the Number of Decimal Places Displayed

The calculator stores numeric values internally to an accuracy of 13 digits, but you can specify the number of decimal places you want to display. The calculator displays up to 10 digits with the floating-decimal option. Results exceeding 10 digits appear in scientific notation.

Changing the number of decimal places affects the display only. Except for amortization and depreciation results, the calculator does not round internal values. To round the internal value, use the round function.

Note: All examples in this guidebook assume a setting of two decimal places. Other settings might show different results.

Choosing the Angle Units

The angle unit value affects the display of results in trigonometric calculations. When you select radians, the **RAD** indicator appears in the upper right corner of the display. No indicator appears when you select the default setting of degrees.

Using Dates

The calculator uses dates with the Bond and Date worksheets and the French depreciation methods. To enter dates, use this convention: *mm.ddyy* (US) or *dd.mmyy* (European). After you key in the date, press ENTER.

Choosing Calculation Methods

When you choose the chain (**Chn**) calculation method, the calculator solves problems in the order that you enter them. (Most financial calculators use **Chn**.)

For example, when you enter 3 ⊞ 2 ⊠ 4 ⊟, the **Chn** answer is 20 (3 + 2 = 5, 5 * 4 = 20).

Using **AOS™** (algebraic operating system), the calculator solves problems according to the standard rules of algebraic hierarchy, computing multiplication and division operations before addition and subtraction operations. (Most scientific calculators use **AOS**.)

For example, when you enter 3 ⊞ 2 ⊠ 4 ⊟, the **AOS** answer is 11 ($2 \times 4 = 8$; 3 + 8 = 11).

Resetting Default Values

To reset default values for all of the calculator formats, press [2nd] [CLR WORK] with one of the formats displayed.

Resetting the Calculator

Resetting the calculator:

- Clears the display, all 10 memories, any unfinished calculations, and all worksheet data.
- Restores all default settings
- Returns operation to the standard-calculator mode

Because the calculator includes alternative methods that let you clear data selectively, use reset carefully to avoid losing data needlessly. (See section "Clearing Calculator Entries and Memories".)

For example, you might reset the calculator before using it for the first time, when starting a new calculation, or when having difficulty operating the calculator and other possible solutions do not work. (See "In Case of Difficulty".)

Pressing 2nd Reset ENTER

1. Press 2nd [RESET]. The **RST ?** and **ENTER** indicators appear.

   Note: To cancel reset, press 2nd [QUIT]. **0.00** appears.

2. Press ENTER. **RST** and **0.00** appear, confirming that the calculator is reset.

Note: If an error condition exists, press CE/C to clear the display before attempting to reset.

Performing a Hard Reset

You can also reset the calculator by gently inserting a pointed object (such as an unfolded paper clip or similar object) in the hole marked **RESET** in back of the calculator.

Clearing Calculator Entries and Memories

Note: To clear variables selectively, see the specific worksheet chapters in this guidebook.

To clear	Press
One character at a time, starting with the last digit keyed in	→
An incorrect entry, error condition, or error message	CE/C
The prompted worksheet and reset default values	2nd [CLR WORK]
Calculator format settings and reset default values	2nd [FORMAT] 2nd [CLR WORK]
• Out of the prompted worksheet and return to standard-calculator mode • All pending operations in standard-calculator mode	2nd [QUIT]
• In a prompted worksheet, the variable value keyed in but not entered (the previous value appears) • Any calculation started but not completed	CE/C CE/C
TVM worksheet variables and reset default values	2nd [QUIT] 2nd [CLR TVM]
One of the 10 memories (without affecting the others)	0 STO and a memory number key (0–9)

Correcting Entry Errors

You can correct an entry without clearing a calculation, if you make the correction before pressing an operation key (for example, $+$ or x^2).

- To clear the last digit displayed, press →.
- To clear the entire number displayed, press CE/C.

Note: Pressing CE/C after you press an operation key clears the calculation in progress.

Example: You mean to calculate 3 × 1234.56 but instead enter 1234.86.

To	Press	Display
Begin the expression	**3** ×	3.00
Enter a number	**1234.86**	1,234.86
Erase the entry error	→ →	1,234.
Key in the correct number	**56**	1,234.56
Compute the result	=	3,703.68

Math Operations

When you select the chain (**Chn**) calculation method, the calculator evaluates mathematical expressions (for example, 3 + 2 × 4) in the order that you enter them.

Examples of Math Operations

These operations require you to press = to complete.

To	Press	Display
Add 6 + 4	**6** + **4** =	10.00
Subtract 6 − 4	**6** − **4** =	2.00
Multiply 6 × 4	**6** × **4** =	24.00
Divide 6 ÷ 4	**6** ÷ **4** =	1.50
Find universal power: $3^{1.25}$	**3** y^x **1.25** =	3.95
Use parentheses: 7 × (3 + 5)	**7** × (**3** + **5**) =	56.00
Find percent: 4% of $453	**453** × **4** % =	18.12
Find percent ratio: 14 to 25	**14** ÷ **25** % =	56.00
Find price with percent add-on: $498 + 7% sales tax	**498** + **7** %	34.86 532.86

To	Press	Display
	$=$	
Find price with percent discount: $69.99 − 10%	**69.99** $-$ **10** $\%$ $=$	**7.00** **62.99**
Square 6.3^2	**6.3** x^2	**39.69**
Find number of combinations where: n = 52, r = 5	**52** $2nd$ $[nCr]$ **5** $=$	**2,598,960.00**
Find number of permutations where: n = 8, r = 3	**8** $2nd$ $[nPr]$ **3** $=$	**336.00**

These operations do not require you to press $=$ to complete.

To	Press	Display
Find square root: $\sqrt{15.5}$	**15.5** $\sqrt{x}$	**3.94**
Find reciprocal: 1/3.2	**3.2** $1/x$	**0.31**
Find factorial: 5!	**5** $2nd$ $[x!]$	**120.00**
Find natural logarithm: ln 203.45	**203.45** LN	**5.32**
Find natural antilogarithm: e$^{.69315}$	**.69315** $2nd$ $[e^x]$	**2.00**
Round 2 ÷ 3 to the set decimal format	**2** $÷$ **3** $=$ $2nd$ $[ROUND]$	**0.67**
Generate random number*	$2nd$ $[RAND]$	**0.86**
Store *seed* value	STO $2nd$ $[RAND]$	**0.86**
Find sine:** sin(11.54°)	**11.54** $2nd$ $[SIN]$	**0.20**
Find cosine:** cos(120°)	**120** $2nd$ $[COS]$	**-0.50**
Find tangent:** tan(76°)	**76** $2nd$ $[TAN]$	**4.01**
Find arcsine:** sin^{-1}(.2)	**.2** INV $[SIN]$	**11.54**
Find arccosine:** cos^{-1}(-.5)	**.5** $+/-$ INV $[COS]$	**120.00**
Find arctangent:** tan^{-1}(4)	**4** INV $[TAN]$	**75.96**
Find hyperbolic sine: sinh(.5)	**.5** $2nd$ $[HYP]$ $[SIN]$	**0.52**
Find hyperbolic cosine: cosh(.5)	**.5** $2nd$ $[HYP]$ $[COS]$	**1.13**
Find hyperbolic tangent: tanh(.5)	**.5** $2nd$ $[HYP]$ $[TAN]$	**0.46**
Find hyperbolic arcsine: sinh^{-1}(5)	**5** $2nd$ $[HYP]$ INV $[SIN]$	**2.31**
Find hyperbolic arccosine: cosh^{-1}(5)	**5** $2nd$ $[HYP]$ INV $[COS]$	**2.29**
Find hyperbolic arctangent: tanh^{-1}(.5)	**.5** $2nd$ $[HYP]$ INV $[TAN]$	**0.55**

* The random number you generate might be different.

** Angles can be computed in degrees or radians. Examples show angles in degrees.
   (See: Choosing the Angle Units).

Universal Power y^x

Press y^x to raise the displayed *postive* number to any power (for example, 2^{-5} or 2 $(1/3)$.)

Note: Because the reciprocal of an even number (such as, 1/2, 1/4, 1/6) is a complex number, you can only raise a negative number to an integer power or the reciprocal of an odd number.

Parentheses $($ $)$

Use parentheses to control the order in which the calculator evaluates a numeric expression in division, multiplication, powers, roots, and logarithm calculations. The calculator includes up to 15 levels of parentheses and up to 8 pending operations.

Note: You do not have to press $)$ for expressions ending in a series of closed parentheses. Pressing $=$ closes parentheses automatically, evaluates the expression, and displays the final result. To view intermediate results, press $)$ once for each open parenthesis.

Factorial $2nd$ [x!]

The number for which you compute a factorial must be a positive integer less than or equal to 69.

Random Numbers $2nd$ [RAND]

The calculator generates a random real number between zero and one ($0<x<1$) from a uniform distribution.

You can repeat a sequence of random numbers by storing a *seed* value in the random number generator. Seed values help you recreate experiments by generating the same series of random numbers.

To store a seed value, key in an integer greater than zero and press STO $2nd$ [RAND].

Combinations $2nd$ [nCr]

The calculator computes the number of combinations of *n* items taken *r* at a time. Both the *n* and *r* variables must be greater than 0.

$$nCr = \frac{n!}{(n-r)! \times r!}$$

Permutations $2nd$ [nPr]

The calculator computes the number of permutations of *n* items taken *r* at a time. Both the *n* and *r* variables must be greater than 0.

$$nPr = \frac{n!}{(n-r)!}$$

Rounding 2nd [ROUND]

The calculator computes using the rounded, displayed form of a number instead of the internally stored value.

For example, working in the Bond worksheet, you might want to round a computed selling price to the nearest penny (two decimal places) before continuing your calculation.
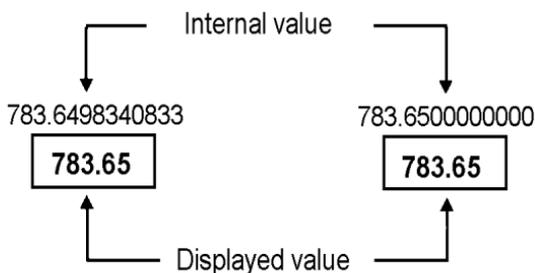
Note: The calculator stores values to an accuracy of up to 13 digits. The decimal format setting rounds the displayed value but not the unrounded, internally stored value. (See "Choosing the Number of Decimal Places Displayed".)

Scientific Notation y^x

When you compute a value in the standard-decimal format that is either too large or small to be displayed, the calculator displays it in scientific notation, that is, a base value (or *mantissa*), followed by a blank space, followed by an exponent.

With AOS selected, you can press y^x to enter a number in scientific notation. (See "Choosing Calculation Methods".)

For example, to enter 3×10^3, key in **3** ⊠ **10** y^x **3**.

Memory Operations

You can store values in any of 10 memories using the standard calculator keys.

Note: You can also use the Memory worksheet. (See Memory Worksheet.)

- You can store in memory any numeric value within the range of the calculator.
- To access a memory **M0** through **M9**, press a numeric key (0 through 9).

Clearing Memory

Clearing memory before you begin a new calculation is a critical step in avoiding errors.

- To clear an individual memory, store a zero value in it.
- To clear all 10 calculator memories, press [2nd] [MEM] [2nd] [CLR WORK].

Storing to Memory

To store a displayed value to memory, press [STO] and a numeric key (0–9).

- The displayed value replaces any previous value stored in the memory.
- The Constant Memory feature retains all stored values when you turn off the calculator.

Recalling From Memory

To recall a number stored in memory, press [RCL] and a numeric key (0–9).

Note: The recalled number remains in memory.

Memory Examples

To	Press
Clear memory 4 (by storing a zero value in it)	**0** [STO] **4**
Store 14.95 in memory 3 (**M3**)	**14.95** [STO] **3**
Recall a value from memory 7 (**M7**)	[RCL] **7**

Memory Arithmetic

Using memory arithmetic, you can perform a calculation with a stored value and store the result with a single operation.

- Memory arithmetic changes only the value in the affected memory and not the displayed value.
- Memory arithmetic does not complete any calculation in progress.

The table lists the available memory arithmetic functions. In each case, the specified memory stores the result.

To	Press
Add the displayed value to the value stored in memory 9 (**M9**).	[STO] [+] **9**
Subtract the displayed value from the value stored in memory 3 (**M3**).	[STO] [−] **3**
Multiply the value in memory 0 (**M0**) by the displayed value.	[STO] [×] **0**
Divide the value in memory 5 (**M5**) by the displayed value.	[STO] [÷] **5**
Raise the value in memory 4 (**M4**) to the power of the displayed value.	[STO] [yˣ] **4**

Calculations Using Constants

To store a constant for use in repetitive calculations, enter a number and an operation, and then press [2nd] [K].

To use the stored constant, key in a value and press [=].

Note: Pressing a key other than a number or [=] clears the constant.

Example: Multiply 3, 7, and 45 by 8

To	Press	Display
Clear the calculator	[2nd][QUIT]	**0.00**
Enter the value for the first calculation.	**3**	**3**
Enter the operation and a constant value.	[×] **8**	**8**
Store the operation and value, and then calculate.	[2nd] [K] [=]	**24.00**
Calculate 7 × 8.	**7** [=]	**56.00**
Compute 45 × 8.	**45** [=]	**360.00**

Keystrokes for Constant Calculations

This table shows how to create a constant for various operations.

To*	Press**
Add *c* to each subsequent entry.	*n* [+] [2nd] [K] *c* [=]
Subtract *c* from each subsequent entry.	*n* [−] [2nd] [K] *c* [=]
Multiply each subsequent entry by *c*.	*n* [×] [2nd] [K] *c* [=]
Divide each subsequent entry by *c*.	*n* [÷] [2nd] [K] *c* [=]
Raise each subsequent entry to the power of *c*.	*n* [yˣ] [2nd] [K] *c* [=]
Add *c*% of each subsequent entry to that entry.	*n* [+] [2nd] [K] *c* [%] [=]
Subtract *c*% of each subsequent entry from the entry.	*n* [−] [2nd] [K] *c* [%] [=]

* The letter *c* denotes the constant value.

** Repeat constant calculations with *n* [=].

Last Answer Feature

Use the Last Answer (**ANS**) feature with problems that call repeatedly for the same value or to copy a value:

- From one place to another within the same worksheet.
- From one worksheet to another.
- From a worksheet to the standard-calculator mode.
- From the standard-calculator mode to a worksheet.

To display the last answer computed, press 2nd [ANS].

Note: The calculator changes the value of the last answer whenever it calculates a value automatically or whenever you:

- Press ENTER to enter a value.
- Press CPT to compute a value.
- Press = to complete a calculation.

Example: Using the Last Answer in a Calculation

To	Press	Display
Key in and complete a calculation	**3** + **1** =	**4.00**
Key in a new calculation	**2** y^x	**2.00**
Recall the last answer	2nd [ANS]	**4.00**
Complete the calculation	=	**16.00**

Using Worksheets: Tools for Financial Solutions

The calculator contains worksheets with embedded formulas to solve specific problems. You apply settings or assign known values to worksheet variables and then compute the unknown value. Changing the values lets you ask *what if* questions and compare results.

Except for TVM variables, accessed in the standard-calculator mode, all variables are *prompted*.

For example, to assign values to amortization variables, you must first press 2nd [AMORT] to access the Amortization worksheet.

Each worksheet is independent of the others: operations in a worksheet do not affect variables in other worksheets. When you exit a worksheet or turn off the calculator, the calculator retains all worksheet data.

To select	Function	Press
TVM worksheet	Analyzes equal cash flows, for example, annuities, loans, mortgages, leases, and savings	N, I/Y, PV, PMT, FV, or 2nd [P/Y]
Amortization worksheet	Performs amortization calculations and generates an amortization schedule	2nd [AMORT]
Cash Flow worksheet	Analyzes unequal cash flows by calculating net present value and internal rate of return	2nd [CF]
Bond worksheet	Computes bond price and yield to maturity or call	2nd [BOND]
Depreciation worksheet	Generates a depreciation schedule using one of six depreciation methods	2nd [DEPR]
Statistics worksheet	Analyzes statistics on one- or two-variable data using four regression analysis options	2nd [STAT]
Percent Change/Compound Interest worksheet	Computes percent change, compound interest, and cost-sell markup	2nd [⌿%]
Interest Conversion worksheet	Converts interest rates between nominal rate (or annual percentage rate) and annual effective rate	2nd [ICONV]
Date worksheet	Computes number of days between two dates, or date/day of the week a specified number of days is from a given date	2nd [DATE]
Profit Margin worksheet	Computes cost, selling price, and profit margin	2nd [PROFIT]
Breakeven worksheet	Analyzes relationship between fixed cost, variable cost, price, profit, and quantity	2nd [BRKEVN]
Memory worksheet	Accesses storage area for up to 10 values	2nd [MEM]

Accessing the TVM Worksheet Variables

- To assign values to the TVM worksheet variables, use the five TVM keys ($\boxed{N}$, $\boxed{I/Y}$, $\boxed{PV}$, $\boxed{PMT}$, $\boxed{FV}$).

