

TEXAS INSTRUMENTS

SCIENTIFIC

TI-34

**QUICK
REFERENCE
GUIDE**



Reminder—In Case of Difficulty

If the calculator does not respond as you expect, it may be in a special mode. Press **AC/ON** to restore the calculator to normal settings.

Key Index

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

$[e^x]$ 26	$[10^x]$ 26	$[\sqrt[x]{y}]$ 25	$[\sqrt{x}]$ 24	
AND 41	OR 41	XOR 41	XNOR 41	
LN 26	LOG 26	y^x 24	x^2 24	AC/ON 4,5
$[d/c]$ 37	$[\sqrt[3]{x}]$ 24	[P\blacktrianglerightR] 30	[\blacktrianglerightDMS] 28	[FIX] 11
NOT 41	<D> 8,40	<E> 8,40	<F> 8,40	
$a^{b/c}$ 36,37	1/x 24	R\blacktrianglerightP 31	[\blacktrianglerightDD] 28	[\rightarrow] 14
	[SIN$^{-1}$] 29	[COS$^{-1}$] 29	[TAN$^{-1}$] 29	[DRG\blacktriangleright] 27
	<A> 8,40	 8,40	<C> 8,40	
HYP 12,35	SIN 29	COS 29	TAN 29	DRG 27
2nd 12		MODE 13		+ 18
$[\Sigma -]$ 33	$[\pi]$ 8			
$[\Sigma +]$ 33	EXP 10	(17) 17	\times 18
[EXC] 22				
STO 22	7 8	8 8	9 8	- 18
$[x \blacktriangleright y]$ 15,30	$[\bar{x}]$ 33	$[\sigma_{n-1}]$ 33	$[\sigma_n]$ 33	
	HEX 13,39	STAT 13,32		
RCL 22	4 8	5 8	6 8	+ 18
$[x!]$ 32	$[\Sigma x]$ 33	$[\Sigma x^2]$ 33	$[n]$ 33	[%] 20
	DEC 13,38	BIN 13,38	OCT 13,39	
SUM 23	1 8	2 8	3 8	= 18
	[FD] 9	[Sci] 9	[Eng] 10	
			NEG 8,40	
CE/C 5,14	0 8	. 8	+/- 8,40	

Multiple-Function Keys

Some calculator keys have multiple functions, accessed by pressing the **2nd**, **HYP**, or **MODE** key just prior to the function key.

The TI-34 Calculator

The TI-34 calculator offers you a wide range of mathematical and statistical capabilities. This manual is designed to help you learn about these capabilities and how to use them effectively.

Features

- ▶ 96 calculator functions assist you in performing a wide range of arithmetic, algebraic, trigonometric, and statistical computations.
- ▶ Functions include hexadecimal, octal, and binary calculations and conversions, logic operations, fraction arithmetic, and statistical functions.
- ▶ New, advanced ANYLITE™ solar-cell technology allows operation of your calculator under extremely low light conditions.
- ▶ A 10-digit display (plus a two-digit exponent) lets you work with both large and small numbers.

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TI-34 Quick Reference Guide

This Quick Reference Guide provides you with information about operating the calculator.

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This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Turning the Calculator On and Off

The calculator turns on automatically when you expose the solar cell panel to an adequate light source. Before using the calculator, however, you should always clear it by pressing **AC/ON**.

Note: When the calculator is first exposed to light, random segments and indicators may appear in the display. The memory and statistical registers also may contain random values. Pressing **AC/ON** clears these random values.

When you press **AC/ON**, "0." and **DEG** appear in the display. The calculator is then ready for you to begin your calculations.

The calculator turns off automatically when the solar cell panel is no longer exposed to an adequate light source. (You can easily turn the calculator off by closing the carrying case.) The display, any pending operations, the automatic constant, the memory, and the statistical registers are cleared.

Note: The calculator does not actually turn off until approximately 10 to 20 seconds after you remove it from the light source. If you re-expose the solar panel to light within approximately 10 seconds, the calculator is not cleared.

Clearing the Calculator

The **[AC/ON]** key resets the calculator to the decimal mode with floating-decimal display, and resets the angle units to degrees (DEG). This key also clears the display, memory, statistical registers, error conditions, and pending operations.

Clearing the Display and Pending Operations

The **[CE/C]** key clears incorrect entries, error conditions, the display, and pending operations. Pressing **[CE/C]** does not affect the mode, display format, angle units, memory, or the statistical registers.

