<table>
<thead>
<tr>
<th>Page</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Getting Started</td>
</tr>
<tr>
<td>2</td>
<td>Low Battery Indicator</td>
</tr>
<tr>
<td>2</td>
<td>Double Labeled Keys</td>
</tr>
<tr>
<td>2</td>
<td>Keying In Numbers Floating Decimal Scientific Notation</td>
</tr>
<tr>
<td>4</td>
<td>Reformat Display Keys: <strong>SCI</strong> and <strong>FLT</strong></td>
</tr>
<tr>
<td>6</td>
<td>Changing Signs: <strong>CHS</strong></td>
</tr>
<tr>
<td>6</td>
<td>Clearing Mistaken Key Depressions: <strong>C</strong> and <strong>FCA</strong></td>
</tr>
<tr>
<td>7</td>
<td>Basic Arithmetic Operations</td>
</tr>
<tr>
<td>7</td>
<td>Multifactor (Chain) Calculations</td>
</tr>
<tr>
<td>9</td>
<td>Two Factor Function Keys</td>
</tr>
<tr>
<td>11</td>
<td>Performing Constant Calculations</td>
</tr>
<tr>
<td>12</td>
<td>One Factor Function Keys</td>
</tr>
<tr>
<td>16</td>
<td>Degree/Grad/Radian Mode: <strong>DEG</strong> <strong>GRAD</strong> <strong>RAD</strong></td>
</tr>
<tr>
<td>17</td>
<td>Degree/Grad/Radian Conversion</td>
</tr>
<tr>
<td>17</td>
<td>Conversion Keys</td>
</tr>
<tr>
<td>22</td>
<td>Memory Operations</td>
</tr>
<tr>
<td>25</td>
<td>Calculating Mean and Standard Deviation</td>
</tr>
<tr>
<td>27</td>
<td>Using Parentheses Keys: <strong>( )</strong></td>
</tr>
<tr>
<td>30</td>
<td>Other Keys: <strong>π</strong> <strong>2</strong> <strong>x</strong> <strong>y</strong></td>
</tr>
<tr>
<td>32</td>
<td>Overflow and Error Indicators</td>
</tr>
<tr>
<td>32</td>
<td>Battery Information</td>
</tr>
<tr>
<td>33</td>
<td>Product Service Locations</td>
</tr>
<tr>
<td>35</td>
<td>Consumer Warranty Claim Certificate</td>
</tr>
</tbody>
</table>
Getting Started

Your calculator is designed for easy learning and efficient operation. It is recommended that you charge your calculator for 3 hours before initial use. See Battery Information. To get started, turn your calculator on with the switch on the left side. The display will show a digit or digits. Depress [C] to clear the display. The display should now show a single zero. If it does not, the battery probably needs recharging.

Low Battery Indicator

An "L" lights on the left side of the display when the battery needs recharging. Charge the batteries immediately.

Double Labeled Keys

Notice that many of the keys on your calculator have two labels, i.e., a designation appears above and below the key.

\[ \begin{array}{c}
+ \\
\text{Doubly Labeled Key}
\end{array} \]

This means that the key has two functions. When the key is depressed directly after the [F], the lower function, e.g., [M+] (memory plus) is accessed. In this manual, the [F] is illustrated as a required prefix to all secondary functions. The [M+] (memory plus) for example, will be shown as [FM+]. If [F] has been depressed by mistake, depress [EEX] to clear the erroneous depression without affecting the display or calculation in progress.

Keying in Numbers

Floating Decimal

The standard format in which numbers within the range 0.00000001 to 9,999,999,999 are entered and displayed is the floating decimal point format. Numbers are entered in the normal calculator fashion, i.e., key in numbers by touching the number keys in the same sequence as if you were writing them down on paper. If a decimal appears in the number, key it in sequence as part of the number. The calculator accepts the first decimal keyed in as the decimal in the number. The decimal need not be keyed in when keying in whole numbers.

The decimal point in the result of a calculation is automatically positioned. This is known as "floating point" notation because the decimal point can "float" to any digit location.

Results of calculations which exceed 9,999,999,999 or are less than .000000001 are automatically displayed in scientific notation since the number of display digits cannot accommodate these very large or very small numbers in the floating point format.

Scientific Notation

Any number within the range 10⁻¹⁰ to 10¹⁰ may be entered into your calculator and displayed in scientific notation using [EEX], Enter Exponent key. Entries in scientific notation are made as they are written, i.e., a decimal numeral (referred to as the mantissa) between 1 and 9.999999999 and a power of ten.

Scientific Notation Entry Procedure

1. Key in the mantissa as a decimal number between 1 and 9.999999999.  
   Note: If the mantissa is keyed in as a number outside this range, the calculator will automatically adjust the mantissa and exponent upon depression of a function key. See example 2.

2. Depress [EEX]: 00 is displayed in the exponent display positions.  
   Note: If a mantissa entry is not keyed in prior to depressing [EEX], the calculator automatically assumes and displays a mantissa of 1.