- To access other TVM worksheet functions, press the $\boxed{2nd}$ key, and then press a TVM function key (**xP/Y**, **P/Y**, **BGN**). **See:** TVM and Amortization Worksheet Variables.

  Note: You can assign values to TVM variables while in a prompted worksheet, but you must return to the standard-calculator mode to calculate TVM values or clear the TVM worksheet.

Accessing Prompted-Worksheet Variables

After you access a worksheet, press $\boxed{\downarrow}$ or $\boxed{\uparrow}$ to select variables. For example, press $\boxed{2nd}$ [AMORT] to access the Amortization worksheet, and then press $\boxed{\downarrow}$ or $\boxed{\uparrow}$ to select the amortization variables (**P1**, **P2**, **BAL**, **PRN**, **INT**). **See:** TVM and Amortization Worksheet Variables.

Indicators prompt you to select settings, enter values, or compute results. For example, the $\boxed{\downarrow}$ and $\boxed{\uparrow}$ indicators remind you to press $\boxed{\downarrow}$ or $\boxed{\uparrow}$ to select other variables.

To return to the standard-calculator mode, press $\boxed{2nd}$ [QUIT].

Types of Worksheet Variables

- Enter-only
- Compute-only
- Automatic-compute
- Enter-or-compute
- Settings

Note: The = sign displayed between the variable label and value indicates that the variable is assigned the value.

Enter-Only Variables

Values for enter-only variables must be entered, cannot be computed, and are often limited to a specified range, for example, **P/Y** and **C/Y**. The value for an enter-only variable can be:

- Entered directly from the keyboard.
- The result of a math calculation.
- Recalled from memory.
- Obtained from another worksheet using the last answer feature.

When you access an enter-only variable, the calculator displays the variable label and **ENTER** indicator. The **ENTER** indicator reminds you to press $\boxed{ENTER}$ after keying in a

value to assign the value to the variable. After you press ENTER, the ◁ indicator confirms that the value is assigned.

Compute-Only Variables

You cannot enter values manually for compute-only variables, for example, net present value (**NPV**). To compute a value, display a compute-only variable and press CPT. The calculator computes and displays the value based on the values of other variables.

When you display a compute-only variable, the **COMPUTE** indicator reminds you to press CPT to compute its value. After you press CPT, the ∗ indicator confirms that the displayed value has been computed.

Automatic-Compute Variables

When you press ↓ or ↑ to display an automatic-compute variable (for example, the Amortization worksheet **INT** variable), the calculator computes and displays the value automatically without you having to press CPT.

Enter-or-Compute Variables in the TVM Worksheet

You can either enter or compute values for the TVM worksheet variables (**N**, **I/Y**, **PV**, **PMT**, and **FV**).

Note: Although you do not have to be in the standard-calculator mode to assign values to these variables, you must be in the standard-calculator mode to compute their values.

• To assign the value of a TVM variable, key in a number and press a variable key.

• To compute the value of a TVM variable, press CPT, and then press the variable key. The calculator computes and displays the value based on the values of other variables.

Enter-or-Compute Variables in Prompted Worksheets

You can either enter or compute values for some prompted worksheet variables (for example, the Bond worksheet **YLD** and **PRI** variables). When you select an enter-or-compute variable, the calculator displays the variable label with the **ENTER** and **COMPUTE** indicators.

• The **ENTER** indicator prompts you to press ENTER to assign the keyed-in value to the displayed variable.

• The **COMPUTE** indicator prompts you to press CPT to compute a value for the variable.

Selecting Worksheet Settings

Many prompted worksheets contain variables consisting of two or more options, or *settings* (for example, the Date worksheet **ACT/360** variable). When you select variables with settings, the calculator displays the **SET** indicator and the current setting.

To scroll through the settings of a variable, press 2nd [SET] once for each setting.

Display Indicators

- The ◁ indicator confirms that the calculator entered the displayed value in the worksheet.

- The ∗ indicator confirms that the calculator computed the displayed value.

- When a change to the worksheet invalidates either entered or computed values, the ◁ and ∗ indicators disappear.

Time-Value-of-Money and Amortization Worksheets

Use the Time-Value-of-Money (TVM) variables to solve problems with equal and regular cash flows that are either all inflows or all outflows (for example, annuities, loans, mortgages, leases, and savings).

For cash-flow problems with unequal cash flows, use the Cash Flow worksheet. (See: Cash Flow Worksheet.)

After solving a TVM problem, you can use the Amortization worksheet to generate an amortization schedule.

- To access a TVM variable, press a TVM key ($\boxed{N}$, $\boxed{I/Y}$, $\boxed{PV}$, $\boxed{PMT}$, or $\boxed{FV}$).
- To access the prompted Amortization worksheet, press $\boxed{2nd}$ [AMORT].

TVM and Amortization Worksheet Variables

Variable	Key	Display	Type of Variable
Number of periods	$\boxed{N}$	**N**	Enter-or-compute
Interest rate per year	$\boxed{I/Y}$	**I/Y**	Enter-or-compute
Present value	$\boxed{PV}$	**PV**	Enter-or-compute
Payment	$\boxed{PMT}$	**PMT**	Enter-or-compute
Future value	$\boxed{FV}$	**FV**	Enter-or-compute
Number of payments per year	$\boxed{2nd}$ [P/Y]	**P/Y**	Enter-only
Number of compounding periods per year	$\boxed{\downarrow}$	**C/Y**	Enter-only
End-of-period payments	$\boxed{2nd}$ [BGN]	**END**	Setting
Beginning-of-period payments	$\boxed{2nd}$ [SET]	**BGN**	Setting
Starting payment	$\boxed{2nd}$ [AMORT]	**P1**	Enter-only
Ending payment	$\boxed{\downarrow}$	**P2**	Enter-only
Balance	$\boxed{\downarrow}$	**BAL**	Auto-compute

Variable	Key	Display	Type of Variable
Principal paid	↓	**PRN**	Auto-compute
Interest paid	↓	**INT**	Auto-compute

Note: This guidebook categorizes calculator variables by the method of entry. (See "Types of Worksheet Variables").

Using the TVM and Amortization Variables

Because the calculator stores values assigned to the TVM variables until you clear or change them, you should not have to perform all steps each time you work a problem.

- To assign a value to a TVM variable, key in a number and press a TVM key (N, I/Y, PV, PMT, FV).

- To change the number of payments (**P/Y**), press [2nd] [P/Y], key in a number, and press [ENTER]. To change the compounding periods (**C/Y**), press [2nd] [P/Y] ↓, key in a number, and press [ENTER].

- To change the payment period (**END/BGN**), press [2nd] [BGN], and then press [2nd] [SET].

- To compute a value for the unknown variable, press [CPT], and then press the key for the unknown variable.

- To generate an amortization schedule, press [2nd] [AMORT], enter the first and last payment number in the range (**P1** and **P2**), and press ↑ or ↓ to compute values for each variable (**BAL**, **PRN**, and **INT**).

Resetting the TVM and Amortization Worksheet Variables

- To reset all calculator variables and formats to default values (including TVM and amortization variables), press [2nd] [RESET] [ENTER]:

Variable	Default	Variable	Default
N	0	**END/BGN**	END
I/Y	0	**P1**	1
PV	0	**P2**	1
PMT	0	**BAL**	0
FV	0	**PRN**	0
P/Y	1	**INT**	0
C/Y	1		

- To reset only the TVM variables (**N**, **I/Y**, **PV**, **PMT**, **FV**) to default values, press [2nd] [CLR TVM].

- To reset **P/Y** and **C/Y** to default values, press [2nd] [P/Y] [2nd] [CLR WORK].

- To reset the Amortization worksheet variables (**P1**, **P2**, **BAL**, **PRN**, **INT**) to default values, press 2nd [CLR WORK] while in the Amortization worksheet.
- To reset **END/BGN** to the default value, press 2nd [BGN] 2nd [CLR WORK].

Clearing the Unused Variable

For problems using only four of the five TVM variables, enter a value of zero for the unused variable.

For example, to determine the present value (**PV**) of a known future value (**FV**) with a known interest rate (**I/Y**) and no payments, enter 0 and press **PMT**.

Entering Positive and Negative Values for Outflows and Inflows

Enter negative values for outflows (cash paid out) and positive values for inflows (cash received).

Note: To enter a negative value, press +/− after entering the number. To change a negative value to positive, press +/−.

Entering Values for I/Y, P/Y, and C/Y

- Enter **I/Y** as the nominal interest rate. The TVM worksheet automatically converts **I/Y** to a *per period* rate based on the values of **P/Y** and **C/Y**.
- Entering a value for **P/Y** automatically enters the same value for **C/Y**. (You can change **C/Y**.)

Specifying Payments Due With Annuities

Use **END**/**BGN** to specify whether the transaction is an ordinary annuity or an annuity due.

- Set **END** for *ordinary annuities*, in which payments occur at the *end* of each payment period. (This category includes most loans.)
- Set **BGN** for *annuities due*, in which payments occur at the *beginning* of each payment period. (This category includes most leases.)

Note: When you select beginning-of-period payments, the **BGN** indicator appears. (No indicator appears for **END** payments.)

Updating P1 and P2

To update **P1** and **P2** for a next range of payments, press CPT with **P1** or **P2** displayed.

Different Values for BAL and FV

The computed value for **BAL** following a specified number of payments might be different than the computed value for **FV** following the same number of payments.

- When solving for **BAL**, **PRN**, and **INT**, the calculator uses the **PMT** value rounded to the number of decimal places specified by the decimal format.
- When solving for **FV**, the calculator uses the unrounded value for **PMT**.

Entering, Recalling, and Computing TVM Values

- To enter a TVM value, key in the value and store it by pressing a TVM key ([N], [I/Y], [PV], [PMT], [FV]).

- To display a stored TVM value, press [RCL] and a TVM key.

You can enter or recall a value for any of the five TVM variables (**N**, **I/Y**, **PV**, **PMT**, or **FV**) in either the standard calculator mode or a worksheet mode. The information displayed depends on which mode is selected.

- In standard calculator mode, the calculator displays the variable label, the = sign, and the value entered or recalled.

- In worksheet modes the calculator displays only the value you enter or recall, although any variable label previously displayed remains displayed.

  Note: You can tell that the displayed value is not assigned to the displayed variable, because the = indicator is not displayed.

To compute a TVM value, press [CPT] and a TVM key in standard-calculator mode.

Using [xP/Y] to Calculate a Value for N

1. Key in the number of years, and then press [2nd] [xP/Y] to multiply by the stored **P/Y** value. The total number of payments appears.

2. To assign the displayed value to **N** for a TVM calculation, press [N].

Entering Cash Inflows and Outflows

The calculator treats cash received (inflows) as a positive value and cash invested (outflows) as a negative value.

- You must enter cash inflows as positive values and cash outflows as negative values.

- The calculator displays computed inflows as positive values and computed outflows as negative values.

Generating an Amortization Schedule

The Amortization worksheet uses TVM values to compute an amortization schedule either manually or automatically.

Generating an Amortization Schedule Manually

1. Press [2nd] [AMORT]. The current **P1** value appears.

2. To specify the first in a range of payments, key in a value for **P1** and press [ENTER].

3. Press [↓]. The current **P2** value appears.

4. To specify the last payment in the range, key in a value for **P2** and press [ENTER].

5. Press [↓] to display each of the automatically computed values:

   - **BAL** — the remaining balance after payment **P2**

   - **PRN** — the principal

   - **INT** — the interest paid over the specified range

6. Press [2nd] [AMORT].
   — or —
   If **INT** is displayed, press [↓] to display **P1** again.

7. To generate the amortization schedule, repeat steps 2 through 5 for each range of payments.

Generating an Amortization Schedule Automatically

After entering the initial values for **P1** and **P2**, you can compute an amortization schedule automatically.

1. Press [2nd] [AMORT].
   — or —
   If **INT** is displayed, press [↓] to display the current **P1** value.

2. Press [CPT]. Both **P1** and **P2** update automatically to represent the next range of payments.

   The calculator computes the next range of payments using the same number of periods used with the previous range of payments. For example, if the previous range was 1 through 12 (12 payments), pressing [CPT] updates the range to 13 through 24 (12 payments).

3. Press [↓] to display **P2**.

   • If you press [CPT] with **P1** displayed, a new value for **P2** will be displayed automatically. (You can still enter a new value for **P2**.)

   • If you did not press [CPT] with **P1** displayed, you can press [CPT] with **P2** displayed to enter values for both **P1** and **P2** in the next range of payments.

4. Press [↓] to display each of the automatically computed values for **BAL**, **PRN**, and **INT** in the next range of payments.

5. Repeat steps 1 through 4 until the schedule is complete.

Example: Computing Basic Loan Interest

If you make a monthly payment of $425.84 on a 30-year mortgage for $75,000, what is the interest rate on your mortgage?

To	Press		Display
Set payments per year to 12	[2nd] [P/Y] **12** [ENTER]	**P/Y=**	**12.00**◁
Return to standard-calculator mode	[2nd] [QUIT]		**0.00**
Enter number of payments using the payment multiplier	**30** [2nd] [xP/Y] [N]	**N=**	**360.00**◁
Enter loan amount	**75000** [PV]	**PV=**	**75,000.00** ◁
Enter payment amount	**425.84** [+/−] [PMT]	**PMT=**	**-425.84**◁
Compute interest rate	[CPT] [I/Y]	**I/Y=**	**5.50**∗

Answer: The interest rate is 5.5% per year.

Examples: Computing Basic Loan Payments

These examples show you how to compute basic loan payments on a $75,000 mortgage at 5.5% for 30 years.

Note: After you complete the first example, you should not have to re-enter the values for loan amount and interest rate. The calculator saves the values you enter for later use.

Computing Monthly Payments

To	Press		Display
Set payments per year to 12	[2nd] [P/Y] **12** [ENTER]	**P/Y=**	12.00◁
Return to standard-calculator mode	[2nd] [QUIT]		0.00
Enter number of payments using payment multiplier	**30** [2nd] [xP/Y] [N]	**N=**	360.00◁
Enter interest rate	**5.5** [I/Y]	**I/Y=**	5.50◁
Enter loan amount	**75000** [PV]	**PV=**	75,000.00◁
Compute payment	[CPT] [PMT]	**PMT=**	–425.84*

Answer: The monthly payments are $425.84.

Computing Quarterly Payments

Note: The calculator automatically sets the number of compounding periods (**C/Y**) to equal the number of payment periods (**P/Y**).

To	Press		Display
Set payments per year to 4	[2nd] [P/Y] **4** [ENTER]	**P/Y=**	4.00◁
Return to standard-calculator mode	[2nd] [QUIT]		0.00
Enter number of payments using payment multiplier	**30** [2nd] [xP/Y] [N]	**N=**	120.00◁
Compute payment	[CPT] [PMT]	**PMT=**	–1,279.82*

Answer: The quarterly payments are $1,279.82.

Examples: Computing Value in Savings

These examples show you how to compute the future and present values of a savings account paying 0.5% compounded at the end of each year with a 20-year time frame.

Computing Future Value

Example: If you open the account with $5,000, how much will you have after 20 years?

To	Press		Display
Set all variables to defaults	[2nd] [RESET][ENTER]	**RST**	0.00
Enter number of payments	**20** [N]	**N=**	20.00◁
Enter interest rate	**.5** [I/Y]	**I/Y=**	0.50◁
Enter beginning balance	**5000** [+/−] [PV]	**PV=**	-5,000.00◁
Compute future value	[CPT] [FV]	**FV=**	5,524.48*

Answer: The account will be worth $5,524.48 after 20 years.

Computing Present Value

Example: How much money must you deposit to have $10,000 in 20 years?

To	Press		Display
Enter final balance	**10000** [FV]	**FV=**	10,000.00◁
Compute present value	[CPT] [PV]	**PV=**	-9,050.63*

Answer: You must deposit $9,050.63.

