BA II PLUS™ Calculator
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- Increase the separation between the equipment and receiver.
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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 ON/OFF.

- If you turned off the calculator by pressing 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 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 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.)
The indicators along the top of the display tell you which keys are active and offer information about the status of the calculator.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd</td>
<td>Press a key to select its second function.</td>
</tr>
<tr>
<td>INV</td>
<td>Press a key to select its inverse trigonometric function.</td>
</tr>
<tr>
<td>HYP</td>
<td>Press a key to select its hyperbolic function.</td>
</tr>
<tr>
<td>COMPUTE</td>
<td>Press $\text{OPT}$ to compute a value for the displayed variable.</td>
</tr>
<tr>
<td>ENTER</td>
<td>Press $\text{ENTER}$ to assign the displayed value to the displayed variable.</td>
</tr>
<tr>
<td>SET</td>
<td>Press $\text{2nd SET}$ to change the setting of the displayed variable.</td>
</tr>
<tr>
<td>$\uparrow\downarrow$</td>
<td>Press 1 or 4 to display the previous or next variable in the worksheet.</td>
</tr>
<tr>
<td>Note:</td>
<td>To easily scroll up or down through a range of variables, press and hold 1 or 4.</td>
</tr>
<tr>
<td>DEL</td>
<td>Press $\text{2nd DEL}$ to delete a cash flow or statistical data point.</td>
</tr>
<tr>
<td>INS</td>
<td>Press $\text{2nd INS}$ to insert a cash flow or statistical data point.</td>
</tr>
<tr>
<td>BGN</td>
<td>TVM calculations use beginning-of-period payments. When $\text{BGN}$ is not displayed, TVM calculations use end-of-period payments (END).</td>
</tr>
<tr>
<td>RAD</td>
<td>Angle values appear in radians. When $\text{RAD}$ is not displayed, angle values appear and must be entered in degrees.</td>
</tr>
<tr>
<td>$&lt;$</td>
<td>The displayed value is entered in the selected worksheet. The indicator clears following a computation.</td>
</tr>
<tr>
<td>$\ast$</td>
<td>The displayed value is computed in the selected worksheet. When a value changes and invalidates a computed value, the indicator clears.</td>
</tr>
<tr>
<td>$\equiv$</td>
<td>The displayed variable is assigned the displayed value.</td>
</tr>
<tr>
<td>$-$</td>
<td>The displayed value is negative.</td>
</tr>
</tbody>
</table>
Setting Calculator Formats

You can change these calculator formats:

<table>
<thead>
<tr>
<th>To Select</th>
<th>Press</th>
<th>Display</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of decimal places</td>
<td>2nd [FORMAT]</td>
<td>DEC 0–9 (Press 9 for floating-decimal)</td>
<td>2</td>
</tr>
<tr>
<td>Angle units</td>
<td></td>
<td>DEG (degrees)</td>
<td>DEG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RAD (radians)</td>
<td></td>
</tr>
<tr>
<td>Dates</td>
<td></td>
<td>US (mm-dd-yyyy)</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eur (dd-mm-yyyy)</td>
<td></td>
</tr>
<tr>
<td>Number separators</td>
<td></td>
<td>US (1,000.00)</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eur (1,000.00)</td>
<td></td>
</tr>
<tr>
<td>Calculation method</td>
<td></td>
<td>Chn (chain)</td>
<td>Chn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AOS™ (algebraic operating system)</td>
<td></td>
</tr>
</tbody>
</table>

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 1 or 1 once for each format.

   For example, to access the angle unit format, press 1. To access the number-separator format, press 1 1 1 or 1 1 1.

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 $\times$ 4 $\equiv$, 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 $\times$ 4 $\equiv$, the **AOS** answer is 11 (2 * 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 “Clearing Calculator Entries and Memories” on page 6.)

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” on page 98.)

Pressing $2^{nd}$ [RESET] [ENTER]


   **Note:** To cancel reset, press $2^{nd}$ [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.

<table>
<thead>
<tr>
<th>To clear</th>
<th>Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>One character at a time, starting with the last digit keyed in</td>
<td>→</td>
</tr>
<tr>
<td>An incorrect entry, error condition, or error message</td>
<td>CE/C</td>
</tr>
</tbody>
</table>
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 ×).  

- 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 x 1234.56 but instead enter 1234.86.

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Begin the expression.</td>
<td>3 [x]</td>
<td>3.00</td>
</tr>
<tr>
<td>Enter a number.</td>
<td>1234.86</td>
<td>1,234.86</td>
</tr>
<tr>
<td>Erase the entry error.</td>
<td>[→]</td>
<td>1,234.</td>
</tr>
<tr>
<td>Key in the correct number.</td>
<td>56</td>
<td>1,234.56</td>
</tr>
<tr>
<td>Compute the result.</td>
<td></td>
<td>3,703.68</td>
</tr>
</tbody>
</table>

**Overview of Calculator Operations**
**Math Operations**

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

**Examples of Math Operations**
These operations require you to press \(=\) to complete.

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add 6 + 4</td>
<td>6 + 4 =</td>
<td>10.00</td>
</tr>
<tr>
<td>Subtract 6 – 4</td>
<td>6 – 4 =</td>
<td>2.00</td>
</tr>
<tr>
<td>Multiply 6 (\times) 4</td>
<td>6 (\times) 4 =</td>
<td>24.00</td>
</tr>
<tr>
<td>Divide 6 (\div) 4</td>
<td>6 (\div) 4 =</td>
<td>1.50</td>
</tr>
<tr>
<td>Find universal power: 3(^{1.25})</td>
<td>3 (y^x) 1.25 =</td>
<td>3.95</td>
</tr>
<tr>
<td>Use parentheses: 7 (\times) (3 + 5)</td>
<td>7 (\times) (3 + 5) =</td>
<td>56.00</td>
</tr>
<tr>
<td>Find percent: 4% of $453</td>
<td>453 (\times) 4 (%) =</td>
<td>18.12</td>
</tr>
<tr>
<td>Find percent ratio: 14 to 25</td>
<td>14 (\div) 25 (%) =</td>
<td>56.00</td>
</tr>
<tr>
<td>Find price with percent add-on: $498 + 7% sales tax</td>
<td>498 + 7 (%) =</td>
<td>34.86</td>
</tr>
<tr>
<td>Find price with percent discount: $69.99 – 10%</td>
<td>69.99 (-) 10 (%) =</td>
<td>7.00</td>
</tr>
<tr>
<td>Find number of combinations where: n = 52, (r) = 5</td>
<td>52 (nC) 5 =</td>
<td>2,598,960.00</td>
</tr>
<tr>
<td>Find number of permutations where: n = 8, (r) = 3</td>
<td>8 (nPr) 3 =</td>
<td>336.00</td>
</tr>
</tbody>
</table>

These operations do not require you to press \(=\) to complete.

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square 6.3(^2)</td>
<td>6.3 (x^2)</td>
<td>39.69</td>
</tr>
<tr>
<td>Find square root: (\sqrt{15.5})</td>
<td>15.5 (\sqrt)</td>
<td>3.94</td>
</tr>
<tr>
<td>Find reciprocal: 1/3.2</td>
<td>3.2 (1/x)</td>
<td>0.31</td>
</tr>
<tr>
<td>Find factorial: 5!</td>
<td>5 (n)</td>
<td>120.00</td>
</tr>
<tr>
<td>Find natural logarithm: ln 203.45</td>
<td>203.45 (LN)</td>
<td>5.32</td>
</tr>
</tbody>
</table>

**Overview of Calculator Operations**
<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find natural antilogarithm: e^0.69315</td>
<td>0.69315 [2nd] [e^x]</td>
<td>2.00</td>
</tr>
<tr>
<td>Round 2 ÷ 3 to the set decimal format</td>
<td>2 ê 3 ê [2nd] [ROUND]</td>
<td>0.67</td>
</tr>
<tr>
<td>Generate random number*</td>
<td>[2nd] [RAND]</td>
<td>0.86</td>
</tr>
<tr>
<td>Store seed value</td>
<td>STO [2nd] [RAND]</td>
<td>0.86</td>
</tr>
<tr>
<td>Find sine:** sin(11.54°)</td>
<td>11.54 [2nd] [SIN]</td>
<td>0.20</td>
</tr>
<tr>
<td>Find cosine:** cos(120°)</td>
<td>120 [2nd] [COS]</td>
<td>-0.50</td>
</tr>
<tr>
<td>Find tangent:** tan(76°)</td>
<td>76 [2nd] [TAN]</td>
<td>4.01</td>
</tr>
<tr>
<td>Find arcsine:** sin⁻¹ (.2)</td>
<td>.2 [INV] [SIN]</td>
<td>11.54</td>
</tr>
<tr>
<td>Find arccosine:** cos⁻¹ (-.5)</td>
<td>.5 [+/−] [INV] [COS]</td>
<td>120.00</td>
</tr>
<tr>
<td>Find arctangent:** tan⁻¹ (4)</td>
<td>4 [INV] [TAN]</td>
<td>75.96</td>
</tr>
<tr>
<td>Find hyperbolic sine: sinh(.5)</td>
<td>.5 [2nd] [HYP] [SIN]</td>
<td>0.52</td>
</tr>
<tr>
<td>Find hyperbolic cosine: cosh(.5)</td>
<td>.5 [2nd] [HYP] [COS]</td>
<td>1.13</td>
</tr>
<tr>
<td>Find hyperbolic tangent: tanh(.5)</td>
<td>.5 [2nd] [HYP] [TAN]</td>
<td>0.46</td>
</tr>
<tr>
<td>Find hyperbolic arcsine: sinh⁻¹ (5)</td>
<td>5 [2nd] [HYP] [INV] [SIN]</td>
<td>2.31</td>
</tr>
<tr>
<td>Find hyperbolic arccosine: cosh⁻¹ (5)</td>
<td>5 [2nd] [HYP] [INV] [COS]</td>
<td>2.29</td>
</tr>
<tr>
<td>Find hyperbolic arctangent: tanh⁻¹ (.5)</td>
<td>.5 [2nd] [HYP] [INV] [TAN]</td>
<td>0.55</td>
</tr>
</tbody>
</table>

* 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” on page 5.)