3. Enter the power of ten exponent digit(s).
To cancel SclenUllc mode and set Floating Decimal mode.

Observe in the example below that results which exceed 9,999,999,999 or are less than .000000001 are automatically converted to scientific notation.

Example 1: Solve \((4 \times 10^{19}) \times (3 \times 10^8) = 1.2 \times 10^{28}\)

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 EEX</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>19 x</td>
<td>4.19</td>
<td></td>
</tr>
<tr>
<td>3 EEX</td>
<td>3.00</td>
<td></td>
</tr>
<tr>
<td>8 =</td>
<td>1.28</td>
<td></td>
</tr>
</tbody>
</table>

Example 2: Solve the preceding problem, except enter \(40 \times 10^{18}\) instead of \(4 \times 10^{19}\) to observe automatic normalization performed on mantissa entries outside the range 1 to 9.999999999.

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 EEX</td>
<td>40.00</td>
<td></td>
</tr>
<tr>
<td>18 x</td>
<td>4.19</td>
<td></td>
</tr>
<tr>
<td>3 EEX</td>
<td>3.00</td>
<td></td>
</tr>
<tr>
<td>8 =</td>
<td>1.28</td>
<td></td>
</tr>
</tbody>
</table>

Example 3: Enter \(2 \times 10^{15}\) and then change the exponent to 27.

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 EEX</td>
<td>2.00</td>
</tr>
<tr>
<td>1</td>
<td>2.01</td>
</tr>
<tr>
<td>5</td>
<td>2.15</td>
</tr>
<tr>
<td>2</td>
<td>2.52</td>
</tr>
<tr>
<td>7</td>
<td>2.27</td>
</tr>
</tbody>
</table>

Reformat Display Keys: SCI and FLT

When the calculator is turned on, it is in the floating decimal mode. Although amounts may be entered in scientific notation using EEX, upon depression of a function key they will be converted to floating decimal notation if capacity permits.

Example:

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 EEX</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5.03</td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>5000.00</td>
<td></td>
</tr>
<tr>
<td>=</td>
<td>25000000.00</td>
<td>Automatically converts to floating notation.</td>
</tr>
</tbody>
</table>

Depress SCI to establish the Scientific Notation mode.

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 EEX</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5.03</td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>2.507</td>
<td></td>
</tr>
<tr>
<td>=</td>
<td>2.507</td>
<td></td>
</tr>
</tbody>
</table>

Observe in the next example that in the scientific mode, entries and results of calculations are displayed in scientific notation even when you key in factors without an exponent.

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI</td>
<td></td>
</tr>
<tr>
<td>5 x</td>
<td>5.101</td>
</tr>
<tr>
<td>2 =</td>
<td>1.0101</td>
</tr>
<tr>
<td>12345 x</td>
<td>12345.04</td>
</tr>
<tr>
<td>2 =</td>
<td>2.469</td>
</tr>
</tbody>
</table>

To cancel Scientific Notation mode and set Floating Decimal mode, depress SCI.

Observe in the example below that results which exceed 9,999,999,999 or are less than .000000001 are automatically converted to scientific notation.
Calculator will display 97421969009 in scientific notation because it exceeds 10-digit capacity.

Changing Signs: CHS

The CHS, change sign key, changes the algebraic sign of an entry or result from positive to negative and vice versa. Depress CHS after mantissa entry or after depression of EEEX to enter these respective values as negatives.

Example:

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>456</td>
<td>-456.</td>
</tr>
<tr>
<td>CHS</td>
<td>-456.</td>
</tr>
<tr>
<td>EEEX</td>
<td>-456.00</td>
</tr>
<tr>
<td>CHS</td>
<td>-456.02</td>
</tr>
<tr>
<td>C</td>
<td>0.</td>
</tr>
</tbody>
</table>

Observe that CHS may be depressed at any time during exponent entry.

Clearing Mistaken Key Depressions:

C and F CA

The C, clear key, is designed to keep operator decision to a minimum. Depress C directly following an erroneous key depression and the calculator will clear the affected register(s) only. More explicitly, C operates as follows:

Depressed directly following a digit key or EEEX
Clears the digit key depression and displays the

contents of the calculating register. Operations are not disturbed and may be continued. The purpose of this function is to enable correction of mistaken digit key depressions.

Depressed directly following other keys (including C, i.e., two consecutive C key depressions). Clears display and calculating register.

The key sequence F CA, clear all, clears the display, calculator register and all three memories. Any mode setting, i.e., scientific notation (SCI), floating decimal notation (FLT), degree, radian or grad mode, is not cleared by depression of F CA.

Basic Arithmetic Operations

The procedure for performing simple addition, subtraction, multiplication or division is to key in the problem as it is written.

Enter first number; depress +, -, x or ÷.
Enter the second number; depress =.

It is a good practice to depress C before performing calculations in order to clear any calculations pending from previous key depressions.

Multifactor (Chain) Calculations

The final result of any calculation may be used in further calculations, eliminating the need to re-enter the value.

Example: A piece of equipment costs $5000. The salvage value is $1200. Find the depreciation expense per year if the equipment has a lifetime of eight years.