Example: Computing Present Value in Annuities

The Furros Company purchased equipment providing an annual savings of $20,000 over 10 years. Assuming an annual discount rate of 10%, what is the present value of the savings using an ordinary annuity and an annuity due?

Cost Savings for a Present-Value Ordinary Annuity
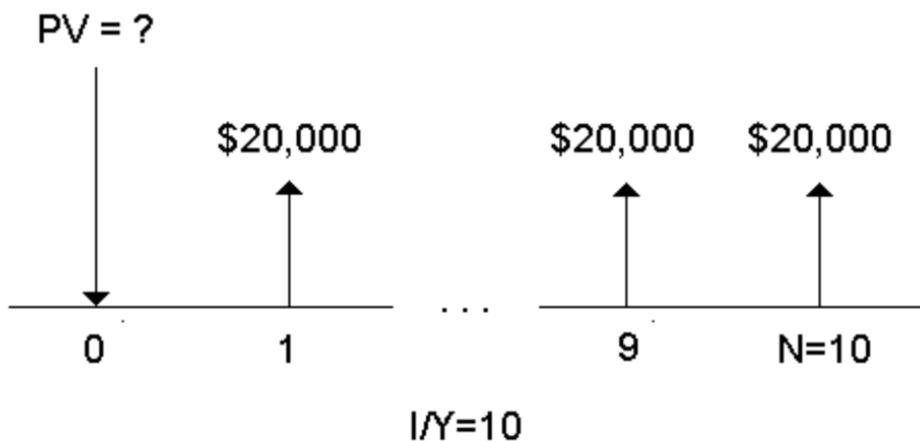
Cost Savings for a Present-Value Annuity Due in a Leasing Agreement

$$PV = ?$$

$20,000 $20,000 $20,000 $0

0   1   . . .   9   N=10
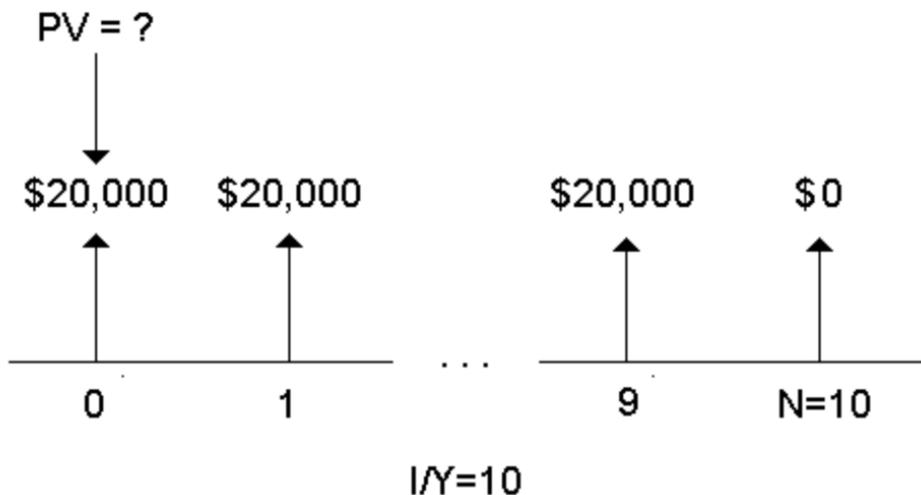
$$I/Y=10$$

To	Press		Display
Set all variables to defaults	[2nd] [RESET] [ENTER]	RST	0.00
Enter number of payments	10 [N]	N=	10.00◁
Enter interest rate per payment period	10 [I/Y]	I/Y=	10.00◁
Enter payment	20000 [+/−] [PMT]	PMT=	-20,000.00◁
Compute present value (ordinary annuity)	[CPT] [PV]	PV=	122,891.34*
Set beginning-of-period payments	[2nd] [BGN] [2nd] [SET]	BGN	
Return to calculator mode	[2nd] [QUIT]		0.00
Compute present value (annuity due)	[CPT] [PV]	PV=	135,180.48*

Answer: The present value of the savings is $122,891.34 with an ordinary annuity and $135,180.48 with an annuity due.

Example: Computing Perpetual Annuities

To replace bricks in their highway system, the Land of Oz has issued perpetual bonds paying $110 per $1000 bond. What price should you pay for the bonds to earn 15% annually?

| To	Press	Display
Calculate the present value for a perpetual ordinary annuity	**110 ÷ 15 % =**	**733.33**
Calculate the present value for a perpetual annuity due	**+ 110 =**	**843.33**

Answer: You should pay $733.33 for a perpetual ordinary annuity and $843.33 for a perpetual annuity due.

A *perpetual annuity* can be an ordinary annuity or an annuity due consisting of equal payments continuing indefinitely (for example, a preferred stock yielding a constant dollar dividend).

Perpetual ordinary annuity
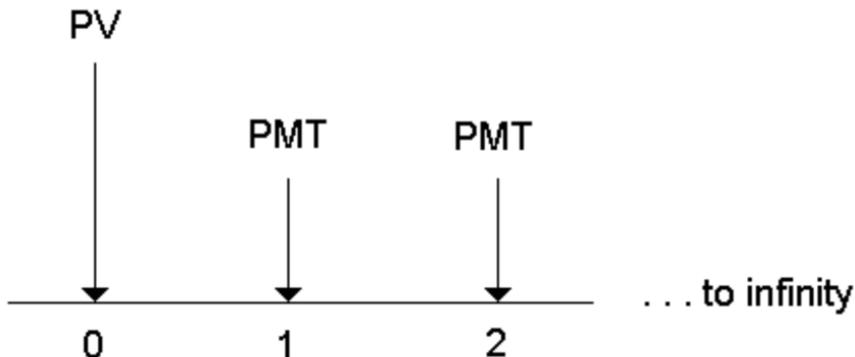
Perpetual annuity due
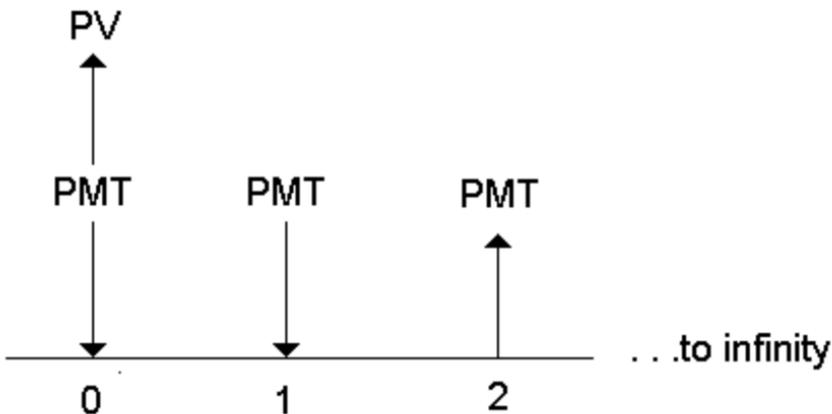
Because the term $(1 + I/Y / 100)^{-N}$ in the present value annuity equations approaches zero as N increases, you can use these equations to solve for the present value of a perpetual annuity:

- Perpetual ordinary annuity

$$PV = \frac{PMT}{(I/Y) \div 100}$$

- Perpetual annuity due

$$PV = PMT + \frac{PMT}{(I/Y)/100}$$

Example: Computing Present Value of Variable Cash Flows

The ABC Company purchased a machine that will save these end-of-year amounts:

Year	1	2	3	4
Amount	$5000	$7000	$8000	$10000

Given a 10% discount rate, does the present value of the cash flows exceed the original cost of $23,000?
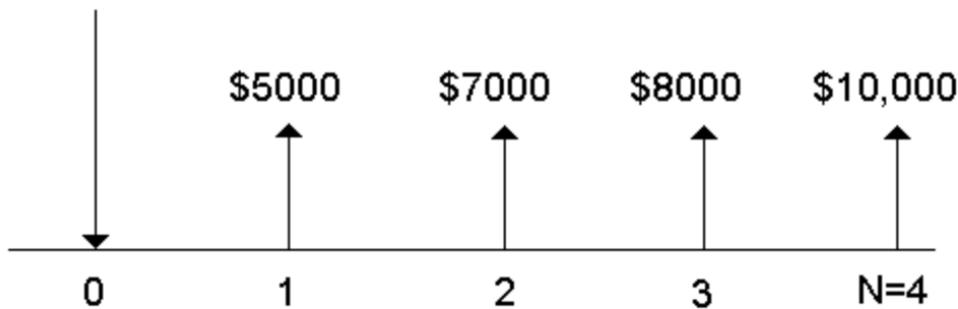
To	Press		Display
Set all variables to defaults	[2nd] [RESET] [ENTER]	RST	0.00
Enter interest rate per cash flow period	10 [I/Y]	I/Y=	10.00◁
Enter 1st cash flow	5000 [+/−] [FV]	FV=	-5,000.00◁
Enter 1st cash flow period	1 [N]	N=	1.00◁

To	Press		Display
Compute present value of 1st cash flow	CPT PV	**PV=**	**4,545.45**∗
Store in **M1**	STO 1		**4,545.45**
Enter 2nd cash flow	7000 +/− FV	**FV=**	**-7,000.00**◁
Enter 2nd cash flow period	2 N	**N=**	**2.00**◁
Compute present value of 2nd cash flow	CPT PV	**PV=**	**5,785.12**∗
Sum to memory	STO + 1		**5,785.12**
Enter 3rd cash flow.	8000 +/− FV	**FV=**	**-8,000.00**◁
Enter period number.	3 N	**N=**	**3.00**◁
Compute present value of 3rd cash flow.	CPT PV	**PV=**	**6,010.52**∗
Sum to memory.	STO + 1		**6,010.52**
Enter 4th cash flow.	10000 +/− FV	**FV=**	**-10,000.00**◁
Enter period number.	4 N	**N=**	**4.00**◁
Compute present value of 4th cash flow.	CPT PV	**PV=**	**6,830.13**∗
Sum to memory.	STO + 1		**6,830.13**
Recall total present value.	RCL 1		**23,171.23**
Subtract original cost.	− **23000** =		**171.23**

Answer: The present value of the cash flows is $23,171.23, which exceeds the machine's cost by $171.23. This is a profitable investment.

Note: Although variable cash flow payments are not equal (unlike annuity payments), you can solve for the present value by treating the cash flows as a series of compound interest payments.

The present value of variable cash flows is the value of cash flows occurring at the end of each payment period discounted back to the beginning of the first cash flow period (time

$$PV = ?$$
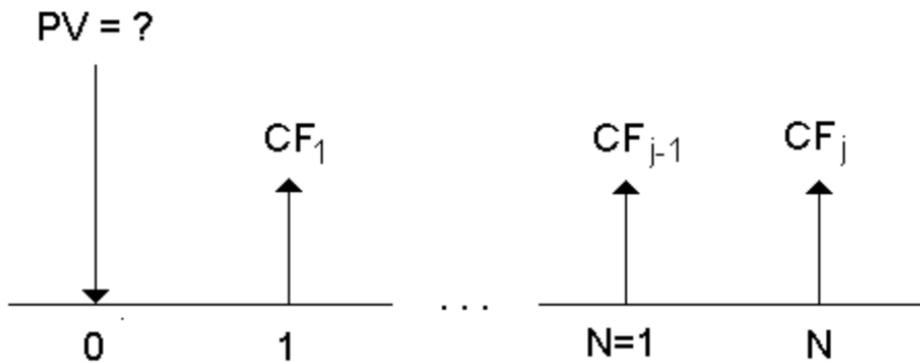
Example: Computing Present Value of a Lease With Residual Value

The Peach Bright Company wants to purchase a machine currently leased from your company. You offer to sell it for the present value of the lease discounted at an annual interest rate of 22% compounded monthly. The machine has a residual value of $6500 with 46 monthly payments of $1200 remaining on the lease. If the payments are due at the beginning of each month, how much should you charge for the machine?

The total value of the machine is the present value of the residual value plus the present value of the lease payments.

To	Press		Display
Set all variables to defaults.	[2nd] [RESET] [ENTER]	RST	0.00
Set beginning-of-period payments.	[2nd] [BGN] [2nd] [SET]	BGN	
Return to standard-calculator mode.	[2nd] [QUIT]		0.00
Enter number of payments.	46 [N]	N=	46.00◁
Calculate and enter periodic interest rate.	22 [÷] 12 [=] [I/Y]	I/Y=	1.83◁
Enter residual value of asset.	6500 [+/−] [FV]	FV=	-6,500.00◁
Compute residual present value.	[CPT] [PV]	PV=	2,818.22*
Enter lease payment amount.	1200 [+/−] [PMT]	PMT=	-1,200.00◁
Compute present value of lease payments.	[CPT] [PV]	PV=	40,573.18*

Answer: Peach Bright should pay your company $40,573.18 for the machine.

Example: Computing Other Monthly Payments

If you finance the purchase of a new desk and chair for $525 at 20% APR compounded monthly for two years, how much is the monthly payment?
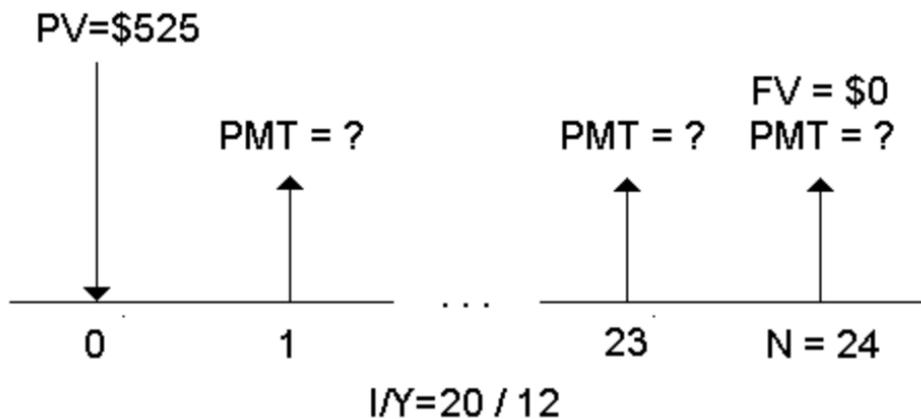
PV=$525

PMT = ?

FV = $0
PMT = ?   PMT = ?

0   1   . . .   23   N = 24

I/Y=20 / 12

To	Press		Display
Set all variables to defaults.	[2nd] [RESET] [ENTER]	RST	0.00
Set payments per year to 12.	[2nd] [P/Y] **12** [ENTER]	P/Y=	12.00◁
Return to standard-calculator mode	[2nd] [QUIT]		0.00
Enter number of payments using payment multiplier.	**2** [2nd] [xP/Y] [N]	N=	24.00◁
Enter interest rate.	**20** [I/Y]	I/Y=	20.00◁
Enter loan amount.	**525** [PV]	PV=	525.00◁
Compute payment.	[CPT] [PMT]	PMT=	-26.72*

Answer: Your monthly payment is $26.72.

Example: Saving With Monthly Deposits

Note: Accounts with payments made at the beginning of the period are referred to as *annuity due* accounts. Interest begins accumulating earlier and produces slightly higher yields.

You invest $200 at the beginning of each month in a retirement plan. What will the account balance be at the end of 20 years, if the fund earns an annual interest of 7.5 % compounded monthly, assuming beginning-of-period payments?

To	Press		Display
Set all variables to defaults.	[2nd] [RESET] [ENTER]	**RST**	**0.00**
Set payments per year to 12.	[2nd] [P/Y] **12** [ENTER]	**P/Y=**	**12.00◁**
Set beginning-of-period payments.	[2nd] [BGN] [2nd] [SET]	**BGN**	
Return to standard-calculator mode.	[2nd] [QUIT]		**0.00**
Enter number of payments using payment multiplier.	**20** [2nd] [xP/Y] [N]	**N=**	**240.00◁**
Enter interest rate.	**7.5** [I/Y]	**I/Y=**	**7.50◁**
Enter amount of payment.	**200** [+/−] [PMT]	**PMT=**	**-200.00◁**
Compute future value.	[CPT] [FV]	**FV=**	**111,438.31→**

$$\text{Interest (I/Y)} = 7.5\%$$

$$\text{Number of Payments (N)} = 240$$

FV =

. . .
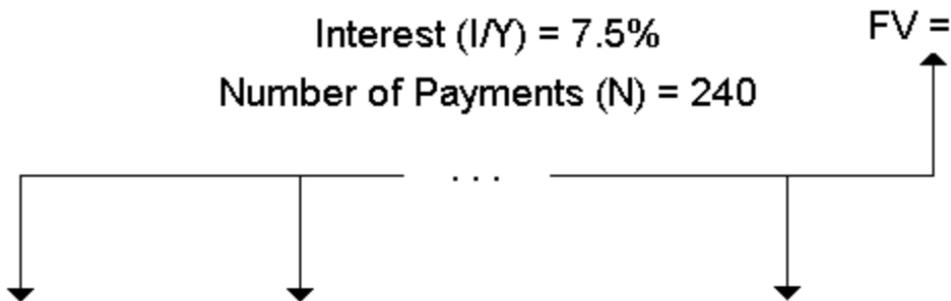
Payment Amount (PMT) = $200

Answer: Depositing $200 at the beginning of each month for 20 years results in a future amount of $111,438.31.