- ▶ To clear an incorrect numerical entry, press **[CE/C]** once.
- ▶ To clear an error condition, indicated by **E** in the display, press **[CE/C]** once.
- ▶ To clear the display and all pending operations, press **[CE/C]** twice.

Clearing the Memory

To clear the memory without changing other settings, press **[STO]** when a zero is in the display.

Clearing the Statistical Registers

If **STAT** is displayed, the calculator is in the statistics mode.

You may need to clear the statistical registers before entering a new data set. To clear the registers without disturbing the contents of memory, press **[MODE] [DEC] [MODE] [STAT]**. (Pressing **[AC/ON] [MODE] [STAT]** clears the registers and the number in memory.)

The Display

The display shows entries and results with a maximum of 10 significant digits (plus a two-digit exponent in scientific and engineering notations). However, the calculator uses a maximum of 12 digits internally. To present additional information about the calculator, special indicators may also appear in the display.

M E 2nd HYP BIN OCT HEX STAT DEG RAD GRAD ()
--

Indicator	Meaning
M	The memory contains a number other than zero.
E	An error condition has occurred. To clear the error, press CE/C or AC/ON .
2nd	The calculator will access the alternate function of the next key pressed.
HYP	The calculator will access the hyperbolic function of the next key pressed.

Indicator	Meaning
BIN	The calculator is in the binary number mode.
OCT	The calculator is in the octal number mode.
HEX	The calculator is in the hexadecimal number mode.
STAT	The calculator is in the statistics mode.
DEG	The angle units are set to degrees.
RAD	The angle units are set to radians.
GRAD	The angle units are set to grads.
()	There are one or more open parentheses.

Data Entry Keys

The keys listed on this page are used to enter numeric values.

[0] - [9], <A> - <F> — Digit Entry Keys

These keys enter digits in the display.

(<A> - <F> are available only in the hexadecimal mode.) You can enter a maximum of 10 digits and a decimal point.

[.] — Decimal-Point Key

This key enters a decimal point in a numeric value.

[+/-] ([NEG]) — Change-Sign Key

This key changes the sign of the number in the display. To enter a negative number, first enter the number as a positive value, then press

[+/-]. (In the binary, octal, or hexadecimal number mode, [+/-] calculates the two's complement of the number in the display.)

[2nd] [π] — Pi Key Sequence

This key sequence enters the value of pi to twelve digits, 3.14159265359. The display shows the value rounded to ten digits, 3.141592654.

Display Formats

After you select a display format, all results are displayed in this format until you select another.

[2nd] [FD]—Floating-Decimal Key Sequence

This key sequence selects floating-decimal notation. This removes scientific or engineering notation; it does not cancel the fix decimal setting. Results are displayed in the following range.

– 9999999999 to – 0.000000001,
0,
0.000000001 to 9999999999

Note: Any results outside of this range are automatically displayed in scientific notation.

[2nd] [Sci]—Scientific Notation Key Sequence

This key sequence selects scientific notation. Each result is expressed as a base value (mantissa) times 10 raised to some power (exponent).

In scientific notation, the calculator always displays 'normalized' results. (That is, the result has a single digit to the left of the decimal point.)

(continued)

Display Formats (Continued)

[2nd] [Eng]—Engineering Notation Key Sequence

This key sequence selects engineering notation. This is like scientific notation, except that all exponents are multiples of 3.

[EXP]—Exponent Entry Key

This key enables you to enter an exponent in scientific or engineering notation. You can enter a number as small as $\pm 1 \times 10^{-99}$ and as large as $\pm 9.999999999 \times 10^{99}$.

To enter such a number:

1. Enter the mantissa. If it is negative, press **[+/-]**.
2. Press **[EXP]**. The number **00** appears in the right side of the display. (If you press **[EXP]** without first entering a mantissa, the calculator sets the mantissa as 1 and displays **1.00**.)
3. Enter the exponent. If it is negative, press **[+/-]**. If you press an incorrect digit key, simply re-enter the correct digits. (The calculator uses only the last two digits entered as the exponent.)
4. Press **[=]** to enter the number. Then, if necessary, press **[2nd] [Sci]** or **[2nd] [Eng]** to place the display in the desired format.