Formula: \( \frac{5000 - 1200}{8} \)

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>5000.</td>
<td></td>
</tr>
</tbody>
</table>
The same problem may be performed more efficiently, with fewer keystrokes, by using the chaining feature. Perform the problem as you would say it, depressing \( \text{ENTER} \) only once, on completion of the problem: \( 5000 \) minus (\( \text{ENTER} \)), \( 1200 \) divided (\( \text{ENTER} \)) by 8 equals (\( \text{ENTER} \)).

**Short Method**

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>5000.</td>
</tr>
<tr>
<td>1200</td>
<td>3800.</td>
</tr>
<tr>
<td>8</td>
<td>475.</td>
</tr>
</tbody>
</table>

**Rule for performing chain calculations**

Perform the problem as it is written with one exception; rewrite formulae which indicate multiplication in the denominator portion of fractions as shown below.

Use parenthesis keys when necessary, i.e., when addition/subtraction is mixed with multiplication/division to form a parenthecated expression. See Parenthesis Keys section of this manual.

Perform on calculator this way:

\[
\frac{144}{2 \times 12} = 6
\]

Do not perform on calculator as written here:

\[
\frac{144}{2 \times 12} = 6
\]

Enter the dividend (first number in division). For

Since your calculator uses true algebraic logic, no guess work or knowledge of mathematical hierarchy is required to perform long, complex problems. An infinite number of problems may be chained together. The calculator displays an intermediate answer upon depression of \( \text{ENTER} \), \( \text{ENTER} \), \( \text{ENTER} \), \( \text{ENTER} \) for information purposes and to remind you that upon depression of these keys any pending add, subtract, multiply, divide, or power command is executed.

**Example:** \[
\frac{5 \times 2 \times 3 \times 4}{6} = \frac{7 + 8 - 3}{6} = 32
\]

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>( \text{ENTER} )</td>
<td>( \text{ENTER} )</td>
</tr>
<tr>
<td>2</td>
<td>( \text{ENTER} )</td>
<td>( \text{ENTER} )</td>
</tr>
<tr>
<td>3</td>
<td>( \times )</td>
<td>( \text{ENTER} )</td>
</tr>
<tr>
<td>4</td>
<td>( \text{ENTER} )</td>
<td>( \text{ENTER} )</td>
</tr>
<tr>
<td>6</td>
<td>( + )</td>
<td>( \text{ENTER} )</td>
</tr>
<tr>
<td>7</td>
<td>( + )</td>
<td>( \text{ENTER} )</td>
</tr>
<tr>
<td>8</td>
<td>( + )</td>
<td>( \text{ENTER} )</td>
</tr>
<tr>
<td>3</td>
<td>( \text{ENTER} )</td>
<td>( \text{ENTER} )</td>
</tr>
</tbody>
</table>

The following keys require the entry of two (or more) factors: \( \text{ENTER} \) \( \text{ENTER} \) \( \text{ENTER} \) \( \text{ENTER} \). The first factor is entered on one of these keys. The second factor is entered on \( \text{ENTER} \) to complete the calculations.

Although you already know how to add, subtract, multiply and divide from previous sections, the following functional description of \( \text{ENTER} \) \( \text{ENTER} \) \( \text{ENTER} \) and \( \text{ENTER} \) is given along with a description of \( \text{ENTER} \) for a complete understanding of the relationship of the two factor function keys:

- **Divide Key**
  - Enters the dividend (first number in division). For
Equals Key
Terminates a two factor calculation (i.e., a "+", "-", "x", "/", "Y^n" calculation which is in progress, not yet terminated by a depression of ). When depression of this key completes a pending calculation, the intermediate result is displayed and set up as a dividend.

Times Key
Enters the multiplicand (first number in multiplication). For chain calculations, completes a pending two factor calculation and sets up intermediate result as a multiplicand: displays intermediate result.

Minus Key
Enters the minuend (top or first number in subtraction). For chain calculations, completes a pending two factor calculation and sets up the intermediate result as a minuend, displays intermediate result.

Plus Key
Enters the addend. For chain calculations, completes a pending two factor calculation and sets up the intermediate result as an addend: displays the intermediate result.

Y to the xth Power Key
Raises a number entered on "Y^n" to a power entered on =.

Example 1: Compute \(5^3 = 125\)
Enter: \(5 \ Y^\ 3 = \)

Example 2: Compute \((125 \div 5)^{-3.2} = 0.00033619\)
Enter: \(125 \ \ Y^\ 5 = \)
\(5 \ Y^\ -3.2 = -3.2 \ \ CHS = \)

Performing Constant Calculations
The second factor in a two factor calculation is retained as a constant in the calculating register.

To use the constant:
Perform an addition, subtraction, multiplication or division problem in the usual manner remembering to enter the constant value last, on =.
Enter variable numbers; depress =, display shows answers.