Example: Computing Amount to Borrow and Down Payment

You consider buying a car for $15,100. The finance company charges 7.5% APR compounded monthly on a 48-month loan. If you can afford a monthly payment of $325, how much can you borrow? How much do you need for a down payment?

$$PV = \$$$

$$\$325 \qquad \$325 \qquad \$325 \qquad FV = \$0$$

$$0 \qquad 1 \qquad \cdots \qquad 47 \qquad N = 48$$

$$I/Y = 7.5 / 12$$

To	Press		Display
Set all variables to defaults.	[2nd] [RESET] [ENTER]	**RST**	**0.00**
Set payments per year to 12.	[2nd] [P/Y] **12** [ENTER]	**P/Y=**	**12.00**◁
Return to standard-calculator mode	[2nd] [QUIT]		**0.00**
Enter number of payments using payment multiplier.	**4** [2nd] [xP/Y] [N]	**N=**	**48.00**◁
Enter interest rate.	**7.5** [I/Y]	**I/Y=**	**7.50**◁
Enter payment.	**325** [+/−] [PMT]	**PMT=**	**-325.00**◁
Compute loan amount.	[CPT] [PV]	**PV=**	**13,441.47** *
Compute down payment	[+] **15,100** [+/−] [=]		**-1,658.53**

Answer: You can borrow $13,441.47 with a down payment of $1,658.53.

Example: Computing Regular Deposits for a Specified Future Amount

You plan to open a savings account and deposit the same amount of money at the beginning of each month. In 10 years, you want to have $25,000 in the account.

How much should you deposit if the annual interest rate is 0.5% with quarterly compounding?

Note: Because **C/Y** (compounding periods per year) is automatically set to equal **P/Y** (payments per year), you must change the **C/Y** value.

To	Press		Display
Set all variables to defaults	[2nd] [RESET] [ENTER]	**RST**	**0.00**
Set payments per year to 12.	[2nd] [P/Y] **12** [ENTER]	**P/Y=**	**12.00◁**
Set compounding periods to 4.	[↓] **4** [ENTER]	**C/Y=**	**4.00◁**
Set beginning-of-period payments.	[2nd] [BGN] [2nd] [SET]	**BGN**	
Return to standard-calculator mode.	[2nd] [QUIT]		**0.00**
Enter number of deposits using payment multiplier.	**10** [2nd] [xP/Y] [N]	**N=**	**120.00◁**
Enter interest rate.	**.5** [I/Y]	**I/Y=**	**0.50◁**
Enter future value.	**25,000** [FV]	**FV=**	**25,000.00◁**
Compute deposit amount.	[CPT] [PMT]	**PMT=**	**-203.13**∗

Answer: You must make monthly deposits of $203.13.

Example: Computing Payments and Generating an Amortization Schedule

This example shows you how to use the TVM and Amortization worksheets to calculate the monthly payments on a 30-year loan and generate an amortization schedule for the first three years of the loan.

Computing Mortgage Payments

Calculate the monthly payment with a loan amount of $120,000 and 6.125% APR.

To	Press		Display
Set all variables to defaults	[2nd] [RESET] [ENTER]	**RST**	**0.00**
Set payments per year to 12	[2nd] [P/Y] **12** [ENTER]	**P/Y=**	**12.00◁**
Return to standard-calculator mode	[2nd] [QUIT]		**0.00**
Enter number of payments using payment multiplier	**30** [2nd] [xP/Y] [N]	**N=**	**360.00◁**
Enter interest rate	**6.125** [I/Y]	**I/Y=**	**6.13◁**
Enter loan amount	**120000** [PV]	**PV=**	**120,000.00◁**
Compute payment	[CPT] [PMT]	**PMT=**	**-729.13**∗

Answer: The computed monthly payment, or outflow, is $729.13.

Generating an Amortization Schedule

Generate an amortization schedule for the first three years of the loan. If the first payment is in April, the first year has nine payment periods. (Following years have 12 payment periods each.)

To	Press		Display
Select the Amortization worksheet	[2nd] [AMORT]	**P1=**	current value
Set beginning period to 1	**1** [ENTER]	**P1=**	1.00
Set ending period to 9	[↓] **9** [ENTER]	**P2=**	9.00◁
Display 1st year amortization data	[↓] [↓] [↓]	**BAL=** **PRN=** **INT=**	118,928.63* -1071.37* -5,490.80*
Change beginning period to 10	[↓] **10** [ENTER]	**P1=**	10.00◁
Change ending period to 21	[↓] **21** [ENTER]	**P2=**	21.00◁
Display 2nd year amortization data	[↓] [↓] [↓]	**BAL=** **PRN=** **INT=**	117,421.60* -1,507.03* -7,242.53*
Move to **P1** and press [CPT] to enter next range of payments	[↓] [CPT]	**P1=**	22.00◁
Display **P2**	[↓]	**P2=**	33.00◁
Display 3rd year amortization data	[↓] [↓] [↓]	**BAL=** **PRN=** **INT=**	115,819.62* -1601.98* -7,147.58*

Example: Computing Payment, Interest, and Loan Balance After a Specified Payment

A group of sellers considers financing the sale price of a property for $82,000 at 7% annual interest, amortized over a 30-year term with a balloon payment due after five years. They want to know:

• Amount of the monthly payment

• Amount of interest they will receive

• Remaining balance at the end of the term (balloon payment)

Computing the Monthly Payment

To	Press		Display
Set all variables to defaults	2nd [RESET] ENTER	**RST**	**0.00**
Set payments per year to 12	2nd [P/Y] **12** ENTER	**P/Y=**	**12.00◁**
Return to standard-calculator mode	2nd [QUIT]		**0.00**
Enter number of payments using payment multiplier	**30** 2nd [xP/Y] N	**N=**	**360.00◁**
Enter interest rate	**7** I/Y	**I/Y=**	**7.00◁**
Enter loan amount	**82000** PV	**PV=**	**82,000.00◁**
Compute payment	CPT PMT	**PMT=**	**-545.55→**

Generating an Amortization Schedule for Interest and Balloon Payment

To	Press		Display
Select Amortization worksheet	2nd [AMORT]	**P1=**	**1.00**
Enter end period (five years)	↓ **5** 2nd [xP/Y] ENTER	**P2=**	**60.00◁**
View balance due after five years (balloon payment)	↓	**BAL=**	**77,187.72→**
View interest paid after five years	↓ ↓	**INT=**	**-27,920.72→**

If the sellers financed the sale, they would receive:

- Monthly payment: $545.55 for five years
- Interest: $27,790.72 over the five years
- Balloon payment: $77,187.72

Cash Flow Worksheet

Use the Cash Flow worksheet to solve problems with unequal cash flows.

To solve problems with equal cash flows, use the TVM worksheet. Time-Value-of-Money and Amortization Worksheets

- To access the Cash Flow worksheet and initial cash flow value (**CFo**), press [CF].
- To access the cash flow amount and frequency variables (**C**nn/**F**nn), press [↓] or [↑].
- To access the discount rate variable (**I**), press [NPV].
- To compute net present value (**NPV**), press [↓] or [↑] and [CPT] for each variable.
- To compute the internal rate of return (**IRR**), press [IRR].

Cash Flow Worksheet Variables

Variable	Key	Display	Variable Type**
Initial cash flow	[CF]	**CFo**	Enter-only
Amount of *n*th cash flow	[↓]	**C**nn*	Enter-only
Frequency of *n*th cash flow	[↓]	**F**nn*	Enter-only
Discount rate	[NPV]	**I**	Enter-only
Net present value	[↓] [CPT]	**NPV**	Compute-only
Internal rate of return	[IRR]	**IRR**	Compute-only

* *nn* represents the cash flow (**C01**–**C24**) or frequency (**F01**–**F24**) number.

Resetting Variables

- To reset **CFo**, **C**nn, and **F**nn to default values, press [CF] and then [2nd] [CLR WORK].
- To reset **NPV** to the default value, press [NPV] and then [2nd] [CLR WORK].
- To reset **IRR** to the default value, press [IRR] and then [2nd] [CLR WORK].
- To reset all calculator variables and formats to default values, including all Cash Flow worksheet variables, press [2nd] [RESET] [ENTER].

Entering Cash Flows

- You must enter an initial cash flow (**CFo**). The calculator accepts up to 24 additional cash flows (**C01**–**C24**). Each cash flow can have a unique value.
- Enter positive values for cash inflows (cash received) and negative values for cash outflows (cash paid out). To enter a negative value, key in a number and press [+/−].
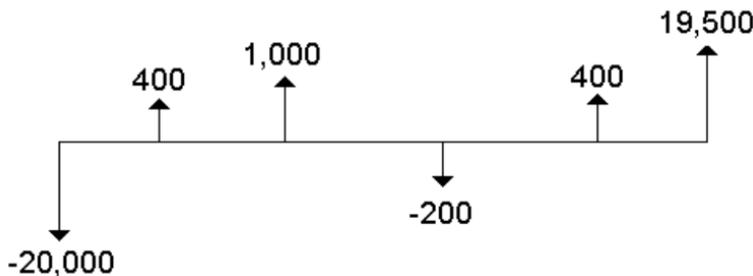
Inserting and Deleting Cash Flows

The calculator displays **INS** or **DEL** to confirm that you can press [2nd] [INS] or [2nd] [DEL] to insert or delete cash flows.

Uneven and Grouped Cash Flows

Uneven Cash Flows

The Cash Flow worksheet analyzes unequal cash flows over equal time periods. Cash-flow values can include both inflows (cash received) and outflows (cash paid out).

All cash-flow problems start with an initial cash flow labeled **CFo**. **CFo** is always a known, entered value.

Grouped Cash Flows

Cash-flow problems can contain cash flows with unique values as well as consecutive cash flows of equal value.

Although you must enter unequal cash flows separately, you can enter groups of consecutive, equal cash flows simultaneously using the **F*nn*** variable.

Entering Cash Flows

Cash flows consist of an initial cash flow (**CFo**) and up to 24 additional cash flows (**C01**-**C24**), each of which can have a unique value. You must enter the number of occurrences (up to 9,999), or *frequency* (**F**), for each additional cash flow (**C01**-**C24**).

•   The calculator displays positive values for inflows (cash received) and negative values for outflows (cash paid out).

•   To clear the Cash Flow worksheet, press [2nd] [CLR WORK].

To enter cash flows:

1.   Press [CF]. The initial cash-flow value (**CFo**) appears.

2.   Key in a value for **CFo** and press [ENTER].

3.   To select an additional cash-flow variable, press [↓]. The **C01** value appears.

4. To change **C01**, key in a value and press ENTER.

5. To select the cash-flow frequency variable (**F01**), press ⬇. The **F01** value appears.

6. To change **F01**, key in a value and press ENTER.

7. To select an additional cash-flow variable, press ⬇. The **C02** value appears.

8. Repeat steps 4 through 7 for all remaining cash flows and frequencies.

9. To review entries, press ⬇ or ⬆.

Deleting Cash Flows

When you delete a cash flow, the calculator decreases the number of subsequent cash flows automatically.
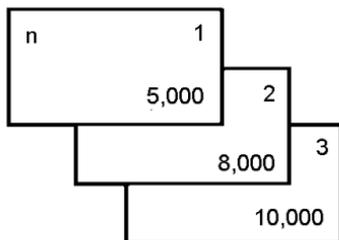
Before deleting
$8,000 cash flow
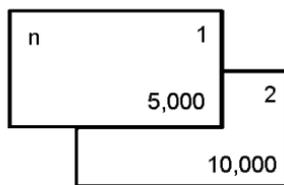
After deleting
$8,000 cash flow

The **DEL** indicator confirms that you can delete a cash flow.

1. Press ⬇ or ⬆ until the cash flow you want to delete appears.

2. Press 2nd DEL. The cash flow you specified and its frequency is deleted.

Inserting Cash Flows

When you insert a cash flow, the calculator increases the number of the following cash flows, up to the maximum of 24.
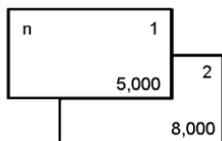
Before inserting
$7,000 cash flow
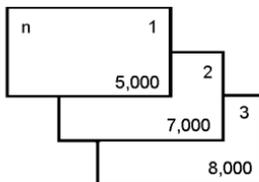
After inserting
$7,000 cash flow

Note: The **INS** indicator confirms that you can insert a cash flow.

1. Press ⬇ or ⬆ to select the cash flow where you want to insert the new one. For example, to insert a new second cash flow, select **C02**.

2. Press [2nd] [INS].

3. Key in the new cash flow and press [ENTER]. The new cash flow is entered at **C02**.

Computing Cash Flows

The calculator solves for these cash-flow values:

- Net present value (**NPV)** is the total *present* value of all cash flows, including inflows (cash received) and outflows (cash paid out). A positive **NPV** value indicates a profitable investment.

- Internal rate of return (**IRR**) is the interest rate at which the net present value of the cash flows is equal to 0.

Computing NPV

1. Press [NPV] to display the current discount rate (**I**).

2. Key in a value and press [ENTER].

3. Press [↓] to display the current net present value (**NPV**).

4. To compute the net present value for the series of cash flows entered, press [CPT].

Computing IRR

1. Press [IRR]. The **IRR** variable and current value are displayed (based on the current cash-flow values).

2. To compute the internal rate of return, press [CPT]. The calculator displays the **IRR** value.

When solving for **IRR**, the calculator performs a series of complex, iterative calculations that can take seconds or even minutes to complete. The number of possible **IRR** solutions depends on the number of sign changes in your cash-flow sequence.

- When a sequence of cash flows has no sign changes, no **IRR** solution exists. The calculator displays **Error 5**.
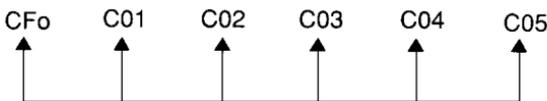
- When a sequence of cash flows has only one sign change, only one **IRR** solution exists, which the calculator displays.
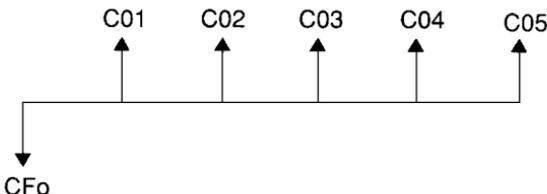
- When a sequence of cash flows has two or more sign changes:
    - At least one solution exists.
    - As many solutions can exist as there are sign changes.

    When more than one solution exists, the calculator displays the one closest to zero. Because the displayed solution has no financial meaning, you should use caution in making investment decisions based on an **IRR** computed for a cash-flow stream with more than one sign change.

    The time line reflects a sequence of cash flows with three sign changes, indicating that one, two, or three **IRR** solutions can exist.
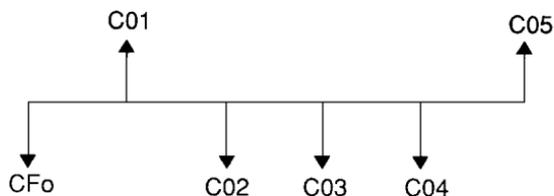
- When solving complex cash-flow problems, the calculator might not find **IRR**, even if a solution exists. In this case, the calculator displays **Error 7** (iteration limit exceeded).

Example: Solving for Unequal Cash Flows

These examples show you how to enter and edit unequal cash-flow data to calculate:

- Net present value (**NPV**)
- Internal rate of return (**IRR**)

A company pays $7,000 for a new machine, plans a 20% annual return on the investment, and expects these annual cash flows over the next six years:

Year	Cash Flow Number	Cash Flow Estimate
Purchase	**CFo**	-$7,000
1	**C01**	3,000
2–5	**C02**	5,000 each year
6	**C03**	4,000

As the time line shows, the cash flows are a combination of equal and unequal values. As an outflow, the initial cash flow (**CFo**) appears as a negative value.