** Universal Power [y^x]

Press [y^x] to raise the displayed positive 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 or equal to 0.

\[ nC_r = \frac{n!}{(n-r)! \times r!} \]

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 or equal to 0.

\[ nP_r = \frac{n!}{(n-r)!} \]

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.

```
<table>
<thead>
<tr>
<th>Internal value</th>
<th>Displayed value</th>
</tr>
</thead>
<tbody>
<tr>
<td>783.6498340833</td>
<td>783.65</td>
</tr>
<tr>
<td>783.65</td>
<td>783.65</td>
</tr>
</tbody>
</table>
```

**Before rounding** | **After rounding**

**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” on page 4.)

**Scientific Notation** \( \times \)

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 \( \times \) to enter a number in scientific notation. (See “Choosing Calculation Methods” on page 5.)

For example, to enter \( 3 \times 10^3 \), key in \( 3 \times 10^3 \).
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” on page 80.)

- 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

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear memory 4 (by storing a zero value in it)</td>
<td>0 STO 4</td>
</tr>
<tr>
<td>Store 14.95 in memory 3 (M3)</td>
<td>14.95 STO 3</td>
</tr>
<tr>
<td>Recall a value from memory 7 (M7)</td>
<td>RCL 7</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add the displayed value to the value stored in memory 9 (M9).</td>
<td>STO+9</td>
<td></td>
</tr>
<tr>
<td>Subtract the displayed value from the value stored in memory 3 (M3).</td>
<td>STO-3</td>
<td></td>
</tr>
<tr>
<td>Multiply the value in memory 0 (M0) by the displayed value.</td>
<td>STO×0</td>
<td></td>
</tr>
<tr>
<td>Divide the value in memory 5 (M5) by the displayed value.</td>
<td>STO÷5</td>
<td></td>
</tr>
<tr>
<td>Raise the value in memory 4 (M4) to the power of the displayed value.</td>
<td>STO^4</td>
<td></td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear the calculator.</td>
<td>2nd [QUIT]</td>
<td>0.00</td>
</tr>
<tr>
<td>Enter the value for the first calculation.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Enter the operation and a constant value.</td>
<td>×8</td>
<td>8</td>
</tr>
<tr>
<td>Store the operation and value, and then calculate.</td>
<td>2nd [K]</td>
<td>24.00</td>
</tr>
<tr>
<td>Calculate 7 × 8.</td>
<td>7</td>
<td>56.00</td>
</tr>
<tr>
<td>Compute 45 × 8.</td>
<td>45</td>
<td>360.00</td>
</tr>
</tbody>
</table>
## Keystrokes for Constant Calculations

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

<table>
<thead>
<tr>
<th>To*</th>
<th>Press**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add (c) to each subsequent entry</td>
<td>(n , + , \text{2nd} , [K] , c , \equiv)</td>
</tr>
<tr>
<td>Subtract (c) from each subsequent entry</td>
<td>(n , - , \text{2nd} , [K] , c , \equiv)</td>
</tr>
<tr>
<td>Multiply each subsequent entry by (c)</td>
<td>(n , \times , \text{2nd} , [K] , c , \equiv)</td>
</tr>
<tr>
<td>Divide each subsequent entry by (c)</td>
<td>(n , \div , \text{2nd} , [K] , c , \equiv)</td>
</tr>
<tr>
<td>Raise each subsequent entry to the power of (c)</td>
<td>(n , \mathtt{^y} , \text{2nd} , [K] , c , \equiv)</td>
</tr>
<tr>
<td>Add (c)% of each subsequent entry to that entry</td>
<td>(n , + , \text{2nd} , [K] , c , % , \equiv)</td>
</tr>
<tr>
<td>Subtract (c)% of each subsequent entry from the entry</td>
<td>(n , - , \text{2nd} , [K] , c , % , \equiv)</td>
</tr>
</tbody>
</table>

*The letter \(c\) denotes the constant value.

**Repeat constant calculations with \(n \, \equiv\).

## Last Answer Feature

Use the Last Answer (\(\text{ANS}\)) 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 \(\text{2nd} \, [\text{ANS}]\).

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

- Press \(\text{ENTER}\) to enter a value.
- Press \(\text{CPT}\) to compute a value.
- Press \(\equiv\) to complete a calculation.

## Example: Using the Last Answer in a Calculation

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key in and complete a calculation</td>
<td>(3 , + , 1 , \equiv)</td>
<td>4.00</td>
</tr>
</tbody>
</table>

14

*Overview of Calculator Operations*
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.

<table>
<thead>
<tr>
<th>To select</th>
<th>Function</th>
<th>Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVM worksheet (Chapter 2)</td>
<td>Analyzes equal cash flows, for example, annuities, loans, mortgages, leases, and savings</td>
<td>N, I/Y, PV, PMT, FV, or 2nd P/Y</td>
</tr>
<tr>
<td>Amortization worksheet (Chapter 2)</td>
<td>Performs amortization calculations and generates an amortization schedule</td>
<td>2nd [AMORT]</td>
</tr>
<tr>
<td>Cash Flow worksheet (Chapter 3)</td>
<td>Analyzes unequal cash flows by calculating net present value and internal rate of return</td>
<td>2nd [CF]</td>
</tr>
<tr>
<td>Bond worksheet (Chapter 4)</td>
<td>Computes bond price and yield to maturity or call</td>
<td>2nd [BOND]</td>
</tr>
<tr>
<td>Depreciation worksheet (Chapter 5)</td>
<td>Generates a depreciation schedule using one of six depreciation methods</td>
<td>2nd [DEPR]</td>
</tr>
</tbody>
</table>
### Accessing the TVM Worksheet Variables

- To assign values to the TVM worksheet variables, use the five TVM keys (N, I/Y, PV, PMT, FV).
- To access other TVM worksheet functions, press the 2nd key, and then press a TVM function key (xP/Y, P/Y, BGN). (See “TVM and Amortization Worksheet Variables” on page 22.)

**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.

---

<table>
<thead>
<tr>
<th>To select</th>
<th>Function</th>
<th>Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistics worksheet (Chapter 6)</td>
<td>yses statistics on one- or two-variable data using four regression analysis options</td>
<td>2nd [STAT]</td>
</tr>
<tr>
<td>Percent Change/Compound Interest worksheet (Chapter 7)</td>
<td>Computes percent change, compound interest, and cost-sell markup</td>
<td>2nd [△%]</td>
</tr>
<tr>
<td>Interest Conversion worksheet (Chapter 7)</td>
<td>Converts interest rates between nominal rate (or annual percentage rate) and annual effective rate</td>
<td>2nd [ICONV]</td>
</tr>
<tr>
<td>Date worksheet (Chapter 7)</td>
<td>Computes number of days between two dates, or date/day of the week a specified number of days is from a given date</td>
<td>2nd [DATE]</td>
</tr>
<tr>
<td>Profit Margin worksheet (Chapter 7)</td>
<td>Computes cost, selling price, and profit margin</td>
<td>2nd [PROFIT]</td>
</tr>
<tr>
<td>Breakeven worksheet (Chapter 7)</td>
<td>Analyzes relationship between fixed cost, variable cost, price, profit, and quantity</td>
<td>2nd [BRKEVN]</td>
</tr>
<tr>
<td>Memory worksheet (Chapter 7)</td>
<td>Accesses storage area for up to 10 values</td>
<td>2nd [MEM]</td>
</tr>
</tbody>
</table>
Accessing Prompted-Worksheet Variables

After you access a worksheet, press \[ \text{[1]} \] or \[ \text{[1]} \] to select variables. For example, press \[ \text{2nd} \ \text{[AMORT]} \] to access the Amortization worksheet, and then press \[ \text{[1]} \] or \[ \text{[1]} \] to select the amortization variables (\( P_1, P_2, \text{BAL}, \text{PRN}, \text{INT} \)). (See “TVM and Amortization Worksheet Variables” on page 22.)

Indicators prompt you to select settings, enter values, or compute results. For example, the \( \text{i} \) \[ \text{[1]} \] indicators remind you to press \[ \text{[1]} \] or \[ \text{[1]} \] to select other variables. (See “Reading the Display” on page 2.)

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

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, \( \text{P/Y} \) and \( \text{C/Y} \). 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 \text{ENTER} indicator. The \text{ENTER} indicator reminds you to press \text{ENTER} after keying in a value to assign the value to the variable. After you press \text{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 (\( \text{NPV} \)). To compute a value, display a compute-only variable and press \text{CPT}. The calculator computes and displays the value based on the values of other variables.
Overview of Calculator Operations

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 **[1]** or **[2]** 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 \( \triangleleft \) indicator confirms that the calculator entered the displayed value in the worksheet.
- The \( \star \) indicator confirms that the calculator computed the displayed value.
- When a change to the worksheet invalidates either entered or computed values, the \( \triangleleft \) and \( \star \) 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” on page 41.)

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 (N, I/Y, PV, PMT, or FV).
- To access the prompted Amortization worksheet, press 2nd [AMORT].
**TVM and Amortization Worksheet Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Type of Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of periods</td>
<td>N</td>
<td>N</td>
<td>Enter-or-compute</td>
</tr>
<tr>
<td>Interest rate per year</td>
<td>I/Y</td>
<td>I/Y</td>
<td>Enter-or-compute</td>
</tr>
<tr>
<td>Present value</td>
<td>PV</td>
<td>PV</td>
<td>Enter-or-compute</td>
</tr>
<tr>
<td>Payment</td>
<td>PMT</td>
<td>PMT</td>
<td>Enter-or-compute</td>
</tr>
<tr>
<td>Future value</td>
<td>FV</td>
<td>FV</td>
<td>Enter-or-compute</td>
</tr>
<tr>
<td>Number of payments per year</td>
<td>2nd [P/Y]</td>
<td>P/Y</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Number of compounding periods per year</td>
<td>1</td>
<td>C/Y</td>
<td>Enter-only</td>
</tr>
<tr>
<td>End-of-period payments</td>
<td>2nd [BGN]</td>
<td>END</td>
<td>Setting</td>
</tr>
<tr>
<td>Beginning-of-period payments</td>
<td>2nd [SET]</td>
<td>BGN</td>
<td>Setting</td>
</tr>
<tr>
<td>Starting payment</td>
<td>2nd [AMORT]</td>
<td>P1</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Ending payment</td>
<td>1</td>
<td>P2</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Balance</td>
<td>1</td>
<td>BAL</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Principal paid</td>
<td>1</td>
<td>PRN</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Interest paid</td>
<td>1</td>
<td>INT</td>
<td>Auto-compute</td>
</tr>
</tbody>
</table>

**Note:** This guidebook categorizes calculator variables by the method of entry. (See “Types of Worksheet Variables” on page 17.)