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 \ Y^\ 3</td>
<td>\ 125.</td>
<td>Problem performed in standard manner.</td>
</tr>
</tbody>
</table>
One Factor Function Keys

The single factor function keys are the easiest to use and understand. These keys are:

- **SIN**
- **SIN⁻¹**
- **COS**
- **COS⁻¹**
- **TAN**
- **TAN⁻¹**
- **LN**
- **eˣ**
- **LOG**
- **10ˣ**
- **√**
- **x²**
- **1/x**
- **x!**

A general procedural statement can be applied to these keys:

With a value entered into the display, depression of a one factor function key executes the indicated function and instantly displays the answer.

These keys may be depressed at any time during a calculation without disturbing any two factor calculation in progress. This feature provides great flexibility in problem solving as shown in the examples on subsequent pages.

Trigonometric Keys

Your calculator has three selectable modes of operation for trigonometric and the inverse functions: degree, grad or radian mode. The calculator is automatically set in degree mode upon turn on. The following key descriptions assume the degree mode setting. A discussion of these modes follows on subsequent pages.

**SIN** Sine Key
Enter into the display a decimal angle within the range -8999.999999° to 8999.999999°. Depress this key; display shows sin(x).

**F SIN⁻¹** Arc Sine Key
Enter into the display a sine within the range -1 to 1. Depress these keys; display shows the principal value, -90° ≤ result ≤ 90°, of the arc sine (x).

**COS** Cosine Key
Enter into the display a decimal angle within the range -8999.999999° to 8999.999999°. Depress this key; display shows cosine (x).

**F COS⁻¹** Arc Cosine Key
Enter into the display a cosine within the range -1 to 1. Depress these keys; display shows the principal value, 0° ≤ result ≤ 180°, of the arc cosine (x).

**TAN** Tangent Key
Enter into the display a decimal angle within the range -8999.999999° to 8999.999999°. Depress this key; display shows tangent (x). Error will be displayed on entries of 90°, 270°, etc.

**F TAN⁻¹** Arc Tangent Key
Enter into the display a tangent of unrestricted magnitude. Depress these keys; display shows the principal value, -90° ≤ result ≤ 90°, of arc tangent.

Logarithm Keys

**LN** Natural Logarithm Key
Enter into the display a value greater than zero. Depress this key; display shows the base e, natural logarithm (x).

Very small numbers, e.g. .0000000001 or 1 x 10⁻¹⁰, are interpreted as zero when entered on trigonometric keys.
Observe in the examples above and below, that one factor function keys may be depressed while a two factor operation is pending without affecting the pending calculation.

Example: Find the cube root of 125

Formula: \(3\sqrt{125} = 125^{1/3}\)

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>125 (Y^x)</td>
<td>125.</td>
</tr>
<tr>
<td>3 (Y^x)</td>
<td>0.333333333</td>
</tr>
<tr>
<td>(=)</td>
<td>5.</td>
</tr>
</tbody>
</table>

Example: \((\sin 30 \times \sin 60) + \sqrt{144}\)

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 (\sin X)</td>
<td>0.5</td>
</tr>
<tr>
<td>60 (\sin X)</td>
<td>0.866025403</td>
</tr>
<tr>
<td>(=)</td>
<td>0.433012701</td>
</tr>
<tr>
<td>144 (\sqrt{_})</td>
<td>12.</td>
</tr>
<tr>
<td>(=)</td>
<td>12.4330127</td>
</tr>
</tbody>
</table>

Example Problem: What is the equivalent resistance of a 220-ohm resistor, a 145-ohm resistor, and a 175-ohm resistor connected in parallel using the following equation?

\[
R_{eq} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}
\]

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>220 (Y^x)</td>
<td>0.004545454</td>
</tr>
<tr>
<td>(=)</td>
<td>0.004545454</td>
</tr>
<tr>
<td>145 (Y^x)</td>
<td>0.00669666666</td>
</tr>
<tr>
<td>(=)</td>
<td>0.01442006</td>
</tr>
<tr>
<td>175 (Y^x)</td>
<td>0.0057142885</td>
</tr>
<tr>
<td>(=)</td>
<td>0.0171562891</td>
</tr>
<tr>
<td>(=)</td>
<td>58.28765335</td>
</tr>
</tbody>
</table>
Example: Permutations
For example: Out of a dinner party for 10, how many ways can the hostess assign players to one table of bridge (4 positions)? The equation for permutations with random arrangement of n items taken r at a time is:

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

\[ \frac{10!}{(10-4)!} \]

ENTER 10
4 = F X1
= 720.
10 F X1 x y
= 5040.

Observe that in the example above, the x-y key (see Other Keys section for a discussion of x-y) is used to swap the dividend and divisor. In other words, the problem was performed such that \((10-4)!/10!\) was pending. The formula was reversed; \(10!/(10-4)!\) by depressing x-y.

Degree/Grad/Radian Mode:

DEG  GRAD  RAD

As stated previously, your calculator has three selectable modes of operation for trigonometric and the inverse functions: degree, grad or radian mode.