[2nd] [FIX]—Fixed-Decimal Key Sequence

This key sequence enables you to set the number of decimal places displayed in a result.

- ▶ To set the number of decimal places, press **[2nd] [FIX]** and then press the appropriate digit key (0 - 9).
- ▶ To remove the fixed-decimal setting, press **[2nd] [FIX] [.]**.

If a result has more than the selected number of decimal places, the displayed result is rounded. If a result has less than the selected number of decimal places, trailing zeros are inserted.

Changing Display Formats

By changing the display format, you can convert the result of a calculation from one format to another.

To convert a result, simply press the **[2nd] [FD]**, **[2nd] [Sci]**, **[2nd] [Eng]**, or **[2nd] [FIX]** key sequence, depending on the display format you desire.

To convert a number that you enter:

1. Enter the number.
2. Press **[=]**.
3. Press the desired key sequence.

Alternate Function Keys

Most keys can perform more than one function. The **[2nd]**, **[HYP]**, and **[MODE]** keys give you access to these alternate functions.

Note: If you press **[2nd]** or **[HYP]** and then a key with no second or hyperbolic function, the key performs its normal function. If you accidentally press **[2nd]** or **[HYP]**, press **[2nd]** or **[HYP]** again to cancel its effect.

[2nd]—Second Function Key

This key enables you to perform the 'second' function that is marked above and to the left of a key.

\sqrt{x}



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To perform a second function, press **[2nd]** and then press the appropriate function key.

[HYP]—Hyperbolic Function Key

The **[HYP]** and **[HYP] [2nd]** key sequences enable you to use the trigonometric keys to perform hyperbolic functions. Press **[HYP]** or **[HYP] [2nd]** and then press the trigonometric function key. For example:

- ▶ Press **[HYP] [SIN]** to find the hyperbolic sine.
- ▶ Press **[HYP] [2nd] [SIN⁻¹]** to find the inverse hyperbolic sine.

MODE — Mode Key

This key enables you to select the “modes” that are marked on the upper-right corner of the **1**, **2**, **3**, **4**, and **5** keys.

Σx



To select a mode, press **MODE** and then press the appropriate key.

Key Sequence	Mode Setting
MODE DEC	Decimal number mode
MODE BIN	Binary number mode
MODE OCT	Octal number mode
MODE HEX	Hexadecimal number mode
MODE STAT	Statistics mode

Note: Some operating features are available only in the decimal mode.

← — backspace key

Correcting Entry Errors



If you enter an incorrect number or function, you can always clear the calculation and begin again. Often, however, you can correct the error without clearing the entire calculation.













— Backspace Key


This key clears the last digit of the current numeric entry. Repeatedly pressing this key clears an entry digit-by-digit until the display becomes zero.

— Clear Entry/Clear Key

This key clears pending operations, incorrect entries, or immediate functions.

- ▶ To clear all pending operations, press  twice.
- ▶ To clear a numeric entry, press  once.

Note: When clearing an incorrect entry, be sure to press  before you press , , ,  , , , , or . Pressing  following any of these keys clears the calculator as if you had pressed  twice.

- ▶ To clear an immediate function, press  once.

After clearing an incorrect entry and entering the correct value, you can continue your calculation.

Correcting Pending Operations

If you press an incorrect pending operation key ($\boxed{y^x}$, $\boxed{2nd} \boxed{[\sqrt[y]{x}]}$, $\boxed{\times}$, $\boxed{\div}$, $\boxed{+}$, or $\boxed{-}$), you may or may not be able to correct the operation.

- ▶ If the incorrect operation has an equal or higher priority than the intended operation, you can press the correct operation key immediately after the incorrect one and continue with the calculation.
- ▶ If the incorrect operation has a lower priority than the intended operation, simply pressing the correct key may not correct the problem. If there are any pending operations, pressing a lower-priority operation key completes the previous pending operations. In this case, you should press $\boxed{CE/C}$ $\boxed{CE/C}$ to clear the calculation and begin again.

The priorities of operations are discussed on the following page.

$\boxed{2nd} \boxed{[x \rightleftharpoons y]}$ —x-Exchange-y Key Sequence

This key sequence exchanges:

- ▶ The values of x and y in universal power and root calculations.
- ▶ The minuend and subtrahend in subtraction.
- ▶ The divisor and dividend in division.
- ▶ The constant value and the value in the display in a constant calculation.