**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] 1, 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 [1] or [4] 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]:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Default</th>
<th>Variable</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>0</td>
<td>END/BGN</td>
<td>END</td>
</tr>
<tr>
<td>I/Y</td>
<td>0</td>
<td>P1</td>
<td>1</td>
</tr>
<tr>
<td>PV</td>
<td>0</td>
<td>P2</td>
<td>1</td>
</tr>
<tr>
<td>PMT</td>
<td>0</td>
<td>BAL</td>
<td>0</td>
</tr>
<tr>
<td>FV</td>
<td>0</td>
<td>PRN</td>
<td>0</td>
</tr>
<tr>
<td>P/Y</td>
<td>1</td>
<td>INT</td>
<td>0</td>
</tr>
<tr>
<td>C/Y</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 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 **1**. 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 **1** 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 \[2^{\text{nd}}\] [AMORT].

— or —

If INT is displayed, press \(1\) 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 \[2^{\text{nd}}\] [AMORT].

— or —

If INT is displayed, press \(4\) to display the current \(P1\) value.

2. Press \(\text{CPT}\). 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 \(\text{CPT}\) updates the range to 13 through 24 (12 payments).

3. Press \(\#\) to display \(P2\).

- If you press \(\text{CPT}\) 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 \(\text{CPT}\) with \(P1\) displayed, you can press \(\text{CPT}\) 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 \(\text{BAL}\), \(\text{PRN}\), and \(\text{INT}\) 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?

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set payments per year to 12.</td>
<td>[2^{\text{nd}}] ( P/Y ) (12) (\text{ENTER})</td>
<td>(P/Y=) (12.00-^4)</td>
</tr>
<tr>
<td>Return to standard-calculator mode.</td>
<td>[2^{\text{nd}}] (\text{QUIT})</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Enter number of payments using the payment multiplier.</td>
<td>(30) [2^{\text{nd}}] (xP/Y) (N)</td>
<td>(N=) (360.00-^4)</td>
</tr>
</tbody>
</table>
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**

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter loan amount.</td>
<td>75000</td>
<td>PV= 75,000.00</td>
</tr>
<tr>
<td>Enter payment amount.</td>
<td>425.84</td>
<td>PMT= -425.84</td>
</tr>
<tr>
<td>Compute interest rate.</td>
<td>CPT I/Y</td>
<td>I/Y= 5.50</td>
</tr>
</tbody>
</table>

**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).

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter number of payments using payment multiplier.</td>
<td>30 2nd [xP/Y] N</td>
<td>N= 360.00</td>
</tr>
<tr>
<td>Enter interest rate.</td>
<td>5.5 I/Y</td>
<td>I/Y= 5.50</td>
</tr>
<tr>
<td>Enter loan amount.</td>
<td>75000</td>
<td>PV= 75,000.00</td>
</tr>
<tr>
<td>Compute payment.</td>
<td>CPT PMT</td>
<td>PMT= -425.84</td>
</tr>
</tbody>
</table>

**Answer:** The quarterly payments are $425.84.

---

*Time-Value-of-Money and Amortization Worksheets* 27
**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?

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compute payment.</td>
<td>[CPT] [PMT]</td>
<td>PMT= -1,279.82*</td>
</tr>
</tbody>
</table>

*Answer:* The quarterly payments are $1,279.82.

**Computing Present Value**

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

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

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

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter final balance.</td>
<td>10000 [FV]</td>
<td>FV= 10,000.00*</td>
</tr>
<tr>
<td>Compute present value.</td>
<td>[CPT] [PV]</td>
<td>PV= -9,050.63*</td>
</tr>
</tbody>
</table>

*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

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
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?

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

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 \((1 + \frac{I/Y}{100})^{-N}\) 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
  \[
P V = \frac{PMT}{(I/Y) / 100}
  \]
- Perpetual annuity due
  \[
P V = PMT + \frac{PMT}{(I/Y)/100}
  \]

**Example: Computing Present Value of Variable Cash Flows**

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

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount</td>
<td>$5000</td>
<td>$7000</td>
<td>$8000</td>
<td>$10000</td>
</tr>
</tbody>
</table>
Given a 10% discount rate, does the present value of the cash flows exceed the original cost of $23,000?

\[
PV = ?
\]

\[
\begin{array}{cccc}
0 & 1 & 2 & 3 \quad N=4 \\
$5000 & $7000 & $8000 & $10,000 \\
\end{array}
\]

**To**

<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd [RESET]</td>
<td>RST 0.00</td>
</tr>
<tr>
<td>10 [I/Y]</td>
<td>I/Y= 10.00&lt;</td>
</tr>
<tr>
<td>5000 [+/- FV]</td>
<td>FV= -5,000.00&lt;</td>
</tr>
<tr>
<td>1 [N]</td>
<td>N= 1.00&lt;</td>
</tr>
<tr>
<td>[CPT PV]</td>
<td>PV= 4,545.45*</td>
</tr>
<tr>
<td>[STO] 1</td>
<td>4,545.45</td>
</tr>
<tr>
<td>7000 [+/- FV]</td>
<td>FV= -7,000.00&lt;</td>
</tr>
<tr>
<td>2 [N]</td>
<td>N= 2.00&lt;</td>
</tr>
<tr>
<td>[CPT PV]</td>
<td>PV= 5,785.12*</td>
</tr>
<tr>
<td>[STO +] 1</td>
<td>5,785.12</td>
</tr>
<tr>
<td>8000 [+/- FV]</td>
<td>FV= -8,000.00&lt;</td>
</tr>
<tr>
<td>3 [N]</td>
<td>N= 3.00&lt;</td>
</tr>
<tr>
<td>[CPT PV]</td>
<td>PV= 6,010.52*</td>
</tr>
<tr>
<td>[STO +] 1</td>
<td>6,010.52</td>
</tr>
<tr>
<td>10000 [+/- FV]</td>
<td>FV= -10,000.00&lt;</td>
</tr>
<tr>
<td>4 [N]</td>
<td>N= 4.00&lt;</td>
</tr>
</tbody>
</table>

32 Time-Value-of-Money and Amortization Worksheets
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 zero).

**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.

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set all variables to defaults.</td>
<td>[2nd] [RESET] [ENTER]</td>
<td>RST 0.00</td>
</tr>
<tr>
<td>Set beginning-of-period payments.</td>
<td>[2nd] [BGN] [2nd] [SET]</td>
<td>BGN</td>
</tr>
<tr>
<td>Return to standard-calculator mode.</td>
<td>[2nd] [QUIT]</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Enter number of payments. 46 \( \text{N} \)  N= 46.00

Calculate and enter periodic interest rate. \( \frac{22}{12} \) \( \text{I/Y} \)  I/Y= 1.83

Enter residual value of asset. 6500 \( \pm \) \( \text{FV} \)  FV= -6,500.00

Compute residual present value. \( \text{CPT} \) \( \text{PV} \)  PV= 2,818.22

Enter lease payment amount. 1200 \( \pm \) \( \text{PMT} \)  PMT= -1,200.00

Compute present value of lease payments. \( \text{CPT} \) \( \text{PV} \)  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?

\[
\begin{align*}
\text{PV} &= 525 \\
\text{PMT} &= ? \\
\text{I/Y} &= 20 \div 12 \\
\text{N} &= 24
\end{align*}
\]

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set all variables to defaults.</td>
<td>[2nd] [RESET] [ENTER]</td>
<td>RST 0.00</td>
</tr>
<tr>
<td>Set payments per year to 12.</td>
<td>[2nd] [P/Y] 12 [ENTER]</td>
<td>P/Y= 12.00</td>
</tr>
</tbody>
</table>

*Time-Value-of-Money and Amortization Worksheets*
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?

```
<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return to standard-calculator mode</td>
<td>2nd (QUIT)</td>
<td>0.00</td>
</tr>
<tr>
<td>Enter number of payments using payment multiplier.</td>
<td>2 2nd [xP/Y] N</td>
<td>N= 24.00</td>
</tr>
<tr>
<td>Enter interest rate.</td>
<td>20 I/Y</td>
<td>I/Y= 20.00</td>
</tr>
<tr>
<td>Enter loan amount.</td>
<td>525 PV</td>
<td>PV= 525.00</td>
</tr>
<tr>
<td>Compute payment.</td>
<td>CPT PMT</td>
<td>PMT= -26.72</td>
</tr>
</tbody>
</table>
```

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?

![Diagram of cash flows]

\[ I/Y = 7.5 / 12 \]

To | Press | Display |
---|---|---|
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< |

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< |
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.

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.