When you turn your calculator on, it is automatically set in degree mode. In degree mode, numbers entered on \(\text{SIN}, \text{COS}, \text{TAN}\) are interpreted as degrees. Angular results displayed after depression of \(\text{F SIN}^{-1}, \text{F COS}^{-1}, \text{F TAN}^{-1}\) are given in degrees.

Depressing \(\text{F RAD}\) or \(\text{F GRAD}\) sets the calculator in radian or grad mode respectively.

Angular input on trig functions and angular results on inverse trig functions are then read as radians or grads.

Example: Calculate the sine of 50 grads.

ENTER F GRAD
50 SIN

0.707106781

Important Note: Remember that your calculator will remain in the angular mode last selected until you turn off the calculator or change the mode to degree or radian.

Degree/Grad/Radian Conversion

Converting angles (for example, from degrees to grads) is done by computing a trigonometric function in one mode, switching modes, than computing the inverse trigonometric function.

Example: How many grads is 45 degrees?

ENTER F DEG
45 SIN

0.707106781

45 degrees = 50.50 grads

Example: How many degrees is 1 radian?

ENTER F RAD
1 SIN

0.841470984

1 radian = 57.29577951 degrees

Conversion Keys

Polar, Rectangular Conversion

The angle of inclination input for polar to rectangular and angular output for rectangular to polar is affected by the degree/grad/radian mode setting.
Example: Convert the following rectangular coordinates to polar coordinates:

\[
\begin{align*}
Y &= 5 & X &= 3 \\
Y &= 2.6 & X &= 10
\end{align*}
\]

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>F DEG</td>
<td>0.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5.</td>
<td></td>
</tr>
<tr>
<td>3 POL</td>
<td>59.03624347</td>
<td>Angle θ</td>
</tr>
<tr>
<td>X-Y</td>
<td>5.830951895</td>
<td>Radius</td>
</tr>
</tbody>
</table>

Example: Convert the following polar coordinates to rectangular coordinates:

\[
\begin{align*}
\text{Radius} &= 10.5 & \theta &= 55° \\
\text{Radius} &= 7 & \theta &= 30°
\end{align*}
\]

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 POL</td>
<td>14.5742162</td>
<td>Angle θ</td>
</tr>
<tr>
<td>X-Y</td>
<td>10.33247308</td>
<td>Radius</td>
</tr>
</tbody>
</table>

Degrees, Minutes, Seconds / Decimal Degree Conversion

The key sequence \( F \ F D \) to degrees, converts degrees, minutes, seconds to decimal degrees.

Enter the angle expressed in degrees, minutes and seconds as follows:

1. Key in degrees.
2. Depress the decimal point to separate degrees from the minutes/seconds portion of your entry.
3. Key in minutes as a two-digit number, e.g., 3 minutes would be keyed in as 03.
4. Key in seconds.
5. Depress \( F \ F D \); display shows degrees, minutes, seconds converted to decimal degrees.

Example: Convert 110 degrees, 35 minutes, 15 seconds to decimal degrees.

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>110.3515 F D</td>
<td>110.5875</td>
<td>Decimal equiv of 110°35'15&quot;</td>
</tr>
</tbody>
</table>
**Metric Conversions**

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>F - KG</td>
<td>Converts the number in the display from pounds to kilograms.</td>
<td>If a French chef uses an English recipe calling for 3 pounds of sugar, how many kilograms must the chef use?</td>
</tr>
<tr>
<td>F - CM</td>
<td>Converts the number in the display from inches to centimeters.</td>
<td>If to fix a dress, a woman needs a 5-inch zipper, how many centimeters of zipper should she order?</td>
</tr>
<tr>
<td>F - IN</td>
<td>Converts the number in the display from centimeters to inches.</td>
<td>If the electrical schematic for your Mercedes calls for a 45.5-cm lead wire, how many inches of wire would you need?</td>
</tr>
<tr>
<td>F - LIT</td>
<td>Converts the number in the display from U.S. gallons to liters.</td>
<td>If a Dutch firm imports 30 gallons of California wine, how many 2-liter carafes will they need to bottle the wine?</td>
</tr>
</tbody>
</table>

**Examples:**

- **Example:** Convert 45.583 centimeters to inches.
  - ENTER 45.583 F - CM
  - DISPLAY 17.91338583

- **Example:** If an U.S. importer receives a 42-kg shipment from Holland and the shipping charge on the American ship is 23¢ per pound, how much does the importer pay for shipping?
  - ENTER 42 F - LB x
  - DISPLAY 21.29665312

- **Example:** If the electrical schematic for your Mercedes calls for a 45.5-cm lead wire, how many inches of wire would you need?
  - ENTER 45.5 F - IN
  - DISPLAY 17.91338583
Memory Operations

Your calculator features three independent memories which operate as follows:

Key Sequence
MS 1
MS 2 Memory Store Key
MS 3
Key a number into the display, depress MS followed by a digit key 1, 2 or 3; the displayed number is stored in the respective memory one, two or three. Any number previously stored in memory is erased; i.e., the new number "writes over" any previous memory contents. The display does not change.