F02 = 4

CFo = −7,000
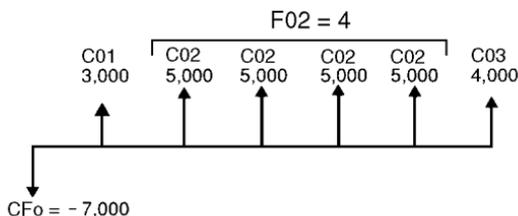
Entering Cash-Flow Data

To	Press		Display
Select Cash Flow worksheet.	CF	CFo=	0.00
Enter initial cash flow.	7000 +/− ENTER	CFo=	-7,000.00◁
Enter cash flow for first year.	↓ 3000 ENTER ↓	C01= F01=	3,000.00◁ 1.00◁
Enter cash flows for years two through five.	↓ 5000 ENTER ↓ 4 ENTER	C02= F02=	5,000.00◁ 4.00◁
Enter cash flow for sixth year.	↓ 4000 ENTER ↓	C03= F03=	4,000.00◁ 1.00◁

Editing Cash-Flow Data

After entering the cash-flow data, you learn that the $4,000 cash-flow value should occur in the second year instead of the sixth. To edit, delete the $4,000 value for year 6 and insert it for year 2.

To	Press	Display	
Move to third cash flow.	↑	C03=	4,000.00◁
Delete third cash flow.	2nd [DEL]	C03=	0.00
Move to second cash flow.	↑ ↑	C02=	5,000.00◁
Insert new second cash flow.	2nd [INS] 4000 ENTER ↓	C02= F02=	4,000.00◁ 1.00◁
Move to next cash flow to verify data.	↓ ↓	C03= F03=	5,000.00◁ 4.0◁

Computing NPV

Use an interest rate per period (**I**) of 20%.

To	Press	Display	
Access interest rate variable	[NPV]	**I=**	**0.00**
Enter interest rate per period.	**20** [ENTER]	**I=**	**20.00**◁
Compute net present value.	[↓] [CPT]	**NPV=**	**7,266.44**∗

Answers: NPV is $7,266.44.

Computing IRR

To	Press	Display	
Access **IRR**.	[IRR]	**IRR=**	**0.00**
Compute internal rate of return.	[CPT]	**IRR=**	**52.71**∗

Answer: IRR is 52.71%.

Example: Value of a Lease with Uneven Payments

A lease with an uneven payment schedule usually accommodates seasonal or other anticipated fluctuations in the lessee's cash position.

A 36-month lease has the following payment schedule and beginning-of-period payments.

Number of Months	Payment Amount
4	$0
8	$5000
3	$0
9	$6000
2	$0
10	$7000

If the required earnings rate is 10% per 12-month period with monthly compounding:

• What is the present value of these lease payments?

• What even payment amount at the beginning of each month would result in the same present value?

Because the cash flows are uneven, use the Cash Flow worksheet to determine the net present value of the lease.

Computing NPV

The cash flows for the first four months are stated as a group of four $0 cash flows. Because the lease specifies beginning-of-period payments, you must treat the first cash flow in this group as the initial investment (**CFo**) and enter the remaining three cash flows on the cash flow screens (**C01** and **F01**).

Note: The BGN/END setting in the TVM worksheet does not affect the Cash Flow worksheet.

```
NPV =                    Interest (I) =

        C01      C02      C03      C04      C05      C06
        $0       $500     $0       $600     $0       $700
       ─┼────────┼────────┼────────┼────────┼────────┼────
        F01 =    F02 =    F03 =    F04 =    F05 =    F06 =

CFo = $0
```
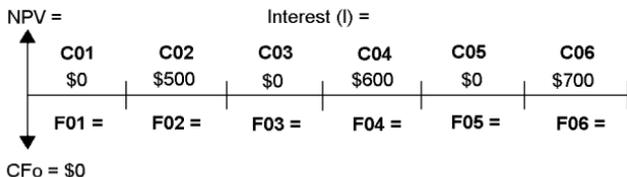
To	Press		Display
Set all variables to defaults.	[2nd] [RESET] [ENTER]	RST	0.00
Select Cash Flow worksheet.	[CF]	CFo=	0.00
Enter first group of cash flows.	[↓] [↓] 3 [ENTER]	C01= F01=	0.00◁ 3.00◁
Enter second group of cash flows.	[↓] 5000 [+/−] [ENTER] [↓] 8 [ENTER]	C02= F02=	-5000.00 ◁ 8.00◁
Enter third group of cash flows.	[↓] [↓] 3 [ENTER]	C03= F03=	0.00 ◁ 3.00◁
Enter fourth group of cash flows.	[↓] 6000 [+/−] [ENTER] [↓] 9 [ENTER]	C04= F04=	-6000.00◁ 9.00◁
Enter fifth group of cash flows.	[↓] [↓] 2 [ENTER]	C05= F05=	0.00◁ 2.00 ◁
Enter sixth group of cash flows.	[↓] 7000 [+/−] [ENTER] [↓] 10 [ENTER]	C06= F06=	-7000.00◁ 10.00◁
Select **NPV**.	[NPV]	I=	0.00
Enter monthly earnings rate.	10 [÷] 12 [ENTER]	I=	0.83◁
Compute **NPV**.	[↓] [CPT]	NPV=	-138,088.44*

Bond Worksheet
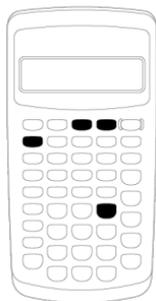
The Bond worksheet lets you compute bond price, yield to maturity or call, and accrued interest.

You can also use the date functions to price bonds purchased on dates other than the coupon anniversary.

- To access the Bond worksheet, press 2nd [BOND].
- To access bond variables, press ↑ or ↓.
- To change the options for day-count methods (**ACT** and **360**) and coupons per year (**2/Y** and **1/Y**), press 2nd [SET] once for each option.

Note: Pressing ↓ or ↑ to navigate through the Bond worksheet before you enter values causes an error (**Error 6**). To clear the error, press CE/C.

Bond Worksheet Variables

Variable	Key	Display	Variable Type
Settlement date	2nd [BOND]	**SDT**	Enter only
Annual coupon rate in percent	↓	**CPN**	Enter only
Redemption date	↓	**RDT**	Enter only
Redemption value (percentage of par value)	↓	**RV**	Enter only
Actual/actual day-count method	↓	**ACT**	Setting
30/360 day-count method	2nd [SET]	**360**	Setting
Two coupons per year	↓	**2/Y**	Setting
One coupon per year	2nd [SET]	**1/Y**	Setting
Yield to redemption	↓	**YLD**	Enter/compute
Dollar price	↓	**PRI**	Enter/compute
Accrued interest	↓	**AI**	Auto-compute

Resetting Bond Worksheet Variables

- To reset the Bond worksheet variables to default values, press 2nd [CLR WORK] while in the Bond worksheet.

Variable	Default	Variable	Default
SDT	12-31-1990	**ACT/360**	**ACT**

Variable	Default	Variable	Default
CPN	0	2/Y, 1/Y	2/Y
RDT	12-31-1990	YLD	0
RV	100	PRI	0

• To reset all calculator variables and formats to default values, including the Bond worksheet variables, press [2nd] [RESET] [ENTER].

Entering Dates

• Use the following convention to key in dates: *mm.ddyy* or *dd.mmyy*. After keying in the date, press [ENTER].

   Note: You can display dates in either US or European format. Setting Calculator Formats

• You can enter dates from January 1, 1980 through December 31, 2079.

• The calculator assumes that the redemption date (**RDT**) coincides with a coupon date:
   • To compute *to maturity*, enter the maturity date for **RDT**.
   • To compute *to call*, enter the call date for **RDT**.

Entering CPN

CPN represents the annual coupon rate as a percentage of the bond par value rather than the dollar amount of the coupon payment.

Entering RV

The redemption value (**RV**) is a percentage of the bond par value:

• For *to maturity* analysis, enter 100 for **RV**.

• For *to call* analysis, enter the call price for **RV**.

Setting the Day-Count Method

1. To display the day-count method, press [↓] until **ACT** or **360** appears.

2. To change the day-count method, press [2nd] [SET].

Setting the Coupon Frequency

1. To display the coupon frequency, press [↓] until **1/Y** or **2/Y** appears.

2. To change the coupon frequency, press [2nd] [SET].

Bond Worksheet Terminology

Term	Definition
Call Date	A callable bond bond can be retired by the issuing agency before the maturity date. The call date for such a bond is printed in the bond contract.

Term	Definition
Coupon Payment	The periodic payment made to the owner of the bond as interest.
Coupon Rate	The annual interest rate printed on the bond.
Dollar Price	Price of the security expressed in terms of dollars per $100 of par value.
Par (Face) Value	The value printed on the bond.
Premium Bond	A bond that sells for an amount greater than the par value.
Discount Bond	A bond selling for less than the par value.
Redemption Date	The date on which the issuing agency retires the bond. This date can be the date of maturity or, for a callable bond, the call date.
Redemption Value	The amount paid to the owner of a bond when retired. If the bond is redeemed at the maturity date, the redemption value is the par value printed on the bond. If the bond is redeemed at a call date, the redemption value is the bond's par value plus any call premium. The calculator treats the redemption value in terms of dollars per $100 of par value.
Settlement Date	The date on which a bond is exchanged for funds.
Yield to Maturity	The rate of return earned from payments of principal and interest, with interest compounded semiannually at the stated yield rate. The yield to maturity takes into account the amount of premium or discount, if any, and the time value of the investment.

Entering Bond Data and Computing Results

To compute values for price (**PRI**) or yield (**YLD**) and accrued interest (**AI**), first enter the four known values for settlement date (**SDT**), coupon rate (**CPN**), redemption date (**RDT**), and redemption value (**RV**).

If necessary, change the day-count method (**ACT** or **360**) and coupon-frequency (**2/Y** or **1/Y**). The Bond worksheet stores all values and settings until you clear the worksheet or change the values and settings.

Entering Known Bond Values

1. Press [2nd] [BOND]. The current **SDT** value appears.
2. To clear the worksheet, press [2nd] [CLR WORK].
3. If necessary, key in a new **SDT** value and press [ENTER].
4. Repeat step 3 for **CPN**, **RDT**, and **RV**, pressing [↓] once for each variable.

Note: To enter dates, use this convention: mm.ddyy (US) or dd.mmyy (European).

Setting the Bond Day-Count Method and Coupon Frequency

1. To display the day-count method, press ⬇ until **ACT** or **360** appears.

2. To change the day-count method, press [2nd] [SET].

3. To display the coupon frequency, press ⬇ until **2/Y** or **1/Y** appears.

4. To change the coupon frequency, press [2nd] [SET].

Computing the Bond Price (PRI)

1. Press ⬇ until **YLD** appears.

2. Key in a value for **YLD** and press [ENTER].

3. Press ⬇ to display **PRI**, and then press [CPT]. The calculator displays the computed **PRI** value.

Computing the Bond Yield (YLD)

1. Press ⬇ until **PRI** appears.

2. Key in a value for **PRI** and press [ENTER].

3. Press ⬇ to display **YLD**, and then press [CPT]. The calculator displays the computed **YLD** value.

Computing Accrued Interest (AI)

To compute accrued interest, press ⬇ until the **AI** variable appears. The calculator automatically computes **AI** in terms of dollars per $100 of par value.

Example: Computing Bond Price and Accrued Interest

You consider buying a semiannual corporate bond maturing on December 31, 2005 and settling on June 12, 2004. The bond is based on the 30/360 day-count method with a coupon rate of 7%, redeemable at 100% of par value. For an 8% yield to maturity, compute the bond's price and accrued interest.

Computing Bond Price and Accrued Interest

To	Press	Display	
Select Bond worksheet.	[2nd] [BOND]	**SDT =**	**12-31-1990**◁
Enter settlement date.	**6.1206** [ENTER]	**SDT =**	**6-12-2006**◁
Enter coupon rate.	⬇ **7** [ENTER]	**CPN =**	**7.00**◁
Enter redemption date.	⬇ **12.3107** [ENTER]	**RDT =**	**12-31-2007**◁
Leave redemption value as is.	⬇	**RV =**	**100.00**
Select 30/360 day-count method.	⬇ [2nd] [SET]	**360**	
Leave two coupon payments per year.	⬇	**2/Y**	
Enter yield.	⬇ **8** [ENTER]	**YLD =**	**8.00**◁

To	Press	Display	
Compute price	↓ CPT	**PRI =**	**98.56**∗
View accrued interest.	↓	**AI =**	**3.15**∗

Answer: The bond price is $98.56 per 100. The accrued interest is $3.15 per 100.

Depreciation Worksheet

The Depreciation worksheet lets you generate a depreciation schedule using your choice of depreciation methods.

- To access the Depreciation worksheet, press [2nd] [DEPR].

- To change depreciation methods, press [2nd] [SET] until the desired method appears.

- To access other depreciation variables, press [↓] or [↑].

  Note: To easily scroll up or down through a range of variables, press and hold [↓] or [↑].

Depreciation Worksheet Variables

Variable	Key	Display	Variable Type**
Straight-line method	[2nd] [DEPR]	**SL**	Setting
Sum-of-the-years'-digits method	[2nd] [SET]	**SYD**	Setting
Declining-balance method	[2nd] [SET]	**DB**	Setting/Enter
Declining-balance method with crossover to **SL** method	[2nd] [SET]	**DBX**	Setting/Enter
French straight-line method*	[2nd] [SET]	**SLF**	Setting/Enter
French declining balance method*	[2nd] [SET]	**DBF**	Setting/Enter
Life of the asset in years	[↓]	**LIF**	Enter only
Starting month	[↓]	**M01**	Enter only
Starting date for French straight-line method**	[↓]	**DT1**	Enter only
Cost of the asset	[↓]	**CST**	Enter only
Salvage value of the asset	[↓]	**SAL**	Enter only
Year to compute	[↓]	**YR**	Enter only
Depreciation for the year	[↓]	**DEP**	Auto-compute
Remaining book value at the end of the year	[↓]	**RBV**	Auto-compute
Remaining depreciable value	[↓]	**RDV**	Auto-compute

* SLF and DBF are available only if you select the European format for dates or separators in numbers. Setting Calculator Formats

** This guidebook categorizes variables by their method of entry. Types of Worksheet Variables

Resetting the Depreciation Worksheet Variables

• To reset all calculator variables and formats to default values, including the Depreciation worksheet variables, press [2nd] [RESET] [ENTER].

Variable	Default	Variable	Default
Depreciation method	**SL**	**M01**	1
DB	**200**	**YR**	1
DBX	**200**	**CST**	0
LIF	**1**	**SAL**	0

• To clear only the **LIF**, **YR**, **CST**, and **SAL** Depreciation worksheet variables and reset default values without affecting the depreciation method or other calculator variables and formats, press [2nd] [CLR WORK] while in the Depreciation worksheet.

Computing Values for DEP, RBV, and RDV

• The calculator computes one year at a time and rounds the results to the number of decimal places set. Setting Calculator Formats

• The calculator computes values for **DEP, RBV**, and **RDV** automatically when you press [↓] to display each variable.

Entering Values for DB and DBX

If you choose either the declining balance (**DB**) or declining balance with crossover to **SL** (**DBX**) depreciation method, remember to enter a value representing the percent of declining balance for the **DB** or **DBX** variable.

Note: The declining balance you enter must be a positive number.

Entering Values for LIF

• If **SL** or **SLF** is selected, the **LIF** value must be a positive real number.

• If **SYD**, **DB**, **DBX**, or **DBF** is selected, the **LIF** value must be a positive integer.

Entering Values for M01

The value you enter for the starting month (**M01**) has two parts:

• The integer portion represents the month in which the asset is placed into service.

• The decimal portion represents the fraction of the initial month in which the asset begins to depreciate.

For example, to specify that the asset will begin to depreciate in the middle of the first month, enter 1.5. To specify that the asset will begin to depreciate a quarter of the way through the fourth month, enter 4.25.

Working with YR

- When computing depreciation, the value you enter for the year-to-compute (**YR**) variable must be a positive integer.

- If the remaining depreciable value (**RDV**) variable is displayed, you can press $\boxed{\downarrow}$ to return to the year to compute (**YR**) variable. To represent the next depreciation year, press $\boxed{\text{CPT}}$ to increment the value for **YR** by one.

- To compute a depreciation schedule, repeatedly return to the year to compute (**YR**) variable, press $\boxed{\text{CPT}}$ to increment the value for **YR**, and compute values for **DEP**, **RBV**, and **RDV**. The schedule is complete when **RDV** equals zero.