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set all variables to defaults.</td>
<td>2nd [RESET] ENTER RST 0.00</td>
<td></td>
</tr>
<tr>
<td>Set payments per year to 12.</td>
<td>2nd [P/Y] 12 ENTER P/Y= 12.00</td>
<td></td>
</tr>
<tr>
<td>Return to standard-calculator mode.</td>
<td>2nd [QUIT]</td>
<td></td>
</tr>
<tr>
<td>Enter number of payments using payment multiplier.</td>
<td>30 2nd [X/P/Y] N N= 360.00</td>
<td></td>
</tr>
<tr>
<td>Enter interest rate.</td>
<td>6.125 I/Y I/Y= 6.13</td>
<td></td>
</tr>
<tr>
<td>Enter loan amount.</td>
<td>120000 PV PV= 120,000.00</td>
<td></td>
</tr>
<tr>
<td>Compute payment.</td>
<td>CPMT PMT= -729.13*</td>
<td></td>
</tr>
</tbody>
</table>

**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.)

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select the Amortization worksheet.</td>
<td>2nd [AMORT] P1= 0</td>
<td></td>
</tr>
<tr>
<td>Set beginning period to 1.</td>
<td>1 ENTER P1= 1.00</td>
<td></td>
</tr>
<tr>
<td>Set ending period to 9.</td>
<td>↓ 9 ENTER P2= 9.00</td>
<td></td>
</tr>
<tr>
<td>Display 1st year amortization data.</td>
<td>↓ ↓ ↓ BAL= 118,928.63* PRN= -1071.37* INT= -5,490.80*</td>
<td></td>
</tr>
<tr>
<td>Change beginning period to 10.</td>
<td>↓ 10 ENTER P1= 10.00</td>
<td></td>
</tr>
<tr>
<td>Change ending period to 21.</td>
<td>↓ 21 ENTER P2= 21.00</td>
<td></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display 2nd year amortization data.</td>
<td>( \downarrow )</td>
<td>BAL= 117,421.60*</td>
</tr>
<tr>
<td></td>
<td>( \downarrow )</td>
<td>PRN= -1,507.03*</td>
</tr>
<tr>
<td></td>
<td>( \downarrow )</td>
<td>INT= -7,242.53*</td>
</tr>
<tr>
<td>Move to P1 and press ( \text{CPT} ) to enter next range of payments.</td>
<td>( \downarrow ) ( \text{CPT} )</td>
<td>P1= 22.00d</td>
</tr>
<tr>
<td>Display P2.</td>
<td>( \downarrow )</td>
<td>P2= 33.00d</td>
</tr>
<tr>
<td>Display 3rd year amortization data.</td>
<td>( \downarrow )</td>
<td>BAL= 115,819.62*</td>
</tr>
<tr>
<td></td>
<td>( \downarrow )</td>
<td>PRN= -1601.98*</td>
</tr>
<tr>
<td></td>
<td>( \downarrow )</td>
<td>INT= -7,147.58*</td>
</tr>
</tbody>
</table>

Time-Value-of-Money and Amortization Worksheets 39
Generating an Amortization Schedule for Interest and Balloon Payment

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Amortization worksheet.</td>
<td>2nd [AMORT]</td>
<td>P1= 1.00</td>
</tr>
<tr>
<td>Enter end period (five years).</td>
<td>5 [2nd] [xP/Y] [ENTER]</td>
<td>P2= 60.00</td>
</tr>
<tr>
<td>View balance due after five years (balloon payment).</td>
<td>1</td>
<td>BAL= 77,187.72*</td>
</tr>
<tr>
<td>View interest paid after five years.</td>
<td>1 1</td>
<td>INT= -27,920.72*</td>
</tr>
</tbody>
</table>

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. (See “Time-Value-of-Money and Amortization Worksheets” on page 21.)

- To access the Cash Flow worksheet and initial cash flow value (CFo), press CF.
- To access the cash flow amount and frequency variables (Cnn/Fnn), 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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial cash flow</td>
<td>CF</td>
<td>CFo</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Amount of $n$th cash flow</td>
<td></td>
<td>Cnn*</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Frequency of $n$th cash flow</td>
<td></td>
<td>Fnn*</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Discount rate</td>
<td>NPV</td>
<td>I</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Net present value</td>
<td></td>
<td>NPV</td>
<td>Compute-only</td>
</tr>
<tr>
<td>Internal rate of return</td>
<td>IRR</td>
<td>IRR</td>
<td>Compute-only</td>
</tr>
</tbody>
</table>

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

- To reset \( CFo \), \( Cnn \), and \( Fnn \) to default values, press \( \text{[2nd]} \) \( \text{[CLR WORK]} \).
- To reset \( NPV \) to the default value, press \( \text{[NPV]} \) and then \( \text{[2nd]} \) \( \text{[CLR WORK]} \).
- To reset \( IRR \) to the default value, press \( \text{[IRR]} \) and then \( \text{[2nd]} \) \( \text{[CLR WORK]} \).
- To reset all calculator variables and formats to default values, including all Cash Flow worksheet variables, press \( \text{[2nd]} \) \( \text{[RESET]} \) \( \text{[ENTER]} \).

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 \( \text{[+/-]} \).

Inserting and Deleting Cash Flows

The calculator displays \( \text{INS} \) or \( \text{DEL} \) to confirm that you can press \( \text{[2nd]} \) \( \text{[INS]} \) or \( \text{[2nd]} \) \( \text{[DEL]} \) 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 \textit{Fnn} variable.

\textbf{Entering Cash Flows}
Cash flows consist of an initial cash flow (\textit{CFo}) and up to 24 additional cash flows (\textit{C01-C24}), each of which can have a unique value. You must enter the number of occurrences (up to 9,999), or \textit{frequency (F)}, for each additional cash flow (\textit{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 \textit{2nd CLR WORK}.

To enter cash flows:
1. Press \textit{CF}. The initial cash-flow value (\textit{CFo}) appears.
2. Key in a value for \textit{CFo} and press \textit{ENTER}.
3. To select an additional cash-flow variable, press \textit{#}. The \textit{C01} value appears.
4. To change \textit{C01}, key in a value and press \textit{ENTER}.
5. To select the cash-flow frequency variable (\textit{F01}), press \textit{#}. The \textit{F01} value appears.
6. To change \textit{F01}, key in a value and press \textit{ENTER}.
7. To select an additional cash-flow variable, press \textit{#}. The \textit{C02} value appears.
8. Repeat steps 4 through 7 for all remaining cash flows and frequencies.
9. To review entries, press \textit{#} or \textit{\textdagger}.

\textbf{Deleting Cash Flows}
When you delete a cash flow, the calculator decreases the number of subsequent cash flows automatically.
The **DEL** indicator confirms that you can delete a cash flow.

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.

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

1. Press [1] or [1] 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 1 to display the current net present value (NPV).
4. To compute the net present value for the series of cash flows entered, press OPT.

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 OPT. 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:

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow Number</th>
<th>Cash Flow Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase</td>
<td><strong>CFO</strong></td>
<td>-$7,000</td>
</tr>
<tr>
<td>1</td>
<td><strong>C01</strong></td>
<td>3,000</td>
</tr>
<tr>
<td>2–5</td>
<td><strong>C02</strong></td>
<td>5,000 each year</td>
</tr>
<tr>
<td>6</td>
<td><strong>C03</strong></td>
<td>4,000</td>
</tr>
</tbody>
</table>

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.
Entering Cash-Flow Data

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Cash Flow worksheet.</td>
<td>CF</td>
<td>CFo= 0.00</td>
</tr>
<tr>
<td>Enter initial cash flow.</td>
<td>7000 +/- ENTER</td>
<td>CFo= -7,000.00</td>
</tr>
<tr>
<td>Enter cash flow for first year.</td>
<td>1 3000 ENTER</td>
<td>C01= 3,000.00</td>
</tr>
<tr>
<td>Enter cash flows for years two through five.</td>
<td>1 5000 ENTER</td>
<td>C02= 5,000.00</td>
</tr>
<tr>
<td>Enter cash flow for sixth year.</td>
<td>1 4000 ENTER</td>
<td>C03= 4,000.00</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move to third cash flow.</td>
<td>t</td>
<td>C03= 4,000.00</td>
</tr>
<tr>
<td>Delete third cash flow.</td>
<td>2nd [DEL]</td>
<td>C03= 0.00</td>
</tr>
<tr>
<td>Move to second cash flow.</td>
<td>t t</td>
<td>C02= 5,000.00</td>
</tr>
<tr>
<td>Insert new second cash flow.</td>
<td>2nd [INS] 4000 ENTER</td>
<td>C02= 4,000.00</td>
</tr>
<tr>
<td>Move to next cash flow to verify data.</td>
<td></td>
<td>C03= 5,000.00</td>
</tr>
</tbody>
</table>
Computing NPV

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

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access interest rate variable</td>
<td><img src="NPV" alt="NPV" /></td>
<td>I= 0.00</td>
</tr>
<tr>
<td>Enter interest rate per period.</td>
<td>20 <img src="ENTER" alt="ENTER" /></td>
<td>I= 20.00</td>
</tr>
<tr>
<td>Compute net present value.</td>
<td><img src="CPT" alt="CPT" /></td>
<td>NPV= 7,266.44</td>
</tr>
</tbody>
</table>

**Answers:** NPV is $7,266.44.

Computing IRR

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access IRR.</td>
<td><img src="IRR" alt="IRR" /></td>
<td>IRR= 0.00</td>
</tr>
<tr>
<td>Compute internal rate of return.</td>
<td><img src="CPT" alt="CPT" /></td>
<td>IRR= 52.71</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Number of Months</th>
<th>Payment Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>$0</td>
</tr>
<tr>
<td>8</td>
<td>$5000</td>
</tr>
<tr>
<td>3</td>
<td>$0</td>
</tr>
<tr>
<td>9</td>
<td>$6000</td>
</tr>
<tr>
<td>2</td>
<td>$0</td>
</tr>
<tr>
<td>10</td>
<td>$7000</td>
</tr>
</tbody>
</table>

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 (C\text{F}_0) 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.

\[
\begin{array}{cccccc}
\text{C01} & \text{C02} & \text{C03} & \text{C04} & \text{C05} & \text{C06} \\
$0 & $5000 & $0 & $6000 & $0 & $7000 \\
\hline
\text{F01} & \text{F02} & \text{F03} & \text{F04} & \text{F05} & \text{F06} \\
\end{array}
\]