Key Sequence
MR 1
MR 2 Memory Recall Key
MR 3
Depress MR followed by a digit key 1, 2 or 3; contents of the respective memory are recalled to the display. Recalling memory contents will not clear the memory.

Key Sequence
F M+ 1
F M+ 2 Memory Plus Key
F M+ 3
Key a number into the display, depress these keys; the number is added to the respective memory one, two or three and the sum is stored in that memory. The display does not change. Recall memory contents to the display using the MR key followed by a digit key to see the sum.

Key Sequence
F M- 1
F M- 2 Memory Minus Key
F M- 3
Key a number into the display, depress these keys; the number is subtracted from the respective memory one, two or three and the resulting difference is stored in that memory. The display does not change.

(They need 55 carafes, and there's a little left over to drink!)

F = GAL
Converts the number in the display from liters to U.S. gallons.
Example: If the Fiat you buy in Italy has a 48-liter tank capacity, how many gallons will the car hold?
ENTER DISPLAY
48 F = GAL 12.63025779

F = °F
Converts the number in the display from centigrade to degrees fahrenheit.
Example: If the doctor in Toronto tells you that you have a temperature of 37°C, should you worry?
ENTER DISPLAY COMMENTS
37 F = °F 98.6 (No need to worry)

F = °C
Converts the number in the display from degrees fahrenheit to degrees centigrade.
Example: The antifreeze sticker on your Celica says that antifreeze should be added at -35°C. If the temperature is -27°F, should you add the antifreeze?
ENTER DISPLAY COMMENTS
27 CHS F = °C -32.77777778. (Close, but not quite!)

(They need 56 carafes, and there's a little left over to drink!)

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Converts the number in the display from liters to U.S. gallons.
Example: If the Fiat you buy in Italy has a 48-liter tank capacity, how many gallons will the car hold?
ENTER DISPLAY
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COMMENTS
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ENTER DISPLAY COMMENTS
27 CHS F = °C -32.77777778. (Close, but not quite!)
Key Sequence

**F Mx 1**
**F Mx 2** Memory Times Key
**F Mx 3**

Key a number into the display, depress these keys; the number is multiplied by contents of the respective memory and the resulting product is stored in that memory. The display does not change.

Key Sequence

**F M+ 1**
**F M+ 2** Memory Divide Key
**F M+ 3**

Key a number into the display, depress these keys; the contents of the respective memory are divided by display contents and the resulting quotient is stored in that memory. Display does not change.

Key Sequence

**F X-M 1**
**F X-M 2** Display/Memory Exchange Key
**F X-M 3**

Key a number into the display, depress these keys; the contents of the respective memory are exchanged with the contents of the display.

**F CA** Clear All Key
Depress these keys to clear memories. Also clears display and any pending operation (add, subtract, etc.) in the calculator register.

Memory Overflow
If the result of a memory operation exceeds the capacity of the calculator, 10^-99 to 10^99. Error is displayed. The affected memory will contain the value displayed prior to the overflow condition.

Example: The following quantities of parts for construction of a device are priced as follows:

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>QUANTITY</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>152</td>
<td>$7.41</td>
</tr>
<tr>
<td>B</td>
<td>76</td>
<td>$6.73</td>
</tr>
<tr>
<td>C</td>
<td>45</td>
<td>$2.55</td>
</tr>
</tbody>
</table>

Find the total cost of construction:

**ENTER**
**DISPLAY**

152
7.41 • 7 6.73.

Example: Will three works of music, one lasting 1 hour, 14 minutes, 43 seconds, the second lasting 36 minutes, 22 seconds and the third lasting 1 hour, 9 minutes and 2 seconds fit on a 3-hour tape?

**ENTER**
**DISPLAY**

1.1443 **F D M+** 1 24527.7778
0.3622 **F D M+** 0.606111111
1.0902 **F D M+** 1.150555555
**MR** 1 3.001944444
**DMS** 3.0007

Calculating Mean and Standard Deviation

The following keys allow fast and easy calculation of standard deviation and mean:

**Σ** Sigma Plus Key
Key in a data point, "x"; depress this key.
1. "x" is added in memory one
2. "x^2" is added in memory two
3. Memory three is incremented by 1 for the n or item count.
The display does not change thereby enabling repeated depressions of \( \sum \) which sum a single data point to the required frequency.

**F \( \sum \)** Sigma Minus Key
This key is used to delete summations of a data point incorrectly entered on \( \sum \) as follows: Key in the "x" to be deleted (not necessary if already in display), depress \( F \sum \).
1. "x" is subtracted from memory one
2. "x^2" is subtracted from memory two
3. Memory three is decremented by 1 for the n or item count.

**F SD** Standard Deviation Key
Depress these keys after entering data points on \( \boxed{2} \) to display the standard deviation according to the formula:

\[
SD = \sqrt{\frac{\sum x^2 - (\sum x)^2}{n-1}} = \sqrt{\frac{m2 - m1^2}{m3 - 1}}
\]

**F \( \bar{x} \)** Mean Key
Depress these keys after entering data points on \( \boxed{2} \) to display the mean.

\[
\bar{x} = \frac{\sum x}{n}
\]

Example: Find the mean and standard deviation of the data points 2, 5, 7, 3, 2.