Entering Data and Computing Results

Because the Depreciation worksheet stores values and settings until you either change them or clear the worksheet, you should not have to perform every step each time you work a problem.

Selecting a Depreciation Method

1. To access the Depreciation worksheet, press $\boxed{\text{2nd}}$ $\boxed{\text{DEPR}}$. The current depreciation method is displayed.

2. To clear the worksheet, press $\boxed{\text{2nd}}$ $\boxed{\text{CLR WORK}}$.

3. Press $\boxed{\text{2nd}}$ $\boxed{\text{SET}}$ until you display the depreciation method you want (**SL**, **SLF**, **SYD**, **DB**, **DBX**, or **DBF**).

   Note: If you select **DB** or **DBX**, you must either key in a value or accept the default of 200.

Entering Depreciation Data

1. To display **LIF**, press $\boxed{\downarrow}$.

2. Key in a value for **LIF** and press $\boxed{\text{ENTER}}$.

3. Repeat steps 1 and 2 for **M01**, **DT1** (if **SLF**), **CST**, **SAL**, and **YR**.

Note: To select **SLF** or **DBF**, you must set either the European date or European separator format first. Setting Calculator Formats

Computing Results for DEP, RBV, and RDV

After entering the data, press $\boxed{\downarrow}$ once for each of the **DEP**, **RBV**, and **RDV** variables to display the computed values.

Note: The ∗ _ indicator confirms that the displayed value is computed.

Generating a Depreciation Schedule

To generate a depreciation schedule and compute values for other years:

1. To display **YR**, press $\boxed{\downarrow}$.

2. To increment the value by one, press $\boxed{\text{CPT}}$.

3. To compute new values for **DEP**, **RBV**, and **RDV**, press ⬇ for each variable.

Example: Computing Straight-Line Depreciation

In mid-March, a company begins depreciation of a commercial building with a 31½ year life and no salvage value. The building cost $1,000,000. Use the straight-line depreciation method to compute the depreciation expense, remaining book value, and remaining depreciable value for the first two years.

To	Press	Display	
Access Depreciation worksheet	2nd [DEPR]	**SL**	
Enter life in years	⬇ **31.5** ENTER	**LIF =**	**31.50**◁
Enter starting month	⬇ **3.5** ENTER	**M01 =**	**3.50**◁
Enter cost	⬇ **1000000** ENTER	**CST =**	**1,000,000.00**◁
Leave salvage value as is	⬇	**SAL =**	**0.00**
Leave year as is	⬇	**YR =**	**1.00**
Display depreciation amount, remaining book value, and remaining depreciable value	⬇ ⬇ ⬇	**DEP =** **RBV =** **RDV =**	**25,132.28*** **974,867.72*** **974,867.72***
View second year	⬇ 2nd ENTER	**YR =** **YR =**	**1.00** **2.00**◁
Display second year depreciation data	⬇ ⬇ ⬇	**DEP =** **RBV =** **RDV =**	**31,746.03*** **943,121.69*** **943,121.69***

Answer: For the first year, the depreciation amount is $25,132.28, the remaining book value is $974,867.72, and the remaining depreciable value is $974,867.72.

For the second year, the depreciation amount is $31,746.03, the remaining book value is $943,121.69, and the remaining depreciable value is $943,121.69.

Statistics Worksheet

The Statistics worksheet performs analysis on one-and two-variable data with four regression analysis models.

- To enter statistical data, press 2nd [DATA].
- To choose a statistics calculation method and compute the results, press 2nd [STAT].
- To access statistics variables, press ↓ or ↑.

Statistics Worksheet Variables

Variable	Key	Display	Variable Type
Current X value	2nd [DATA]	**X***nn**	Enter-only
Current Y value	↓	**Y***nn**	Enter-only
Standard linear regression		**LIN**	Setting
Logarithmic regression		**Ln**	Setting
Exponential regression	2nd [STAT] 2nd [SET]	**EXP**	Setting
Power regression		**PWR**	Setting
One-variable statistics		**1-V**	Setting
Number of observations		**n**	Auto-compute
Mean (average) of X values		$\bar{x}$	Auto-compute
Sample standard deviation of X		**Sx**	Auto-compute
Population standard deviation of X		σx	Auto-compute
Mean (average) of Y values		$\bar{y}$**	Auto-compute
Sample standard deviation of Y		**Sy****	Auto-compute
Population standard deviation of Y		σy**	Auto-compute
Linear regression y-intercept		**a****	Auto-compute
Linear regression slope	↓ (as needed)	**b****	Auto-compute
Correlation coefficient		**r****	Auto-compute
Predicted X value		**X'****	Enter/compute
Predicted Y value		**Y'****	Enter/compute
Sum of X values		ΣX	Auto-compute
Sum of X squared values		ΣX^2	Auto-compute
Sum of Y values		ΣY**	Auto-compute
Sum of Y squared values		ΣY^2**	Auto-compute
Sum of XY products		ΣXY**	Auto-compute

* *nn* represents the number of the current X or Y value.

** Not displayed for one-variable statistics.

*** This guidebook categorizes calculator variables by their method of entry. Types of Worksheet Variables

Resetting Statistics Worksheet Variables

- To clear all **X** and **Y** values as well as all values in the statistics portion of the worksheet without affecting the statistics calculation method, press 2nd [CLR WORK] while in the data-entry portion of the worksheet (2nd [DATA]).

- To reset the statistics calculation method to **LIN** and clear all values except **X** and **Y**, press 2nd [CLR WORK] while in the calculation method and computation portion of the worksheet (2nd [STAT]).

- To reset the statistics calculation method to **LIN** and clear all values, including **X** and **Y**, press 2nd [RESET] [ENTER].

Entering Data Points

- You can enter up to 50 (*x,y*) data points.

- If you press ↓ or ↑ to move through the portion of the worksheet that displays results without entering data points, the calculator will display an error.

- When you enter data for one-variable statistics, **X*nn*** represents the value and **Y*nn*** specifies the number of occurrences (frequency).

- When you enter a value for **X*nn***, the value for **Y*nn*** defaults to 1.

Analyzing One-Variable Statistics

To analyze one-variable statistics, select **1-V**. Only values for **n**, $\bar{x}$, **Sx**, σ**X**, Σ**X**, and Σ**X₂** are computed and displayed for one-variable statistics.

Analyzing Two-Variable Statistics

You can choose from among these four regression-analysis methods:

- **LIN**

- **Ln**

- **EXP**

- **PWR**

Computing Values Automatically

Except for the predicted **X'** and **Y'** values, the calculator computes and displays values for statistics variables automatically when you access them.

Using X' and Y' for Regression Predictions

To use the **X'** and **Y'** variables for regression predictions, you either can enter a value for **X'** to compute **Y'** or enter a value for **Y'** to compute **X'**.

Regression Models

For two-variable data, the Statistics worksheet uses four regression models for curve fitting and forecasting.

Model	Formula	Restrictions
LIN	Y = a + b X	None
Ln	Y = a + b ln(X)	All X values > zero
EXP	Y = a b_x	All Y values > zero
PWR	Y = a X_b	All X and Y values > zero

The calculator interprets the **X** value as the independent variable and the **Y** value as the dependent variable.

The calculator computes the statistical results using these transformed values:

- **LIN** uses X and Y.

- **Ln** uses ln(X) and Y.

- **EXP** uses X and ln(Y).

- **PWR** uses ln(X) and ln(Y).

The calculator determines the values for **a** and **b** that create the line or curve that best fits the data.

Correlation Coefficient

The calculator also determines **r**, the correlation coefficient, which measures the goodness of fit of the equation with the data. Generally:

- The closer **r** is to 1 or –1, the better the fit.

- The closer **r** is to zero, the worse the fit.

Entering Statistical Data

Because the Statistics worksheet lets you enter and display up to 50 data points, and then stores the values until you clear the worksheet or change the values, you probably will not have to perform every step for each Statistics calculation.

1. To select the data-entry portion of the Statistics worksheet, press [2nd] [DATA]. **X01** is displayed along with any previous value.

2. To clear the worksheet, press [2nd] [CLR WORK].

3. Key in a value for **X01** and press [ENTER].

   - For one-variable data, **X01** is the first data point.

   - For two-variable data, **X01** is the first **X** value.

4. To display the **Y01** variable, press [↓].

5. Key in a value for **Y01** and press [ENTER].

   - For one-variable data, you can enter the number of times the **X** value occurs (frequency).

     The default value is 1.

- For two-variable data, enter the first **Y** value.

6. To display the next **X** variable, press $\boxed{\downarrow}$.

7. Repeat steps 3 through 5 until you enter all of the data points.

   Note: To easily scroll up or down through a range of variables, press and hold $\boxed{\downarrow}$ or $\boxed{\uparrow}$.

Computing Statistical Results

Selecting a Statistics Calculation Method

1. Press $\boxed{\text{2nd}}$ $\boxed{\text{STAT}}$ to select the statistical calculation portion of the Statistics worksheet.

2. The last selected statistics calculation method is displayed (**LIN**, **Ln**, **EXP**, **PWR**, or **1-V**).

3. Press $\boxed{\text{2nd}}$ $\boxed{\text{SET}}$ repeatedly until the statistics calculation method you want is displayed.

4. If you are analyzing one-variable data, select **1-V**.

5. Press $\boxed{\downarrow}$ to begin computing results.

Computing Results

To compute results based on the current data set, press $\boxed{\downarrow}$ repeatedly after you have selected the statistics calculation method.

The calculator computes and displays the results of the statistical calculations (except for **X'** and **Y'**) automatically when you access them.

For one-variable statistics, the calculator computes and displays only the values for **n**, $\overline{\text{x}}$, **Sx**, σ**X**, Σ**X**, and Σ**X₂**.

Computing Y'

1. To select the Statistics worksheet, press $\boxed{\text{2nd}}$ $\boxed{\text{STAT}}$.

2. Press $\boxed{\uparrow}$ or $\boxed{\downarrow}$ until **X'** is displayed.

3. Key in a value for **X'** and press $\boxed{\text{ENTER}}$.

4. Press $\boxed{\downarrow}$ to display the **Y'** variable.

5. Press $\boxed{\text{CPT}}$ to compute a predicted **Y'** value.

Computing X'

1. To select the Statistics worksheet, press $\boxed{\text{2nd}}$ $\boxed{\text{STAT}}$.

2. Press $\boxed{\uparrow}$ or $\boxed{\downarrow}$ until **Y'** is displayed.

3. Key in a value for **Y'** and press $\boxed{\text{ENTER}}$.

4. Press $\boxed{\uparrow}$ to display the **X'** variable.

5. Press $\boxed{\text{CPT}}$ to compute an **X'** value.

Other Worksheets

The calculator also includes these worksheets:

- Percent Change/Compound Interest worksheet (2nd [⊿%])
- Interest Conversion worksheet (2nd [ICONV])
- Date worksheet (2nd [DATE])
- Profit Margin worksheet (2nd [PROFIT])
- Breakeven worksheet (2nd [BRKEVN])
- Memory worksheet (2nd [MEM])

Percent Change/Compound Interest Worksheet

Use the Percent Change/Compound Interest worksheet to solve percent change, compound interest, and cost-sell-markup problems.

- To access the Percent Change/Compound Interest worksheet, press 2nd [⊿%].
- To access the Percent Change/Compound Interest variables, press ↓ or ↑.

Percent Change/Compound Interest Worksheet Variables

Variable	Key	Display	Variable Type
Old value/Cost	2nd [⊿%]	**OLD**	Enter/compute
New value/Selling price	↓	**NEW**	Enter/compute
Percent change/Percent markup	↓	**%CH**	Enter/compute
Number of periods	↓	**#PD**	Enter/compute

Note: This guidebook categorizes variables by their method of entry.

Resetting the Percent Change/Compound Interest Worksheet Variables

- To reset the Percent Change/Compound Interest variables to default values, press 2nd [CLR WORK] while in the Percent Change/Compound Interest worksheet.

Variable	Default	Variable	Default
OLD	0	**%CH**	0
NEW	0	**#PD**	0

- To reset default values for all calculator variables and formats, press 2nd [RESET] ENTER.

Entering Values

- For percent-change calculations, enter values for any two of the three variables (**OLD**, **NEW**, and **%CH**) and compute a value for the unknown variable (leave **#PD=1**). A positive percent change represents a percentage increase; a negative percent change represents a percentage decrease.

- For compound-interest calculations, enter values for the three known variables and compute a value for the unknown fourth variable.

    - **OLD** = present value
    - **NEW** = future value
    - **%CH** = interest rate per period
    - **#PD** = number of periods

- For cost-sell-markup calculations, enter values for two of the three variables (**OLD**, **NEW**, and **%CH**) and compute a value for the unknown.

    - **OLD** = cost
    - **NEW** = selling price
    - **%CH** = percent markup
    - **#PD** = **1**

Computing Values

1. To select the Percent Change/Compound Interest worksheet, press [2nd] [⌂%]. The current value for **OLD** is displayed.

2. To clear the worksheet, press [2nd] [CLR WORK].

3. To enter values for the known variables, press [↓] or [↑] until the variable you want is displayed, then key in a value, and press [ENTER]. (Do not enter a value for the variable you wish to solve.)

    - **Percent Change** — Enter values for two of these three variables: **OLD**, **NEW**, and **%CH**. Leave **#PD** set to 1.

    - **Compound Interest** — Enter values for three of these four variables: **OLD**, **NEW**, **%CH**, and **#PD**.

    - **Cost-Sell-Markup** — Enter values for two of these three variables: **OLD**, **NEW**, and **%CH**. Leave **#PD** set to 1.

4. To compute a value for the unknown variable, press [↓] or [↑] until the variable you want is displayed and press [CPT]. The calculator displays the value.

Example: Computing Percent Change

First, determine the percentage change from a forecast amount of $658 to an actual amount of $700. Second, determine what the new amount would be if it were 7% below the original forecast.

To	Press	Display	
Select Percent Change/Compound Interest worksheet	[2nd] [⌂%]	**OLD=**	Current value

To	Press	Display	
Enter original forecast amount	**658** ENTER	**OLD=**	**658.00◁**
Enter actual amount	↓ **700** ENTER	**NEW=**	**700.00◁**
Compute percent change	↓ CPT	**%CH=**	**6.38***
Enter −7 as percent change	**7** +/− ENTER	**%CH=**	**-7.00◁**
Compute new actual amount	↑ CPT	**NEW=**	**611.94***

Answer: $700 represents a 6.38% increase over the original forecast of $658. A decrease of 7% would result in a new actual amount of $611.94.

Example: Computing Compound Interest

You purchased stock in 1995 for $500. Five years later, you sell the stock for $750. What was the annual growth rate?

To	Press	Display	
Select Percent Change/Compound Interest worksheet	2nd [⊿%]	**OLD=**	Current value
Enter stock purchase price	**500** ENTER	**OLD=**	**500.00◁**
Enter stock selling price	↓ **750** ENTER	**NEW=**	**750.00◁**
Enter number of years	↓ ↓ **5** ENTER	**#PD=**	**5.00◁**
Compute annual growth rate	↑ CPT	**%CH=**	**8.45***

Answer: The annual growth rate is 8.45%.

Example: Computing Cost-Sell-Markup

The original cost of an item is $100; the selling price is $125. Find the markup.

To	Press	Display	
Select Percent Change/ Compound Interest worksheet	2nd [⊿%]	**OLD=**	Current value
Clear worksheet variables	2nd [CLR WORK]	**OLD=**	**0.00**
Enter original cost	**100** ENTER	**OLD=**	**100.00◁**
Enter selling price	↓ **125** ENTER	**NEW=**	**125.00◁**

To	Press	Display	
Compute percent markup	↓ CPT	**%CH=**	**25.00**∗

Answer: The markup is 25%.

Interest Conversion Worksheet

The Interest Conversion worksheet converts interest rates between nominal rate (or annual percentage rate) and annual effective rate.

- To access the Interest Conversion worksheet, press 2nd [ICONV].

- To select interest conversion variables, press ↓ or ↑.

Interest Conversion Variables

Variable	Key	Display	Variable Type
Nominal rate	2nd [ICONV]	**NOM**	Enter/compute
Annual effective rate	↓	**EFF**	Enter/compute
Compounding periods per year	↓	**C/Y**	Enter-only

Note: The calculator categorizes variables by their method of entry.

Comparing the Nominal Interest Rate of Investments

Comparing the nominal interest rate (annual percentage rate) of investments is misleading when the investments have the same nominal rate but different numbers of compounding periods per year.