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

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set all variables to defaults.</td>
<td>(\text{2nd} ; \text{[RESET]} ; \text{[ENTER]})</td>
<td>(\text{RST} ; 0.00)</td>
</tr>
<tr>
<td>Select Cash Flow worksheet.</td>
<td>(\text{CF})</td>
<td>(\text{C01}= 0.00)</td>
</tr>
<tr>
<td>Enter first group of cash flows.</td>
<td>(\text{1} ; \text{3} ; \text{[ENTER]})</td>
<td>(\text{F01}= 3.00)</td>
</tr>
<tr>
<td>Enter second group of cash flows.</td>
<td>(\text{1} ; 5000 ; \text{[+] [ENTER]})</td>
<td>(\text{C02}= -5000.00)</td>
</tr>
<tr>
<td>Enter third group of cash flows.</td>
<td>(\text{1} ; \text{8} ; \text{[ENTER]})</td>
<td>(\text{F02}= 8.00)</td>
</tr>
<tr>
<td>Enter fourth group of cash flows.</td>
<td>(\text{1} ; 6000 ; \text{[+] [ENTER]})</td>
<td>(\text{C04}= -6000.00)</td>
</tr>
<tr>
<td>Enter fifth group of cash flows.</td>
<td>(\text{1} ; \text{9} ; \text{[ENTER]})</td>
<td>(\text{F04}= 9.00)</td>
</tr>
<tr>
<td>Enter sixth group of cash flows.</td>
<td>(\text{1} ; 7000 ; \text{[+] [ENTER]})</td>
<td>(\text{C06}= -7000.00)</td>
</tr>
<tr>
<td>Select NPV.</td>
<td></td>
<td>(\text{l=} 0.00)</td>
</tr>
<tr>
<td>To</td>
<td>Press</td>
<td>Display</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>Enter monthly earnings rate.</td>
<td>10 ÷ 12 ENTER</td>
<td>I = 0.83</td>
</tr>
<tr>
<td>Compute NPV.</td>
<td>[2] [CPT]</td>
<td>NPV = -138,088.44</td>
</tr>
</tbody>
</table>
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 1 or 1.
- 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 5 or 4 to navigate through the Bond worksheet before you enter values causes an error (Error 6). To clear the error, press CE/C. (See “Error Messages” on page 94.)
## Bond Worksheet Variables

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

### Resetting Bond Worksheet Variables

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Default</th>
<th>Variable</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDT</td>
<td>12-31-1990</td>
<td>ACT/360</td>
<td>ACT</td>
</tr>
<tr>
<td>CPN</td>
<td>0</td>
<td>2/Y, 1/Y</td>
<td>2/Y</td>
</tr>
<tr>
<td>RDT</td>
<td>12-31-1990</td>
<td>YLD</td>
<td>0</td>
</tr>
<tr>
<td>RV</td>
<td>100</td>
<td>PRI</td>
<td>0</td>
</tr>
</tbody>
</table>

- 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. (See “Setting Calculator Formats” on page 4.)

- You can enter dates from January 1, 1950 through December 31, 2049.
• 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**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call Date</td>
<td>A callable 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.</td>
</tr>
<tr>
<td>Coupon Payment</td>
<td>The periodic payment made to the owner of the bond as interest.</td>
</tr>
<tr>
<td>Coupon Rate</td>
<td>The annual interest rate printed on the bond.</td>
</tr>
<tr>
<td>Dollar Price</td>
<td>Price of the security expressed in terms of dollars per $100 of par value.</td>
</tr>
<tr>
<td>Par (Face) Value</td>
<td>The value printed on the bond.</td>
</tr>
<tr>
<td>Premium Bond</td>
<td>A bond that sells for an amount greater than the par value.</td>
</tr>
<tr>
<td>Discount Bond</td>
<td>A bond selling for less than the par value.</td>
</tr>
<tr>
<td>Redemption Date</td>
<td>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.</td>
</tr>
<tr>
<td>Redemption Value</td>
<td>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.</td>
</tr>
<tr>
<td>Settlement Date</td>
<td>The date on which a bond is exchanged for funds.</td>
</tr>
<tr>
<td>Yield to Maturity</td>
<td>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.</td>
</tr>
</tbody>
</table>

**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.

**Note:** Dates are not changed when you clear a worksheet.

### 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 **[1]** 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 **[1]** until **ACT** or **360** appears.
2. To change the day-count method, press **2nd [SET]**.
3. To display the coupon frequency, press **[1]** until **2/Y** or **1/Y** appears.
4. To change the coupon frequency, press **2nd [SET]**.

### Computing the Bond Price (PRI)
1. Press **[1]** until **YLD** appears.
2. Key in a value for **YLD** and press **[ENTER]**.
3. Press **[1]** to display **PRI**, and then press **[CPT]**. The calculator displays the computed **PRI** value.

### Computing the Bond Yield (YLD)
1. Press **[1]** until **PRI** appears.
2. Key in a value for **PRI** and press **[ENTER]**.
3. Press **[1]** to display **YLD**, and then press **[CPT]**. The calculator displays the computed **YLD** value.

### Computing Accrued Interest (AI)
To compute accrued interest, press **[1]** 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, 2007 and settling on June 12, 2006. 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, accrued interest, and modified duration.

Computing Bond Price and Accrued Interest

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Bond worksheet.</td>
<td>2nd [BOND]</td>
<td>SDT = 12-31-1990</td>
</tr>
<tr>
<td>Enter settlement date.</td>
<td>6.1206 ENTER</td>
<td>SDT = 6-12-2006</td>
</tr>
<tr>
<td>Enter coupon rate.</td>
<td>7 ENTER</td>
<td>CPN = 7.00</td>
</tr>
<tr>
<td>Enter redemption date.</td>
<td>12.3107 ENTER</td>
<td>RDT = 12-31-2007</td>
</tr>
<tr>
<td>Leave redemption value as is.</td>
<td></td>
<td>RV = 100.00</td>
</tr>
<tr>
<td>Select 30/360 day-count method.</td>
<td>2nd [SET]</td>
<td>360</td>
</tr>
<tr>
<td>Leave two coupon payments per year.</td>
<td></td>
<td>2/Y</td>
</tr>
<tr>
<td>Enter yield.</td>
<td>8 ENTER</td>
<td>YLD = 8.00</td>
</tr>
<tr>
<td>Compute price</td>
<td>CPT</td>
<td>PRI = 98.56*</td>
</tr>
<tr>
<td>View modified duration</td>
<td></td>
<td>DUR = 1.44</td>
</tr>
</tbody>
</table>

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 [1] or [†].

**Note:** To easily scroll up or down through a range of variables, press and hold [1] or [†].

### Depreciation Worksheet Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight-line method</td>
<td>[2nd] [DEPR]</td>
<td>SL</td>
<td>Setting</td>
</tr>
<tr>
<td>Sum-of-the-years’-digits method</td>
<td>[2nd] [SET]</td>
<td>SYD</td>
<td>Setting</td>
</tr>
<tr>
<td>Declining-balance method</td>
<td>[2nd] [SET]</td>
<td>DB</td>
<td>Setting/Enter</td>
</tr>
<tr>
<td>Declining-balance method with crossover to SL method</td>
<td>[2nd] [SET]</td>
<td>DBX</td>
<td>Setting/Enter</td>
</tr>
<tr>
<td>French straight-line method*</td>
<td>[2nd] [SET]</td>
<td>SLF</td>
<td>Setting</td>
</tr>
<tr>
<td>French declining balance method*</td>
<td>[2nd] [SET]</td>
<td>DBF</td>
<td>Setting/Enter</td>
</tr>
<tr>
<td>Life of the asset in years</td>
<td>[1]</td>
<td>LIF</td>
<td>Enter only</td>
</tr>
<tr>
<td>Starting month</td>
<td>[1]</td>
<td>M01</td>
<td>Enter only</td>
</tr>
<tr>
<td>Starting date for French straight-line method**</td>
<td>[1]</td>
<td>DT1</td>
<td>Enter only</td>
</tr>
<tr>
<td>Cost of the asset</td>
<td>[1]</td>
<td>CST</td>
<td>Enter only</td>
</tr>
<tr>
<td>Salvage value of the asset</td>
<td>[1]</td>
<td>SAL</td>
<td>Enter only</td>
</tr>
</tbody>
</table>

*French methods are used only for the French straight-line and declining balance methods.
**The straight-line method is used only for the straight-line and sum-of-the-years’-digits methods.

Depreciation Worksheet
### Depreciation Worksheet

**SLF and DBF are available only if you select the European format for dates or separators in numbers. (See “Setting Calculator Formats” on page 4.)**

**This guidebook categorizes variables by their method of entry. (See “Types of Worksheet Variables” on page 17.)**

### Resetting the Depreciation Worksheet Variables

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year to compute</td>
<td>![Key]</td>
<td>YR</td>
<td>Enter only</td>
</tr>
<tr>
<td>Depreciation for the year</td>
<td>![Key]</td>
<td>DEP</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Remaining book value at the end of the year</td>
<td>![Key]</td>
<td>RBV</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Remaining depreciable value</td>
<td>![Key]</td>
<td>RDV</td>
<td>Auto-compute</td>
</tr>
</tbody>
</table>

### 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. (See “Setting Calculator Formats” on page 4.)

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

---

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_Depreciation Worksheet_
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 $ to return to the year to compute (YR) variable. To represent the next depreciation year, press CPT to increment the value for YR by one.
- To compute a depreciation schedule, repeatedly return to the year to compute (YR) variable, press 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.

Note: Dates are not changed when you clear a worksheet.
Selecting a Depreciation Method

1. To access the Depreciation worksheet, press \([2nd \text{[DEPR]}]\). The current depreciation method is displayed.
2. To clear the worksheet, press \([2nd \text{[CLR WORK]}]\).
3. Press \([2nd \text{[SET]}]\) 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 \([\text{L}]\).
2. Key in a value for LIF and press \([\text{ENTER}]\).
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. (See “Setting Calculator Formats” on page 4.)

Computing Results for DEP, RBV, and RDV

After entering the data, press \([\text{L}]\) 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 \([\text{L}]\).
2. To increment the value by one, press \([\text{CPT}]\).
3. To compute new values for DEP, RBV, and RDV, press \([\text{L}]\) 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.

**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 \[2\text{nd} \ [\text{DATA}].
- To choose a statistics calculation method and compute the results, press \[2\text{nd} \ [\text{STAT}].
- To access statistics variables, press \[1\] or \[1].