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>F ( \sum )</td>
<td>0.</td>
<td></td>
</tr>
<tr>
<td>2 ( \sum )</td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>5 ( \sum )</td>
<td>5.</td>
<td></td>
</tr>
<tr>
<td>7 ( \sum )</td>
<td>7.</td>
<td></td>
</tr>
<tr>
<td>3 ( \sum )</td>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>2 ( \sum )</td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>F ( \sum )</td>
<td>3.8</td>
<td>Mean</td>
</tr>
<tr>
<td>F SD</td>
<td>2.167948339</td>
<td>Standard Deviation</td>
</tr>
</tbody>
</table>

New data points can be added to the summations in memory registers and a new mean and standard deviation obtained.

Example: Add to the summations computed in the previous example, the data point 8. Find the new mean and standard deviation.

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 ( \sum )</td>
<td>8.</td>
<td></td>
</tr>
<tr>
<td>F ( \sum )</td>
<td>4.5</td>
<td>New mean</td>
</tr>
<tr>
<td>F SD</td>
<td>2.588435821</td>
<td>New Standard Deviation</td>
</tr>
</tbody>
</table>

Using Parentheses Keys

The calculator is capable of handling two levels of parentheses which, in combination with the independent calculator register and memory, allow very complex problems to be solved efficiently.

Think of the function of \((\) and \(\)) in terms of internal machine registers which are accessed upon depression of \(\) and \(\).

\(\)

The open parentheses key, when depressed, signals the calculator to save results of subsequent key depressions in a special internal register. There are two such registers permitting double nesting of parentheses.

\(\)

The close parentheses key, when depressed, causes the calculator to execute the key depressions made from the time of the last \(\) depression. The intermediate result of these operations is displayed.

\(\)

The equals key is used in conjunction with the parentheses keys to finally complete the equation.
Example: 28 - [(13 + 7) ÷ (6 - 2)] = 23

Register Action

<table>
<thead>
<tr>
<th>28</th>
<th>(</th>
<th>28 minus instruction in calculator register.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(</td>
<td></td>
<td>Opens 1st level parens.</td>
</tr>
<tr>
<td>)</td>
<td></td>
<td>Displays contents, 20, set up to divide in parens level 1.</td>
</tr>
<tr>
<td>)</td>
<td></td>
<td>Takes displayed result, 4, and operates on instructions stored in parens level 1.</td>
</tr>
<tr>
<td>)</td>
<td></td>
<td>Displays contents, 20, set up to divide in parens level 1.</td>
</tr>
<tr>
<td>)</td>
<td></td>
<td>Takes display contents, 6, completes pending operation in calculator register. Displays final result, 23.</td>
</tr>
</tbody>
</table>

Rules for Using Parentheses:

Let math symbols represent keys: ( indicates depression, | indicates key depression.

No: (5 + 2) (4 - 2) = Yes: (5 + 2) × (4 - 2) =
Operator (÷ depression) required.
No "implied" times.

No: 2 (5 + 3) = Yes: 2 × (5 + 3) =
Operator (× depression) required.
No "implied" times.

No: (5 + 2) + 3 = Yes: (5 + 2) + (3) =
or 5 + 2 + 3 =
Since Y^x is a two factor function key and thereby completes a pending calculation, the left most method performs (5 + 2 + 3), display shows 100.
Also, this key sequence allows no equals key depression.

No: (....)(....) Yes: (....)(....)
An error condition will occur when there are more than two open parenthesis key depress-

Example: Find the vertical stress at a point in a soil which is 4.5 feet deep and located 5 feet horizontally from a concentrated surface load of 12,800 pounds.

Vertical Stress = \( \frac{3 \times 12,800}{2\pi \times (4.5)^2} \) \[1 + \left(\frac{5}{4.5}\right)^2\]^{1/2}

Rewrite formula as discussed in Basic Arithmetic Operations section:

\[ \frac{3 \times 12,800}{2\pi \times (4.5)^2} \] \[1 + \left(\frac{5}{4.5}\right)^2\]^{1/2} = 2252.73558

Example: Solve

25.6 + 5.3 - [12.3 + 8] ÷ (2 + 6.5/4)] = 21.34705882
### Other Keys: \( \pi \), \( 2\pi \), \( x \cdot y \)

**Pi Key**
The \( \pi \) key, display \( \pi \) to 10 decimal places, \( 3.141592654 \).

Example: Calculate the area of a circle of radius 5 using the formula: \( \text{Area} = r^2 \pi \).

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 ( \times ) ( \pi ) ( = )</td>
<td>( 15.70796327 )</td>
<td>( \pi ) ( = ) ( 3.141592654 ) ( \times ) ( 5 )</td>
</tr>
</tbody>
</table>

This problem may also be performed:

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \pi ) ( \times ) 5 ( = )</td>
<td>( 15.70796327 )</td>
<td>( \pi ) ( = ) ( 3.141592654 ) ( \times ) ( 5 )</td>
</tr>
</tbody>
</table>

**Two-Pi Key**
The \( 2\pi \) key displays \( 6.283185307 \).

Example: Calculate the circumference of a circle of radius 5 using the formula: \( \text{Circumference} = 2\pi r \).