To make a more valid comparison, convert the nominal interest rate (**NOM**) to the annual effective interest rate (**EFF**) for each investment.

- The nominal interest rate (**NOM**) is the interest rate per compounding period multiplied by the number of compounding periods per year.

- The annual effective interest rate (**EFF**) is the compound annual interest rate that you actually earn for the period of time stated.

Resetting Variables

- To reset all calculator variables and formats to default values, including the Interest Conversion worksheet variables, press 2nd [RESET] [ENTER].

Variable	Default
NOM	0

Variable	Default
EFF	0
C/Y	1

• To clear the **NOM** and **EFF** variables and reset default values without affecting **C/Y**, press [2nd] [CLR WORK] in the Interest Conversion worksheet.

Converting Variables

You can convert a nominal rate to an annual effective rate or vice versa.

Entering Values for Nom and EFF

Enter a value for **NOM** or **EFF** as an annual rate.

Converting Interest Rates

1. To access the Interest Conversion worksheet, press [2nd] [ICONV]. The current **NOM** value appears.

2. To clear the worksheet, press [2nd] [CLR WORK].

3. Enter a value for the known interest rate (either **NOM** or **EFF**).

4. To enter a value for a known variable, press [↓] or [↑] until **NOM** or **EFF** is displayed, key in a value, and press [ENTER].

5. Press [↓] to display **C/Y**. If necessary, change the value and press [ENTER].

6. To compute a value for the unknown variable (interest rate), press [↓] or [↑] until **NOM** or **EFF** is displayed, and then press [CPT]. The calculator displays the computed value.

Example: A bank offers a certificate that pays a nominal interest rate of 15% with quarterly compounding. What is the annual effective interest rate?

To	Press	Display	
Select Interest Conversion worksheet.	[2nd] [ICONV]	**NOM=**	Current value
Enter nominal interest rate.	**15** [ENTER]	**NOM=**	**15.00**◁
Enter number of compounding periods per year.	[↓] [↓] **4** [ENTER]	**C/Y=**	**4.00**◁
Compute annual effective interest rate.	[↑] [CPT]	**EFF=**	**15.87**∗

Answer: A nominal interest rate of 15% compounded quarterly is equivalent to an annual effective interest rate of 15.87%.

Date Worksheet

Use the Date worksheet to find the number of days between two dates. You can also compute a date and day of the week based on a starting date and a specified number of days.

- To access the Date worksheet, press [2nd] [DATE].

- To access the date variables, press [↓] or [↑].

- To select the day-count method (**ACT** and **360**), press [2nd] [SET] once for each option.

Date Worksheet Variables

Variable	Key	Display	Variable Type
Date 1	[2nd] [DATE]	**DT1**	Enter/compute
Date 2	[↓]	**DT2**	Enter/compute
Days between dates	[↓]	**DBD**	Enter/compute
Actual/actual day-count method	[↓]	**ACT***	Setting
30/360 day-count method	[↓]	**360***	Setting

Note: The calculator categorizes variables by their method of entry. Types of Worksheet Variables

Resetting the Date Worksheet Variables

- To reset default values for all calculator variables and formats, including the Date worksheet variables, press [2nd] [RESET] [ENTER].

Variable	Default	Variable	Default
DT1	12-31-1990	**DBD**	0
DT2	12-31-1990	Day-count method	**ACT**

- To clear Date worksheet variables and reset default values without affecting the day-count method, press [2nd] [CLR WORK] while in the Date worksheet.

Entering Dates

- The calculator assumes that **DT1** is earlier than **DT2**.

- Enter dates for **DT1** and **DT2** in the selected US or European date format.

- When you compute a date for **DT1** or **DT2**, the calculator displays a three-letter abbreviation for the day of the week (for example, **WED**).

Selecting the Day-Count Method Affects Calculations

- When you select **ACT** as the day-count method, the calculator uses the actual number of days in each month and each year, including adjustments for leap years.

- When you select **360** as the day-count method, the calculator assumes 30 days per month (360 days per year). You can compute **DBD** using this day-count method, but not **DT1** or **DT2**.

Computing Dates

1. To select the Date worksheet, press [2nd] [DATE]. The **DT1** value is displayed.

2. To clear the worksheet, press [2nd] [CLR WORK].

3. Enter values for two of the three variables: **DT1**, **DT2**, and **DBD**.

   Note: Do not enter a value for the variable you wish to solve for.

4. To enter a value for a variable, press [↓] or [↑] to display the variable.

5. Key in a value and press [ENTER].

6. To change the day-count method setting, press [↓] until **ACT** or **360** is displayed, and then press [2nd] [SET] to select the other day-count method.

7. To compute a value for the unknown variable, press [↓] or [↑] to display the variable, and then press [CPT]. The calculator displays the computed value.

Example: Computing Days between Dates

A loan made on September 4, 2003 defers the first payment until November 1, 2003. How many days does the loan accrue interest before the first payment?

To	Press	Display	
Select Date worksheet	[2nd] [DATE]	**DT1=**	**12-31-1990**
Enter first date	**9.0403** [ENTER]	**DT1=**	**9-04-2003**◁
Enter second date	[↓] **11.0103** [ENTER]	**DT2=**	**11-01-2003**◁
Select actual/actual day-count method	[↓] [↓]	**ACT**	
Compute days between dates	[↑] [CPT]	**DBD=**	**58.00**∗

Answer: Because there are 58 days between the two dates, the loan accrues interest for 58 days before the first payment.

Profit Margin Worksheet

The Profit Margin worksheet computes cost, selling price, and gross profit margin.

Note: To perform markup calculations, use the Percent Change/Compound Interest worksheet.

- To access the Profit Margin worksheet, press 2nd [PROFIT].

- To access profit margin variables, press ↑ or ↓.

- Enter values for the two known variables, and then compute a value for the unknown variable.

Profit Margin Worksheet Variables

Variable	Key	Display	Variable Type
Cost	2nd [PROFIT]	**CST**	Enter/compute
Selling price	↓	**SEL**	Enter/compute
Profit margin	↓	**MAR**	Enter/compute

Note: This guidebook categorizes calculator variables by their method of entry.

Gross Profit Margin and Markup

The terms *margin* and *markup* often are used interchangeably, but each has a distinct meaning.

- *Gross profit margin* is the difference between selling price and cost, expressed as a percentage of the selling price.

- *Markup* is the difference between selling price and cost, expressed as a percentage of the cost.

Clearing Profit Margin Worksheet Variables

- To clear the Profit Margin worksheet variables and reset default values, press 2nd [CLR WORK]. All Profit Margin worksheet variables default to zero.

- To reset default values for all calculator variables and formats, including the Profit Margin worksheet variables, press 2nd [RESET] [ENTER].

Computing Profit Margin

1. To select the Profit Margin worksheet, press 2nd [PROFIT]. The **CST** value appears.

2. To enter a value for one of the two known variables, press ↓ or ↑ to select a variable, then key in a value and press [ENTER].

3. Repeat step 2 for the second known variable.

4. To compute a value for the unknown variable, press ↓ or ↑ to select the variable and press [CPT]. The calculator displays the computed value.

Example: Computing Profit Margin

The selling price of an item is $125. The gross profit margin is 20%. Find the original cost.

To	Press	Display	
Select Profit Margin worksheet	[2nd] [PROFIT]	**CST=**	**0.00**
Enter selling price	[↓] 125 [ENTER]	**SEL=**	**125.00◁**
Enter profit margin	[↓] 20 [ENTER]	**MAR=**	**20.00◁**
Compute cost	[↑] [↑] [CPT]	**CST=**	**100.00 ∗**

Answer: The original cost is $100.

Breakeven Worksheet

The Breakeven worksheet computes the breakeven point and sales level needed to earn a given profit by analyzing relationships between fixed costs, variable costs per unit, quantity, price, and profit.

You operate at a loss until you reach the breakeven quantity (that is, total costs = total revenues).

- To access the Breakeven worksheet, press [2nd] [BRKEVN].
- To access breakeven variables, press [↑] or [↓].
- Enter known values for the four known variables, then compute a value for the fifth, unknown variable.

Note: To solve for quantity (**Q**), enter a value of zero for profit (**PFT**).

Breakeven Worksheet Variables

Variable	Key	Display	Variable Type
Fixed cost	[2nd] [BRKEVN]	**FC**	Enter/compute
Variable cost per unit	[↓]	**VC**	Enter/compute
Unit price	[↓]	**P**	Enter/compute
Profit	[↓]	**PFT**	Enter/compute
Quantity	[↓]	**Q**	Enter/compute

Note: This guidebook categorizes calculator variables by their method of entry. Types of Worksheet Variables

Resetting the Breakeven Worksheet Variables

- To reset default values for all Breakeven worksheet variables, press [2nd] [CLR WORK]. All Breakeven worksheet variables default to zero.

- To clear all calculator variables and formats and reset default values, including the Breakeven worksheet variables, press [2nd] [RESET] [ENTER].

Computing Breakeven

1. To access the Breakeven worksheet, press [2nd] [BRKEVN]. The **FC** variable appears.

2. Press [↓] or [↑] to select a known variable, key in the value, and press [ENTER].

3. Repeat step 3 for each of the remaining known variables.

4. To compute a value for the unknown variable, press [↓] or [↑] until the variable is displayed, and then press [CPT] The calculator displays the computed value.

Example: Computing Breakeven Quantity

A canoe company sells paddles for $20 each. The unit variable cost is $15, and the fixed costs are $3,000. How many paddles must be sold to break even?

To	Press	Display	
Access Breakeven worksheet.	[2nd] [BRKEVN]	**FC=**	Current value
Enter fixed costs.	**3000** [ENTER]	**FC=**	**3,000.00◁**
Enter variable cost per unit.	[↓] **15** [ENTER]	**VC=**	**15.00◁**
Enter price.	[↓] **20** [ENTER]	**P=**	**20.00◁**
Leave profit as is.	[↓]	**PFT=**	**0.00**
Compute quantity.	[↓] [CPT]	**Q=**	**600.00∗**

Answer: 600 paddles must be sold to break even.

Memory Worksheet

The Memory worksheet lets you compare and recall stored values by accessing the calculator's 10 memories. All memory variables are enter-only. Types of Worksheet Variables

- To access the Memory worksheet, press [2nd] [MEM].

- To access memory variables, press [↑] or [↓].

  Note: You can access memories individually using [STO], [RCL], and the digit keys. Memory Operations

Memory Worksheet Variables

Variables	Key	Display	Variable Type
Memory 0	[2nd] [MEM]	**M0**	Enter-only
Memory 1	[↓]	**M1**	Enter-only
Memory 2	[↓]	**M2**	Enter-only

Variables	Key	Display	Variable Type
Memory 3	⬇	**M3**	Enter-only
Memory 4	⬇	**M4**	Enter-only
Memory 5	⬇	**M5**	Enter-only
Memory 6	⬇	**M6**	Enter-only
Memory 7	⬇	**M7**	Enter-only
Memory 8	⬇	**M8**	Enter-only
Memory 9	⬇	**M9**	Enter-only

Note: This guidebook categorizes calculator variables by their method of entry.

Clearing the Memory Worksheet Variables

To clear all 10 memories at once, press [2nd] [CLR WORK] in the Memory worksheet.

Using the Memory Worksheet

1. To select the Memory worksheet, press [2nd] [MEM]. **M0** apears.
2. Perform any of the following operations:
    - To clear all 10 memories at once, press [2nd] [CLR WORK].
    - To view the contents of the memories, press [⬇] or [⬆] once for each memory.
    - To store a value, select a memory (**M0-M9**), key in a value, and press [ENTER].
    - Memory arithmetic.

Examples: Using the Memory Worksheet

To	Press	Display	
Access Memory worksheet	[2nd] [MEM]	**M0=**	Current value
Select **M4**.	[⬇] [⬇] [⬇] [⬇]	**M4=**	Current value
Clear **M4**.	**0** [ENTER]	**M4=**	**0.00**◁
Store 95.	**9 5** [ENTER]	**M4=**	**95.00**◁
Add 65.	[+] **6 5** [ENTER]	**M4=**	**160.00**◁
Subtract 30.	[−] **3 0** [ENTER]	**M4=**	**130.00**◁
Multiply by 95.	[×] **9 5** [ENTER]	**M4=**	**12,350.00**◁
Divide by 65.	[÷] **6 5** [ENTER]	**M4=**	**190.00**◁
Raise to 2nd power.	[yˣ] **2** [ENTER]	**M4=**	**36,100.00**◁

APPENDIX - Reference Information

This appendix includes supplemental information to help you use your BA II PLUS™ calculator:

- Formulas
- Error conditions
- Accuracy information
- IRR (internal-rate-of-return) calculations
- Algebraic operating system (AOS™)
- Battery information
- In case of difficulty
- TI product service and warranty information

Formulas

This section lists formulas used internally by the calculator.

Time Value of Money

$$i = \left[e^{(y \times \ln(x+1))} \right] - 1$$

where: $\quad PMT = 0$

$$y = C/Y \div P/Y$$

$$x = (.01 \times I/Y) \div C/Y$$

C/Y = compounding periods per year

P/Y = payment periods per year

I/Y = interest rate per year

$$i = (-FV \div PV)^{1 \div N} - 1$$

where: $\quad PMT = 0$

The iteration used to compute i:

$$0 = PV + PMT \times G_i \left[\frac{1-(1+i)^{-N}}{i} \right] + FVx(1+i)^{-N}$$

$$I/Y = 100 \times C/Y \times \left[e^{(y \times \ln(x+1))} - 1 \right]$$

where: $\quad x = i$

$$y = P/Y \div C/Y$$

Gi = 1 + i × k

where: k = 0 for end-of-period payments
           k = l for beginning-of-period payments

$$N = \frac{\ln \frac{PMT \times G_i - FV \times 1}{PMT \times G_i + PV \times i}}{\ln(l+i)}$$

where: $i \neq 0$

$$N = -(PV + FV) \div PMT$$

where: $i = 0$

$$PMT = \frac{i}{G_i} \times \left[PV + \frac{PV+FV}{(1+i)^N - 1} \right]$$

where: $i \neq 0$

$$PMT = -(PV + FV) \div N$$

where: $i = 0$

$$PV = \left[\frac{PMT \times G_i}{i} - FV \right] \times \frac{1}{(1+i)^N} - \frac{PMT \times G_i}{i}$$

where: $i \neq 0$

$$PV = -(FV + PMT \times N)$$

where: $i = 0$

$$FV = \frac{PMT \times G_i}{i} - (l+i)^N \times \left(PV + \frac{PMT \times G}{i} \right)$$

where: $i \neq 0$

$$FV = -(PV + PMT \times N)$$

where: $i = 0$

Amortization

If computing	$bal(), pmt2 = npmt$
Let:	$bal(0) = RND(PV)$
Iterate from:	$m = 1$ to $pmt2$

$$\begin{cases} l_m = RND\left[RND12\left(-i \times bal\left(m - l\right)\right)\right] \\ bal(m) = bal(m - l - l_m + RND(PMT)) \end{cases}$$

then:

$$bal() = bal(pmt2)$$

$$\Sigma Prn() = bal(pmt2) - bal(pmt1)$$

$$\Sigma Int() = (pmt2 - pmt1 + 1) \times RND(PMT) - \Sigma Prn()$$

where:

$RND =$ round the diplay to the number or decimal places selected

$RND12 =$ round to 12 decimal places

Balance, principal, and interest are dependent on the values of $PMT, PV, I/Y$, and $pmt1$ and $pmt2$.

Cash Flow

$$NPV = CF_0 + \sum_{j=1}^{N} CF_j (1 + i)^{-S_j - 1} \frac{\left(1 - (1+i)^{-n_j}\right)}{i}$$

where:

$$S_j = \begin{cases} \sum_{i=1}^{j} n_i & j \geq 1 \\ 0 & j = 0 \end{cases}$$

Net present value depends on the values of the initial cash flow ($CF0$), subsequent cash flows (CFj), frequency of each cash flow (nj), and the specified interest rate (i).

IRR = 100 x i

where: i satisfies $npv() = 0$

Internal rate of return depends on the values of initial cash flow ($CF0$), subsequent cash flows (CFj).

$$i = I/Y \div 100$$

Bonds [1]

Price (given yield) with one coupon period or less to redemption:

$$PRI = \left[\frac{RV + \frac{100 \times R}{M}}{1 + \left(\frac{DSR}{E} \right) \times \frac{Y}{M}} \right] - \left[\frac{A}{E} \times \frac{100 \times R}{M} \right]$$

where: PRI = dollar price per $100 par value

RV = redemption value of the security per $100 par value (RV except in those cases where call or put features must be considered)

R = annual interest rate (as a decimal; CPN_100)

M = number of coupon periods per year standard for the particular security involved (set to 1 or 2 Bond worksheet)

DSR = number of days from settlement date to redemption date (maturity date, call date, put date, etc.)