Statistics Worksheet Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current X value</td>
<td>[2\text{nd} \ [\text{DATA}]]</td>
<td>(X_{nn^*})</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Current Y value</td>
<td>[1]</td>
<td>(Y_{nn^*})</td>
<td>Enter-only</td>
</tr>
</tbody>
</table>

- Standard linear regression
- Logarithmic regression
- Exponential regression
- Power regression
- One-variable statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[2\text{nd} \ [\text{STAT}]]</td>
<td>LIN</td>
<td>Setting</td>
</tr>
<tr>
<td></td>
<td>[2\text{nd} \ [\text{SET}]]</td>
<td>Ln</td>
<td>Setting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXP</td>
<td>Setting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PWR</td>
<td>Setting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[1-V]</td>
<td>Setting</td>
</tr>
</tbody>
</table>
### Variable Key Display Variable Type

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of observations</td>
<td>( \text{n} ) (as ( \text{n} ) needed)</td>
<td>( \text{n} )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Mean (average) of X values</td>
<td>( \bar{x} )</td>
<td>( \bar{x} )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Sample standard deviation of X</td>
<td>( s_x )</td>
<td>( s_x )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Population standard deviation of X</td>
<td>( \sigma_x )</td>
<td>( \sigma_x )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Mean (average) of Y values</td>
<td>( \bar{y} )</td>
<td>( \bar{y} )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Sample standard deviation of Y</td>
<td>( s_y )</td>
<td>( s_y )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Population standard deviation of Y</td>
<td>( \sigma_y )</td>
<td>( \sigma_y )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Linear regression y-intercept</td>
<td>( b )</td>
<td>( b )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Linear regression slope</td>
<td>( a )</td>
<td>( a )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>( r )</td>
<td>( r )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Predicted X value</td>
<td>( X' )</td>
<td>( X' )</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Predicted Y value</td>
<td>( Y' )</td>
<td>( Y' )</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Sum of X values</td>
<td>( \Sigma X )</td>
<td>( \Sigma X )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Sum of X squared values</td>
<td>( \Sigma X^2 )</td>
<td>( \Sigma X^2 )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Sum of Y values</td>
<td>( \Sigma Y )</td>
<td>( \Sigma Y )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Sum of Y squared values</td>
<td>( \Sigma Y^2 )</td>
<td>( \Sigma Y^2 )</td>
<td>Auto-compute</td>
</tr>
<tr>
<td>Sum of XY products</td>
<td>( \Sigma XY )</td>
<td>( \Sigma XY )</td>
<td>Auto-compute</td>
</tr>
</tbody>
</table>

* \( nn \) 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. (See "Types of Worksheet Variables" on page 17.)

### 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 \( \text{2nd} \ [\text{CLR WORK}] \) while in the data-entry portion of the worksheet (\( \text{2nd} \ [\text{DATA}] \)).

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

- To reset the statistics calculation method to LIN and clear all values, including X and Y, press \( \text{2nd} \ [\text{RESET}] \ [\text{ENTER}] \).

### Entering Data Points

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

- If you press \( \text{1} \) or \( \text{1} \) 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 $n$, $\bar{X}$, $Sx$, $\sigma X$, $\Sigma X$, and $\Sigma X^2$ 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.

<table>
<thead>
<tr>
<th>Model</th>
<th>Formula</th>
<th>Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIN</td>
<td>$Y = a + b X$</td>
<td>None</td>
</tr>
<tr>
<td>Ln</td>
<td>$Y = a + b \ln(X)$</td>
<td>All $X$ values &gt; zero</td>
</tr>
<tr>
<td>EXP</td>
<td>$Y = a b^X$</td>
<td>All $Y$ values &gt; zero</td>
</tr>
<tr>
<td>PWR</td>
<td>$Y = a X^b$</td>
<td>All $X$ and $Y$ values &gt; zero</td>
</tr>
</tbody>
</table>

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 \([\#]\).
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 \([\#]\) or \([\#]\).
Computing Statistical Results

Selecting a Statistics Calculation Method
1. Press $2^{nd}$ [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 $2^{nd}$ [SET] repeatedly until the statistics calculation method you want is displayed.
4. If you are analyzing one-variable data, select 1-V.

Computing Results
To compute results based on the current data set, press [1] 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 $n$, $\bar{x}$, $Sx$, $sX$, $G X$, and $G X^2$.

Computing $Y'$
1. To select the Statistics worksheet, press $2^{nd}$ [STAT].
3. Key in a value for $X'$ and press [ENTER].
4. Press [1] to display the $Y'$ variable.
5. Press [CPT] to compute a predicted $Y'$ value.

Computing $X'$
1. To select the Statistics worksheet, press $2^{nd}$ [STAT].
3. Key in a value for $Y'$ and press [ENTER].
4. Press [1] to display the $X'$ variable.
5. Press [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 1 or 1.

Percent Change/Compound Interest Worksheet Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old value/Cost</td>
<td>2nd [△%]</td>
<td>OLD</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>New value/Selling price</td>
<td>1</td>
<td>NEW</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Percent change/Percent markup</td>
<td>1</td>
<td>%CH</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Number of periods</td>
<td>1</td>
<td>#PD</td>
<td>Enter/compute</td>
</tr>
</tbody>
</table>

Note: This guidebook categorizes variables by their method of entry. (See “Types of Worksheet Variables” on page 17.)
Resetting the Percent Change/Compound Interest Worksheet Variables

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Default</th>
<th>Variable</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLD</td>
<td>0</td>
<td>%CH</td>
<td>0</td>
</tr>
<tr>
<td>NEW</td>
<td>0</td>
<td>#PD</td>
<td>1</td>
</tr>
</tbody>
</table>

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

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 \[2^{\text{nd}}\ [^\text{a}]\]. The current value for OLD is displayed.
2. To clear the worksheet, press \[2^{\text{nd}}\ \text{CLR WORK}\].
3. To enter values for the known variables, press \([\text{4}]\) or \([\text{1}]\) until the variable you want is displayed, then key in a value, and press \([\text{ENTER}]\). (Do not enter a value for the variable you wish to solve.)
   - **Percent Change** — Enter values for two of these three variables: \(\text{OLD}, \text{NEW}, \text{and} \ %\text{CH}\). Leave \#PD set to 1.
   - **Compound Interest** — Enter values for three of these four variables: \(\text{OLD}, \text{NEW}, \ %\text{CH}, \text{and} \ #PD\).
   - **Cost-Sell-Markup** — Enter values for two of these three variables: \(\text{OLD}, \text{NEW}, \text{and} \ %\text{CH}\). Leave \#PD set to 1.

4. To compute a value for the unknown variable, press \([\text{4}]\) or \([\text{1}]\) until the variable you want is displayed and press \([\text{CPT}]\). 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.

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Percent Change/Compound Interest worksheet.</td>
<td>([\text{2nd}] [\downarrow %])</td>
<td>(\text{OLD}= 0)</td>
</tr>
<tr>
<td>Enter original forecast amount.</td>
<td>(658 \text{ ENTER})</td>
<td>(\text{OLD}= 658.00)</td>
</tr>
<tr>
<td>Enter actual amount.</td>
<td>(1700 \text{ ENTER})</td>
<td>(\text{NEW}= 700.00)</td>
</tr>
<tr>
<td>Compute percent change.</td>
<td>(\text{1} \text{ CPT})</td>
<td>(%\text{CH}= 6.38\times)</td>
</tr>
<tr>
<td>Enter -7 as percent change.</td>
<td>(7 \text{ +/- ENTER})</td>
<td>(%\text{CH}= -7.00\times)</td>
</tr>
<tr>
<td>Compute new actual amount.</td>
<td>(\text{1} \text{ CPT})</td>
<td>(\text{NEW}= 611.94\times)</td>
</tr>
</tbody>
</table>

**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?

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Percent Change/Compound Interest worksheet.</td>
<td>([\text{2nd}] [\downarrow %])</td>
<td>(\text{OLD}= 0)</td>
</tr>
<tr>
<td>Enter stock purchase price.</td>
<td>(500 \text{ ENTER})</td>
<td>(\text{OLD}= 500.00)</td>
</tr>
<tr>
<td>Enter stock selling price.</td>
<td>(1750 \text{ ENTER})</td>
<td>(\text{NEW}= 750.00)</td>
</tr>
</tbody>
</table>

*Other Worksheets* 71
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.

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter number of years.</td>
<td>5 ENTER</td>
<td>#PD= 5.00</td>
</tr>
<tr>
<td>Compute annual growth rate.</td>
<td>CPT</td>
<td>%CH= 8.45*</td>
</tr>
</tbody>
</table>

**Answer:** The annual growth rate is 8.45%.

### 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 [ICOND].
- To select interest conversion variables, press 1 or 1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal rate</td>
<td>2nd [ICOND]</td>
<td>NOM</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Annual effective rate</td>
<td>1</td>
<td>EFF</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Compounding periods per year</td>
<td>1</td>
<td>C/Y</td>
<td>Enter-only</td>
</tr>
</tbody>
</table>

**Note:** The calculator categorizes variables by their method of entry. (See “Types of Worksheet Variables” on page 17.)
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].

<table>
<thead>
<tr>
<th>Variable</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOM</td>
<td>0</td>
</tr>
<tr>
<td>EFF</td>
<td>0</td>
</tr>
<tr>
<td>C/Y</td>
<td>1</td>
</tr>
</tbody>
</table>

- 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 \[4\] or \[1\] until NOM or EFF is displayed, key in a value, and press \[ENTER\].
5. Press \[1\] to display C/Y. If necessary, change the value and press \[ENTER\].
6. To compute a value for the unknown variable (interest rate), press \( \boxed{1} \) or \( \boxed{1} \) until \textbf{NOM} or \textbf{EFF} is displayed, and then press \boxed{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?