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 2 ) ( + ) ( \pi ) ( \times ) 5 ( = )</td>
<td>( 31.41592654 )</td>
<td>( 2 ) ( + ) ( \pi ) ( \times ) ( 5 )</td>
</tr>
</tbody>
</table>

### Display/Register Exchange Key
The \( x \cdot y \) swaps contents of the display and calculator registers. It is used primarily for:

- Recalling the radius or \( y \) coordinate after depression of [POL] or [REC].
- With \( Y^x \) utilization. See example 1.
- For solving formulae consisting of fractions whose denominators are sums or differences. See example 2.

**Example 1:** Solve: \( 2.6 \times \ln(3.6 \times 2.1 \times 3.3) \)

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.6 ( \times ) ( \ln ) ( \times ) 2.1 ( \times ) 3.3 ( = )</td>
<td>( 32.97861789 )</td>
<td>( 2.6 ) ( \times ) ( - \ln ) ( 3.6 \times 2.1 \times 3.3 )</td>
</tr>
</tbody>
</table>

**Example 2:** Solve: \( \frac{12}{2 + 3 + 5} \)

<table>
<thead>
<tr>
<th>ENTER</th>
<th>DISPLAY</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 ( + ) 3 ( + ) 5 ( = ) ( \div ) 12 ( = )</td>
<td>( 1.2 )</td>
<td>( 2 ) ( + ) ( 3 ) ( + ) ( 5 ) ( = ) ( \div ) ( 12 ) ( = )</td>
</tr>
</tbody>
</table>
Overflow and Error Indicators

Any result larger than 9,9999999 x 10^99 or smaller than 1 x 10^-99 or logic errors (e.g., division by zero) will result in the error indicator Error being displayed. Touching will clear the affected register except in the case of memory overflow. See Memory Operations. Touching any other key permits continuation of the calculation with the calculator assuming that the contents of the display are zero.

Results and operations resulting in an Error indication.

Results > 9,99999999 x 10^99
Results > 1 x 10^-99
Division by zero
LOG, LN < 0
SIN, COS, TAN > 25 revolutions (9000°)
TAN 90°, 270° etc. TAN of 89.99999999
SIN^-1, COS^-1 > 1/1
SIN^-1, COS^-1 < 10^-50
\(\sqrt{x} < 0\)
\(Y^2\) where \(Y < 0\)
More than two (((( depressions without a )) during calculation
DMS/D conversions > 10^19
\(X!\) where \(X < 0\) or > 69

Battery Information

Your calculator is powered by rechargeable NiCad batteries. It is important to charge your battery for a minimum of 3 hours before initial use because if the batteries are completely drained from a long storage period, using the calculator in this state can permanently damage the batteries. The display will blank when batteries need charging. To charge the battery, connect the AC charger to the jack at the top of the machine. A full charge takes five hours and lasts approximately five hours. You can use your machine while the charger is plugged in but it will charge faster if you turn it off. The machine will not overcharge.

If your calculator is left on for an extended period of time, the batteries may be drained to the extent that the calculator will not operate after being recharged for a few minutes. The batteries can usually be restored by charging overnight.

Repeated extensive draining of batteries causes permanent damage to batteries.

Mailing Instructions

Should your calculator need servicing, pack it carefully in a sturdy box for shipping. Proof of original purchase date must be enclosed. Be sure to include your name and return address. The package should be mailed postpaid to the nearest National Semiconductor Service Center. If your calculator is returned for warranty repairs more than ninety days after the original purchase date, you must enclose the appropriate service charge (if the service charge during the POST WARRANTY period has been changed, National Semiconductor will request you to supply the additional amount. If any is needed, or make the appropriate refund, if there is any difference, by check or money order payable to National Semiconductor).

Product Service Locations

United States
N.C.P.S.—Central U.S.
P.O. Box 1000
West Jordan, UT 84064

Asia
NS Electronics
4 Hing Yip Street,
Kwun Tong,
Hong Kong.
Canada
N.C.P.S.
266 Wilson Road
Downview
Ontario M5J 2N5
Canada

Australia
N.S. Electronics
Corner St. Rd. and
Mountain Highway
Bayswater
Victoria 8153
Australia

Great Britain
NS—UK Ltd.
National Semiconductor
Product Service
Larkfield Industrial Estate
Greenock PA 16 02Q
Great Britain

Germany
National Semiconductor GmbH
Product Service
DB 00 Furstenfeldbruck
Industriestasse 19
Bundesrepublik
Deutschland

Consumer Warranty Claim Certificate

Should your calculator ever require repair, please return this form with the unit.

Model 4660

Purchase Date
(month/day/year)

Purchased from

Address

City, State, Zip

Your Name

Your Address

City, State, Zip

Description of problem:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

34

35