E = number of days in coupon period in which the settlement date falls

Y = annual yield (as a decimal) on investment with security held to redemption (YLD $\div$ 100)

A = number of days from beginning of coupon period to settlement date (accrued days)

Note: The first term computes present value of the redemption amount, including interest, based on the yield for the invested period. The second term computes the accrued interest agreed to be paid to the seller.

Yield (given price) with one coupon period or less to redemption:

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[1]Source for bond formulas (except duration): Lynch, John J., Jr., and Jan H. Mayle. *Standard Securities Calculation Methods*. New York: Securities Industry Association, 1986.

$$Y = \left[\cfrac{\left(\frac{RV}{100} + \frac{R}{M}\right) - \left(\frac{PRI}{100} + \left(\frac{A}{E} \times \frac{R}{M}\right)\right)}{\frac{PRI}{100} + \left(\frac{A}{E} \times \frac{R}{M}\right)} \right] \times \left[\frac{M \times E}{DSR} \right]$$

Price (given yield) with more than one coupon period to redemption:

$$PRI = \left[\cfrac{RV}{\left(1 + \frac{Y}{M}\right)^{N-1+\frac{DSC}{E}}} \right] + \left[\sum_{K=1}^{N} \cfrac{100 \times \frac{R}{M}}{\left(1 + \frac{Y}{M}\right)^{K-1+\frac{DSC}{E}}} \right]$$
$$- \left[100 \times \frac{R}{M} \times \frac{A}{E} \right]$$

where: N =   number of coupons payable between settlement date and redemption date (maturity date, call date, put date, etc.). (If this number contains a fraction, raise it to the next whole number; for example, 2.4 = 3.)

DSC =   number of days from settlement date to next coupon date

K =   summation counter

Note: The first term computes present value of the redemption amount, not including interest. The second term computes the present values for all future coupon payments. The third term computes the accrued interest agreed to be paid to the seller.

Yield (given price) with more than one coupon period to redemption: Yield is found through an iterative search process using the "Price with more than one coupon to redemption" formula.

Accrued interest for securitites with standard coupons or interest at maturity:

$$AI = PAR \times \frac{R}{M} \times \frac{A}{E}$$

where: AI = accrued interest
PAR = par value (principal amount to be paid at maturity)

Depreciation

$RDV = CST - SAL$—accumulated depreciation

Values for $DEP, RDV, CST, and SAL$ are rounded to the number of decimals you choose to be displayed.

Straight-line depreciation

$$\frac{CST - SAL}{LIF}$$

First year: $\frac{CST - SAL}{LIF} \times FSTYR$

Last year or more: $DEP = RDV$

Sum-of-the-years'-digits depreciation

$$\frac{(LIF + 2 - YR - FSTYR) \times (CST - SAL)}{((LIF \times (LIF + 1)) \div 2)}$$

First year: $\frac{LIF \times (CST - SAL)}{((LIF \times (LIF + 1)) \div 2)} \times FSTYR$

Last year or more: $DEP = RDV$

Declining-balance depreciation

$$\frac{RBV \times DB\%}{LIF \times 100}$$

where: RBV is for YR -1

First year: $\frac{CST \times DB\%}{LIF \times 100} \times FSTYR$

Unless; $\frac{CST \times DB\%}{LIF \times 100} > RDV$; then use $RDV \times FSTYR$

If $DEP > RDV$, use $DEP = RDV$

If computing last year, $DEP = RDV$

Statistics

Note: Formulas apply to both x and y.

Standard deviation with n weighting (σ_x):

$$\left[\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n}\right]^{\frac{1}{2}}$$

Standard deviation with n–1 weighting (s_x):

$$\left[\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}\right]^{\frac{1}{2}}$$

Mean: $\overline{x} = \frac{(\sum x)}{n}$

Regressions

Formulas apply to all regression models using transformed data.

$$b = \frac{n(\sum xy) - (\sum y)(\sum x)}{n(\sum x2) - \sum x)2}$$

$$a = \frac{(\sum y - b \sum x)}{n}$$

$$r = \frac{b\delta x}{\delta y}$$

Interest Rate Conversions

$$EFF = 100 \times (eC/Y \times In(x \div 1) - 1$$

where: $\quad x = .01 \times NOM \div CY$

$$NOM = 100 \times C/Y \times (e1 \div C/Y \times IN(x+1) - 1$$

where: $\quad x = .01 \times EFF$

Percent Change

$$NEW = OLD\left(1 + \frac{\%CH}{100}\right)\#PD$$

where: OLD = old value
                  NEW = new value
                  $\%CH$ = percent change
                  $\#PD$ = number of periods

Profit Margin

$$GrossProfit\ M\arg in\ =\ \frac{SellingPrice - Cost}{SellingPrice} \times 100$$

Breakeven

$$PFT = PQ - (FC + VCQ)$$

where: PFT = profit
                  P = price
                  FC = fixed cost
                  VC = variable cost
                  Q = quantity

Days between Dates

With the Date worksheet, you can enter or compute a date within the range January 1, 1980, through December 31, 2079.

Actual/actual day-count method

Note: The method assumes the actual number of days per month and per year.

DBD (days between dates) = *number of days II-number of days I*

Number of Days I = $(Y1 - YB)\ Q$ 365
    + (*number of days MB to MI*)
    + $DT1$

   $+ \dfrac{(Y1 - YB)}{4}$

Number of Days II = (*Y2 −YB*) ✕ 365
     + (*number of days MB to M2*)
     + *DT2*

$$+ \frac{(Y2-YB)}{4}$$

where: $M1$ = month of first date
          $DT1$ = day of first date
          $Y1$ = year of first date
          $M2$ = month of second date
          $DT2$ = day of second date
          $Y2$ = year of second date
          MB = base month (January)
          DB = base day (1)
          YB = base year (first year after leap year)

30/360 day-count method[1]

Note: The method assumes 30 days per month and 360 days per year.

$$DBD = (Y2 - Y1) \times 360 + (M2 - M1) \times 30 + (DT2 - DT1$$

where: $M1$ = month of first date
          $DT1$ = day of first date
          $Y1$ = year of first date
          $M2$ = month of second date
          $DT2$ = day of second date
          $Y2$ = year of second date

Note: If $DT1$ is 31, change $DT1$ to 30. If $DT2$ is 31 and $DT1$ is 30 or 31, change $DT2$ to 30; otherwise, leave it at 31.

Note:

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[1]Source for 30/360 day-count method formula Lynch, John J., Jr., and Jan H. Mayle.***Standard Securities Calculation Methods***. New York: Securities Industry Association, 1986

Day Type 30/360

This day counting convention is much less intuitive. The general assumption is that each month has 30 days and therefore each year has 360 days. Obviously, this is not the case and so adjustments are incorporated. We follow Jan Mayle's *Standard Securities Calculation Methods* (1993) for this algorithm. We introduced Julian numbers with actual calendar dates. That is not possible here, so our function will produce the number of days between two dates. We adopt the following notation:

M1, M2—month of first and second date.
D1, D2—day of first and second date.
Y1, Y2—year of first and second date.

We observe the following rules:

1. If D2 is the last day of February, D1 is the last day of February, then change D2 to 30.
2. If D1 is the last day of February, then change D1 to 30.
3. If D2 is 31 and D1 is 30 or 31, then change D2 to 30.
4. If D1 is 31, then change D1 to 30.

Therefore, the number of days between two dates under the 30/360 day count method is

Number of Days = (Y2 - Y1)*360 + (M2 - M1)*30 +(D2 - D1)

Other general rules, other than those above, include:

1. A year always has 360 days.
2. Days per period is equal to 360 divided by the number of periods. For example, monthly periods would be 30 (= 360/12).
3. Remaining days in a period is equal to the total number of days in the period minus the number of days accrued.

Error Messages

Note: To clear an error message, press $\boxed{\text{CE/C}}$.

Error	Possible Causes
Error 1 Overflow	• A result is outside the calculator range ($\pm9.9999999999999E99$). • Tried to divide by zero (can occur internally). • Tried to compute 1/x when x is zero. • Statistics worksheet: a calculation included X or Y values that are all the same.
Error 2 Invalid argument	• Tried to compute x! when x is not an integer 0-69. • Tried to compute LN of x when x is not > 0. • Tried to compute yx when y < 0 and x is not an integer or the inverse of an integer. • Tried to compute $\sqrt{x}$ when x < 0. • Amortization worksheet: tried to compute **BAL**, **PRN**, and **INT** when **P2** < **P1**. • Depreciation worksheet: a calculation included **SAL** > **CST**.
Error 3 Too many pending operations	• More than 15 active levels of parentheses were tried in a calculation. • A calculation tried to use more than 8 pending operations.
Error 4 Out of range	• Amortization worksheet: the value entered for **P1** or **P2** is outside the range 1-9,999. • TVM worksheet: the **P/Y** or **C/Y** value 0. • Cash Flow worksheet: the **F***nn* value is outside the range 0.5-9,999. • Bond worksheet: the **RV, CPN**, or **PRI** value 0. • Date worksheet: the computed date is outside the range January 1, 1980 through December 31, 2079. • Depreciation worksheet: the value entered for: declining balance percent 0; **LIF** 0; **YR** _ 0; **CST** < 0; **SAL** < 0; or **M01** 1 **M01** 13. • Interest Conversion worksheet: the **C/Y** value 0. • The **DEC** value is outside the range 0-9.
Error 5 No solution exists	• TVM worksheet: the calculator computed **I/Y** when **FV**, (**N** × **PMT**), and **PV** all have the same sign. (Make sure cash inflows are positive and outflows are negative.) • TVM, Cash Flow, and Bond worksheets: the **LN** (logarithm) input is not > 0 during calculations. • Cash Flow worksheet: the calculator computed **IRR** without at least one sign change in the cash-flow list.

Error	Possible Causes
Error 6 Invalid date	• Bond and Date worksheets: a date is invalid (for example, January 32) or in the wrong format (for example, *MM.DDYYYY* instead of *MM.DDYY*). • Bond worksheet: the calculator attempted a calculation with a redemption date earlier than or the same as the settlement date.
Error 7 Iteration limit exceeded	• TVM worksheet: the calculator computed **I/Y** for a very complex problem involving many iterations. • Cash Flow worksheet: the calculator computed **IRR** for a complex problem with multiple sign changes. • Bond worksheet: the calculator computed **YLD** for a very complex problem.
Error 8 Canceled iterative calculation	• TVM worksheet: ON/OFF was pressed to stop the evaluation of **I/Y**. • Amortization worksheet: ON/OFF was pressed to stop the evaluation of **BAL** or **INT**. • Cash Flow worksheet: ON/OFF was pressed to stop the evaluation of **IRR**. • Bond worksheet: ON/OFF was pressed to stop the evaluation of **YLD**. • Depreciation worksheet: ON/OFF was pressed to stop the evaluation of **DEP** or **RDV**.

Accuracy Information

The calculator stores results internally as 13-digit numbers but displays them rounded to 10 digits or fewer, depending on the decimal format. The internal digits, or *guard* digits, increase the calculator's accuracy. Additional calculations use the internal value, not the value displayed.

Rounding

If a calculation produces a result with 11-digits or more, the calculator uses the internal guard digits to determine how to display the result. If the eleventh digit of the result is 5 or greater, the calculator rounds the result to the next larger value for display.

For example, consider this problem.

$1 \div 3 \times 3 = ?$

Internally, the calculator solves the problem in two steps, as shown below.

1. $1 \div 3 = 0.3333333333333$
2. $0.3333333333333 \times 3 = 0.9999999999999$

The calculator rounds the result and displays it as 1. This rounding enables the calculator to display the most accurate result.

Although most calculations are accurate to within ±1 in the last displayed digit, higher-order mathematical functions use iterative calculations, in which inaccuracies can accumulate in the guard digits. In most cases, the cumulative error from these calculations is maintained beyond the 10-digit display so that no inaccuracy is shown.

AOS™ (Algebraic Operating System) Calculations

When you select the **AOS** calculation method, the calculator uses the standard rules of algebraic hierarchy to determine the order in which it performs operations.

Algebraic Hierarchy

The table shows the order in which the calculator performs operations using the **AOS** calculation method.

Priority	Operations
1 (highest)	**x2, x!, 1/x, %,(x, LN, e2, HYP, INV, SIN, COS, TAN**
2	**nCr, nPr**
3	**Yx**
4	**×, ÷**
5	**+, -**
6	**)**
7 (lowest)	**=**

Note: For "Replacing the Battery" section, more detail steps noted in the BAIIPlus™.

Battery Information

Replacing the Battery

Replace the battery with a new CR2032 lithium battery.

Caution: The calculator cannot retain data when the battery is removed or discharged. Replacing the battery has the same effect as resetting the calculator.

1. Turn off the calculator and turn it over with the back facing you.

2. Using a small Phillips screwdriver, remove the four screws from the back cover.

3. Carefully pry off the back cover.

4. Using a small Phillips screwdriver, remove the screws from the metal battery cover and lift the cover off the battery.

5. Tip the calculator slightly to remove the battery.

    Caution: Avoid contact with other calculator components.

6. Install the new battery with the positive sign (+) sign down (not showing).

7. Replace the battery cover and the screws that hold it in place.

8. Align the screw holes in the back cover with those in the calculator, then snap the back cover onto the calculator. Replace the screws.

Battery Precautions

• Do not leave batteries within the reach of children.

- Do not mix new and used batteries. Do not mix brands (or types within brands) of batteries.
- Do not mix rechargeable and non-rechargeable batteries.
- Install batteries according to polarity (+ and –) diagrams.
- Do not place non-rechargeable batteries in a battery recharger.
- Properly dispose of used batteries immediately.
- Do not incinerate or dismantle batteries.

Australian Lithium Battery Warning

WARNING

KEEP BATTERIES OUT OF THE REACH
OF CHILDREN

Coin Battery
inside the product.

- Swallowing may lead to severe or fatal injuries in as little as 2 hours or less due to chemical burns and potential perforation of the esophagus.
- Never allow children to replace coin batteries of any device.
- If it is suspected your child has swallowed or inserted a coin battery immediately call the 24-hour Poisons Information Centre on 13 11 26 immediately for expert advice.
- Examine devices and make sure the battery compartment is correctly secured. E.g. that the screw or other mechanical fastener is tightened. Do not use if compartment is not secure.
- Dispose of used coin batteries immediately and safely. A battery can still be dangerous even when it can no longer operate the device.
- Tell others about the risk associated with the coin batteries and how to keep their children safe.

In Case of Difficulty

Use this list of possible solutions to difficulties you might encounter with the calculator to determine if you can correct a problem before having to return it for service.

Difficulty	Solution
The calculator computes wrong answers.	Check the settings of the current worksheet to make sure they are correct for the problem you are working; for example, in the TVM worksheet, check **END** and **BGN** and be sure the unused variable is set to zero.
The display is blank; digits do not appear.	Select the worksheet again. Be sure the battery is properly installed and replace, if necessary.
The calculator does not display the correct worksheet variables.	Be sure you have selected the correct worksheet.
The calculator does not display the correct number of decimal places.	Press [2nd] [FORMAT] to check or adjust the setting for number of decimal places displayed.
The calculator does not display the correct date format.	Press [2nd] [FORMAT] [↓] [↓] to check or adjust the setting for date format.
The calculator does not display the correct separator format.	Press [2nd] [FORMAT] [↓] [↓] [↓] to check or adjust the setting for separator format.
The calculator does not display the correct result in a math calculation.	Press [2nd] [FORMAT] [↓] [↓] [↓] [↓] to check or adjust the setting for calculation method.
An error occurs.	Error Messages

If you experience difficulties other than those listed above, press [2nd] [RESET] [ENTER] to clear the calculator, and then repeat your calculations.

Note: You can also perform a hard reset using the reset hole in back of the calculator. Resetting the Calculator

General Information

Online Help

education.ti.com/eguide

Select your country for more product information.

Contact TI Support

education.ti.com/ti-cares

Select your country for technical and other support resources.

Service and Warranty Information

education.ti.com/warranty

Select your country for information about the length and terms of the warranty or about product service.

Limited Warranty. This warranty does not affect your statutory rights.