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Interest Conversion worksheet.</td>
<td>( \boxed{2nd \ CONV} )</td>
<td>\textbf{NOM}= 0</td>
</tr>
<tr>
<td>Enter nominal interest rate.</td>
<td>15 \boxed{ENTER}</td>
<td>\textbf{NOM}= 15.00</td>
</tr>
<tr>
<td>Enter number of compounding periods per year.</td>
<td>( \boxed{1} \boxed{1} \boxed{4} \boxed{ENTER} )</td>
<td>\textbf{C/Y}= 4.00</td>
</tr>
<tr>
<td>Compute annual effective interest rate.</td>
<td>( \boxed{1} \boxed{CPT} )</td>
<td>\textbf{EFF}= 15.87</td>
</tr>
</tbody>
</table>

**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 \( \boxed{2nd \ DATE} \).
- To access the date variables, press \( \boxed{1} \) or \( \boxed{1} \).
- To select the day-count method (\textbf{ACT} and \textbf{360}), press \( \boxed{2nd \ SET} \) once for each option.

**Date Worksheet Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date 1</td>
<td>( \boxed{2nd \ DATE} )</td>
<td>DT1</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Date 2</td>
<td>\boxed{1}</td>
<td>DT2</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Days between dates</td>
<td>\boxed{1}</td>
<td>DBD</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Actual/actual day-count method</td>
<td>\boxed{1}</td>
<td>\textbf{ACT} *</td>
<td>Setting</td>
</tr>
<tr>
<td>30/360 day-count method</td>
<td>\boxed{1}</td>
<td>\textbf{360} *</td>
<td>Setting</td>
</tr>
</tbody>
</table>
Note: The calculator categorizes variables by their method of entry. (See “Types of Worksheet Variables” on page 17.)

Resetting the Date Worksheet Variables

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Default</th>
<th>Variable</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>DT1</td>
<td>12-31-1990</td>
<td>DBD</td>
<td>0</td>
</tr>
<tr>
<td>DT2</td>
<td>12-31-1990</td>
<td>Day-count method</td>
<td>ACT</td>
</tr>
</tbody>
</table>

- 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.
5. Key in a value and press [ENTER].
6. To change the day-count method setting, press \([\#]\) until \(\text{ACT}\) or \(360\) is displayed.

7. To compute a value for the unknown variable, press \([\#]\) or \([\#]\) to display the variable, and then press \([\text{CPT}]\). 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?

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Date worksheet.</td>
<td>([\text{2nd} \ [\text{DATE}]])</td>
<td>(\text{DT1=} \ 12-31-1990)</td>
</tr>
<tr>
<td>Enter first date.</td>
<td>(9.0403 \ [\text{ENTER}])</td>
<td>(\text{DT1=} \ 9-04-2003&lt;)</td>
</tr>
<tr>
<td>Enter second date.</td>
<td>(11.0103 \ [\text{ENTER}])</td>
<td>(\text{DT2=} \ 11-01-2003&lt;)</td>
</tr>
<tr>
<td>Select actual/actual day-count method.</td>
<td></td>
<td>(\text{ACT})</td>
</tr>
<tr>
<td>Compute days between dates.</td>
<td>([#] \ [\text{CPT}])</td>
<td>(\text{DBD=} \ 58.00&lt;)</td>
</tr>
</tbody>
</table>

**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. (See “Percent Change/Compound Interest Worksheet” on page 69.)

- To access the Profit Margin worksheet, press \([\text{2nd} \ [\text{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**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>([\text{2nd} \ [\text{PROFIT}]]</td>
<td>CST</td>
<td>Enter/compute</td>
</tr>
</tbody>
</table>
Note: This guidebook categorizes calculator variables by their method of entry. (See “Types of Worksheet Variables” on page 17.)

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 **1** or **1** 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 **1** or **1** 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.

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Profit Margin worksheet.</td>
<td>2nd [PROFIT]</td>
<td>CST= 0.00</td>
</tr>
<tr>
<td>Enter selling price.</td>
<td>1 125 ENTER</td>
<td>SEL= 125.00</td>
</tr>
</tbody>
</table>

Other Worksheets
Enter profit margin. | 20 ENTER | MAR = 20.00
Compute cost. | 1 1 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 1 or 2.
- 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**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed cost</td>
<td>[2nd] [BRKEVN]</td>
<td>FC</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Variable cost per unit</td>
<td>1</td>
<td>VC</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Unit price</td>
<td>1</td>
<td>P</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Profit</td>
<td>1</td>
<td>PFT</td>
<td>Enter/compute</td>
</tr>
<tr>
<td>Quantity</td>
<td>1</td>
<td>Q</td>
<td>Enter/compute</td>
</tr>
</tbody>
</table>

**Note:** This guidebook categorizes calculator variables by their method of entry. (See “Types of Worksheet Variables” on page 17.)

**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 \[2^{nd}\] [BRKEVN]. The FC variable appears.
2. Press 1 or 2 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 1 or 2 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?

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Breakeven worksheet.</td>
<td>2^{nd} [BRKEVN]</td>
<td>FC= 0</td>
</tr>
<tr>
<td>Enter fixed costs.</td>
<td>3000 ENTER</td>
<td>FC= 3,000.00</td>
</tr>
<tr>
<td>Enter variable cost per unit.</td>
<td>1 15 ENTER</td>
<td>VC= 15.00</td>
</tr>
<tr>
<td>Enter price.</td>
<td>1 20 ENTER</td>
<td>P= 20.00</td>
</tr>
<tr>
<td>Leave profit as is.</td>
<td>1</td>
<td>PFT= 0.00</td>
</tr>
<tr>
<td>Compute quantity.</td>
<td>1 [CPT]</td>
<td>Q= 600.00*</td>
</tr>
</tbody>
</table>

**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. (See “Types of Worksheet Variables” on page 17.)

- 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. (See “Memory Operations” on page 12.)

### Memory Worksheet Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Key</th>
<th>Display</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory 0</td>
<td>[2nd] [MEM]</td>
<td>M0</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Memory 1</td>
<td>†</td>
<td>M1</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Memory 2</td>
<td>†</td>
<td>M2</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Memory 3</td>
<td>†</td>
<td>M3</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Memory 4</td>
<td>†</td>
<td>M4</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Memory 5</td>
<td>†</td>
<td>M5</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Memory 6</td>
<td>†</td>
<td>M6</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Memory 7</td>
<td>†</td>
<td>M7</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Memory 8</td>
<td>†</td>
<td>M8</td>
<td>Enter-only</td>
</tr>
<tr>
<td>Memory 9</td>
<td>†</td>
<td>M9</td>
<td>Enter-only</td>
</tr>
</tbody>
</table>

Note: This guidebook categorizes calculator variables by their method of entry. (See “Types of Worksheet Variables” on page 17.)

### 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 appears.
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 \[ 1 \] or \[ 2 \] once for each memory.
- To store a value, select a memory (M0-M9), key in a value, and press \( \text{[ENTER]} \).
- Memory arithmetic. (See “Memory Arithmetic” on page 12.)

**Examples: Using the Memory Worksheet**

<table>
<thead>
<tr>
<th>To</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Memory worksheet</td>
<td>2nd [MEM]</td>
<td>M0= 0</td>
</tr>
<tr>
<td>Select M4.</td>
<td>1 1 1 1</td>
<td>M4= 0</td>
</tr>
<tr>
<td>Clear M4.</td>
<td>0 [ENTER]</td>
<td>M4= 0.00</td>
</tr>
<tr>
<td>Store 95.</td>
<td>9 5 [ENTER]</td>
<td>M4= 95.00</td>
</tr>
<tr>
<td>Add 65.</td>
<td>+ 6 5 [ENTER]</td>
<td>M4= 160.00</td>
</tr>
<tr>
<td>Subtract 30.</td>
<td>- 3 0 [ENTER]</td>
<td>M4= 130.00</td>
</tr>
<tr>
<td>Multiply by 95.</td>
<td>( \times 9 5 ) [ENTER]</td>
<td>M4= 12,350.00</td>
</tr>
<tr>
<td>Divide by 65.</td>
<td>( \div 6 5 ) [ENTER]</td>
<td>M4= 190.00</td>
</tr>
<tr>
<td>Raise to 2(^{\text{nd}}) power.</td>
<td>( \sqrt[2]{2} ) [ENTER]</td>
<td>M4= 36,100.00</td>
</tr>
</tbody>
</table>
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

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

where: \( \text{PMT} \neq 0 \)

\[ y = \frac{C/Y}{P/Y} \]
\[ x = \frac{.01 \times I/Y}{C/Y} \]

\( C/Y = \) compounding periods per year
\( P/Y = \) payment periods per year
\( I/Y = \) interest rate per year

\[ i = \left(-FV \div PV\right)^{(1 + N)} - 1 \]

where: \( \text{PMT} = 0 \)

The iteration used to compute \( i \):

\[ 0 = PV + PMT \times G_i \left[ \frac{1 - (1 + i)^{-N}}{i} \right] + FV \times (1 + i)^{-N} \]
\[ I/Y = 100 \times C/Y \times \left[ e^{\left( \frac{y \ln(x+1)}{x} \right)} - 1 \right] \]

where:  
\[ x = i \]  
\[ y = P/Y \div C/Y \]

\[ G_i = 1 + i \times k \]

where:  
\[ k = 0 \] for end-of-period payments  
\[ k = 1 \] for beginning-of-period payments

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

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:  
\[ i = 0 \]

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

where:  
\[ i \neq 0 \]

\[ PV = -(FV + PMT \times N) \]

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

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 \( pmt2 \)

\[
\begin{align*}
I_m &= RND[RND12(-i \times bal(m - 1))] \\
bal(m) &= bal(m - 1) - I_m + RND(PMT)
\end{align*}
\]

then: \( bal() = bal(pmt2) \)

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

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

where: \( RND \) = round the display to the number of 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**

\[
NPV = CF_0 + \sum_{j=1}^{N} CF_j (1 + i)^{-j-1} \frac{1 - (1 + i)^{-n_j}}{i}
\]

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 \((CF_0)\), subsequent cash flows \((CF_j)\), frequency of each cash flow \((n_j)\), and the specified interest rate \((i)\).

\[ IRR = 100 \times i, \text{ where } i \text{ satisfies } npv() = 0 \]

Internal rate of return depends on the values of the initial cash flow \((CF_0)\) and the subsequent cash flows \((CF_j)\).

\[ i = \frac{I/Y}{100} \]
Bonds

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

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

where: 
- \( PRI \) = dollar price per $100 par value 
- \( RV \) = redemption value of the security per $100 par value (\( RV = 100 \) except in those cases where call or put features must be considered) 
- \( R \) = annual interest rate (as a decimal; \( CPN \times 100 \)) 
- \( M \) = number of coupon periods per year standard for the particular security involved (set to 1 or 2 in 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 (\( YLD \times 100 \)) 
- \( A \) = 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:

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

---

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

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

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 period to redemption” formula.

Accrued interest for securities 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

\[
RDV = CST - SAL \quad \text{– accumulated depreciation}
\]

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

In the following formulas, \( FSTYR = (13 - MO1) \div 12 \).
Straight-line depreciation

\[
\frac{\text{CST} - \text{SAL}}{\text{LIF}}
\]

First year: \(\frac{\text{CST} - \text{SAL}}{\text{LIF}} \times \text{FSTYR}\)

Last year or more: \(\text{DEP} = \text{RDV}\)
Sum-of-the-years’-digits depreciation

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

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 \((\sigma_x)\):

\[
\left[ \frac{\sum x^2 - \left( \frac{\sum x}{n} \right)^2}{n} \right]^{1/2}
\]
Standard deviation with \( n-1 \) weighting (\( s_x \)):

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

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

**Regressions**

Formulas apply to all regression models using transformed data.

\[
b = \frac{n(\sum xy) - (\sum y)(\sum x)}{n(\sum x^2) - (\sum x)^2}
\]

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

\[
r = \frac{b\delta_x}{\delta_y}
\]

**Interest Rate Conversions**

\[
EFF = 100 \times (e^{C/Y \times \ln(x+1)} - 1)
\]

where: \( x = .01 \times NOM \div C_{\infty}Y \)

\[
NOM = 100 \times C/Y \times (e^{1 + C/Y \times \ln(x+1)} - 1)
\]

where: \( x = .01 \times EFF \)

**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**

\[
\text{Gross Profit Margin} = \frac{\text{Selling Price} - \text{Cost}}{\text{Selling Price}} \times 100
\]

**Breakeven**

\[
PFT = P \times Q - (FC + VC \times Q)
\]

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, 1950, through December 31, 2049.

**Actual/actual day-count method**

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

\[
DBD \text{ (days between dates)} = \text{number of days } I \text{ - number of days } II
\]

\[
\begin{align*}
\text{Number of Days } I &= (Y_1 - Y_B) \times 365 \\
\text{ } &\quad + \text{(number of days } MB \text{ to } M1) \\
\text{ } &\quad + DT1 \\
\text{ } &\quad + \left(\frac{Y_1 - Y_B}{4}\right)
\end{align*}
\]

\[
\begin{align*}
\text{Number of Days } II &= (Y_2 - Y_B) \times 365 \\
\text{ } &\quad + \text{(number of days } MB \text{ to } M2) \\
\text{ } &\quad + DT2 \\
\text{ } &\quad + \left(\frac{Y_2 - Y_B}{4}\right)
\end{align*}
\]
where:  
\( M_1 \) = month of first date  
\( DT_1 \) = day of first date  
\( Y_1 \) = year of first date  
\( M_2 \) = month of second date  
\( DT_2 \) = day of second date  
\( Y_2 \) = 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\(^2\)

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

\[
DBD = (Y_2 - Y_1) \times 360 + (M_2 + M_1) \times 30 + (DT_2 - DT_1)
\]

where:  
\( M_1 \) = month of first date  
\( DT_1 \) = day of first date  
\( Y_1 \) = year of first date  
\( M_2 \) = month of second date  
\( DT_2 \) = day of second date  
\( Y_2 \) = year of second date

**Note:** If \( DT_1 \) is 31, change \( DT_1 \) to 30. If \( DT_2 \) is 31 and \( DT_1 \) is 30 or 31, change \( DT_2 \) to 30; otherwise, leave it at 31.

---

## Error Messages

**Note:** To clear an error message, press `[CE/C]`.  

<table>
<thead>
<tr>
<th>Error</th>
<th>Possible Causes</th>
</tr>
</thead>
</table>
| **Error 1** Overflow   | • A result is outside the calculator range ($\pm 9.9999999999999E99$).  
                            • 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 $y^x$ 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 $\leq 0$.  
                            • Cash Flow worksheet: the $Fnn$ value is outside the range 0.5-9,999.  
                            • Bond worksheet: the $RV$, $CPN$, or $PRI$ value $\leq 0$.  
                            • Date worksheet: the computed date is outside the range January 1, 1950 through December 31, 2049.  
                            • Depreciation worksheet: the value entered for: declining balance percent $\leq 0$; $LIF \leq 0$; $YR \leq 0$; $CST < 0$; $SAL < 0$; or $M01 1 \leq M01 \leq 13$.  
                            • Interest Conversion worksheet: the $C/Y$ value $\leq 0$.  
                            • The $DEC$ value is outside the range 0-9. |
<table>
<thead>
<tr>
<th>Error</th>
<th>Possible Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Error 5</strong>&lt;br&gt;No solution exists</td>
<td>- TVM worksheet: the calculator computed I/Y when FV, (N \times PMT), and PV all have the same sign. (Make sure cash inflows are positive and outflows are negative.)&lt;br&gt;- TVM, Cash Flow, and Bond worksheets: the LN (logarithm) input is not &gt; 0 during calculations.&lt;br&gt;- Cash Flow worksheet: the calculator computed IRR without at least one sign change in the cash-flow list.</td>
</tr>
<tr>
<td><strong>Error 6</strong>&lt;br&gt;Invalid date</td>
<td>- 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).&lt;br&gt;- Bond worksheet: the calculator attempted a calculation with a redemption date earlier than or the same as the settlement date.</td>
</tr>
<tr>
<td><strong>Error 7</strong>&lt;br&gt;Iteration limit exceeded</td>
<td>- TVM worksheet: the calculator computed I/Y for a very complex problem involving many iterations.&lt;br&gt;- Cash Flow worksheet: the calculator computed IRR for a complex problem with multiple sign changes.&lt;br&gt;- Bond worksheet: the calculator computed YLD for a very complex problem.</td>
</tr>
<tr>
<td><strong>Error 8</strong>&lt;br&gt;Canceled iterative calculation</td>
<td>- TVM worksheet: [\text{ON/OFF}] was pressed to stop the evaluation of I/Y.&lt;br&gt;- Amortization worksheet: [\text{ON/OFF}] was pressed to stop the evaluation of BAL or INT.&lt;br&gt;- Cash Flow worksheet: [\text{ON/OFF}] was pressed to stop the evaluation of IRR.&lt;br&gt;- Bond worksheet: [\text{ON/OFF}] was pressed to stop the evaluation of YLD.&lt;br&gt;- Depreciation worksheet: [\text{ON/OFF}] was pressed to stop the evaluation of DEP or RDV.</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Priority (highest)</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( x^2, x!, 1/x, % , \sqrt{x}, LN, e^2, HYP, INV, SIN, COS, TAN )</td>
</tr>
<tr>
<td>2</td>
<td>nCr, nPr</td>
</tr>
<tr>
<td>3</td>
<td>Yx</td>
</tr>
<tr>
<td>4</td>
<td>( \times, \div )</td>
</tr>
<tr>
<td>5</td>
<td>+, -</td>
</tr>
<tr>
<td>6</td>
<td>)</td>
</tr>
<tr>
<td>7 (lowest)</td>
<td>=</td>
</tr>
</tbody>
</table>
Battery Information

Replacing the Battery
Replace the battery with a new CR2032 lithium battery.

Caution: Risk of explosion if replaced by an incorrect type. Replace only with the same or equivalent type recommended by Texas Instruments. Dispose of used batteries according to local regulations.

Note: 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.

Caution: Risk of explosion if replaced by an incorrect type. Replace only with the same or equivalent type recommended by Texas Instruments. Dispose of used batteries according to local regulations.

Battery Precautions
• Do not leave battery within the reach of children.
• Do not mix new and used batteries.
• Do not mix rechargeable and non-rechargeable batteries.
• Install battery 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.
• Seek Medical Advice immediately if a cell or battery has been swallowed. (In the USA, contact the National Poison Control Center collect at 202-625-3333.) Used only for small button cell batteries.
Battery Disposal

- Do not mutilate, or dispose of batteries in fire.
- The batteries can burst or explode, releasing hazardous chemicals.
- Discard used batteries according to local regulations.

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.

<table>
<thead>
<tr>
<th>Difficulty</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The calculator computes wrong answers.</td>
<td>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.</td>
</tr>
<tr>
<td>The display is blank; digits do not appear.</td>
<td>Select the worksheet again. Be sure the battery is properly installed and replace, if necessary.</td>
</tr>
<tr>
<td>The calculator does not display the correct worksheet variables.</td>
<td>Be sure you have selected the correct worksheet.</td>
</tr>
<tr>
<td>The calculator does not display the correct number of decimal places.</td>
<td>Press [2nd] [FORMAT] to check or adjust the setting for number of decimal places displayed.</td>
</tr>
<tr>
<td>The calculator does not display the correct date format.</td>
<td>Press [2nd] [FORMAT] [1] [1] to check or adjust the setting for date format.</td>
</tr>
<tr>
<td>The calculator does not display the correct separator format.</td>
<td>Press [2nd] [FORMAT] [1] [1] [1] to check or adjust the setting for separator format.</td>
</tr>
<tr>
<td>The calculator does not display the correct result in a math calculation.</td>
<td>Press [2nd] [FORMAT] [1] [1] [1] [1] to check or adjust the setting for calculation method.</td>
</tr>
<tr>
<td>An error occurs.</td>
<td>(See “Error Messages” on page 94.)</td>
</tr>
</tbody>
</table>

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. (See “Resetting the Calculator” on page 6.)
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