Algebraic Operating System

The AOST™ Algebraic Operating System completes all operations according to their relative priorities, which are listed below.

Priority	Operations
1 (highest)	Trigonometric, hyperbolic, square, square root, cube root, factorial, reciprocal, angle conversion, percent, logarithms, change sign
2	Universal powers and roots
3	Multiplication and division
4	Addition and subtraction
5 (lowest)	Equals

Operations in priority 1 are immediate functions; they are performed as soon as you press the operation keys.

Operations in priorities 2, 3, and 4 are completed by any operation with the same priority or with a lower priority.

The [=] key completes all operations.

Pending Operations and Parentheses

A pending operation is any operation that is delayed until you press a key with an equal or lower priority. The parentheses keys help you arrange the order of completion for a calculation.

Pending Operation Keys

Because the operation keys in priorities 2, 3, and 4— y^x , 2^{nd} [$\sqrt[y]{x}$], \times , $+$, $-$, and \div —create pending operations, they are called the **pending operation keys**. If you enter 4×5 , for example, the result is not displayed until you complete the operation by pressing an appropriate key, such as $=$. Until completed, 4×5 creates a pending multiplication.

The calculator allows you to enter a maximum of six pending operations. If you attempt to enter a seventh, an error condition occurs. Pending operations are cleared when you press any of the following keys or key sequences.

$\boxed{CE/C}$	$\boxed{CE/C}$	$\boxed{AC/ON}$
$\boxed{R\blacktriangleright P}$		$\boxed{2^{nd}} \boxed{[P\blacktriangleright R]}$
\boxed{MODE}	\boxed{STAT}	

$\boxed{(}$, $\boxed{)}$ —Parentheses Keys

These keys open and close a parenthetical expression. A set of operations enclosed in parentheses is given priority over operations outside the parentheses. Within each level of parentheses, the calculator operates according to the rules of AOS.

With each pending operation, you can enter up to 15 levels of open parentheses.

Basic Operations

Arithmetic Functions

The $\boxed{+}$, $\boxed{-}$, $\boxed{\times}$, and $\boxed{\div}$ keys perform the arithmetic operations of addition, subtraction, multiplication, and division.

The $\boxed{=}$ key completes all pending operations and displays the result.

Example: $-4 \times 7.3 \div 2 = -14.6$

Enter	Press	Display
4	$\boxed{+/-}$ $\boxed{\times}$	- 4.
7.3	$\boxed{\div}$	- 29.2
2	$\boxed{=}$	- 14.6

Rounding and Accuracy

Even though a calculation can produce a 12-digit result, the display can show only 10 digits. Results are, therefore, rounded to a 10-digit standard display or to a 10-digit mantissa and 2-digit exponent for scientific notation.

Higher-order mathematical functions use iterative calculations. The cumulative error from these calculations in most cases is maintained beyond the 10-digit display. Most calculations are accurate to ± 1 in the last displayed digit.

Constant Calculations

The constant register is set automatically when you perform a calculation that uses $+$, $-$, \times , \div , y^x , or $2^{\text{nd}} [\sqrt[n]{y}]$. The register uses the number entered **after** the function key as the constant number.

When you enter another number and press $=$, the calculator completes the problem using the number and function in the constant register.

The constant register is cleared when you press CE/C , AC/ON , or a pending operation key.

Example: Use \times $2^{\text{nd}} [\pi]$ as a constant to calculate π^2 , π^4 , and π^8 .

Enter	Press	Display
2	\times $2^{\text{nd}} [\pi] =$	6.283185307
4	$=$	12.56637061
8	$=$	25.13274123

Percentage Calculations

2nd [%]—Percent Key Sequence

This key sequence automatically divides the number in the display by 100, converting the number to its equivalent decimal percent.

For example, if you enter 43.9 and press **2nd [%]**, **0.439** is displayed.

In the chart below, the “principal amount” is the number in the display immediately after you press **×**, **+**, **−**, or **÷**.

Operation	Key Sequence	Function
Percentage	× n 2nd [%] =	Calculates n% of the principal amount.
Add-On	+ n 2nd [%] =	Calculates n% of the principal amount and adds the percentage to the number.
Discount	− n 2nd [%] =	Calculates n% of the principal amount and subtracts the percentage from the number.
Percentage	÷ n 2nd [%] =	Divides the ratio principal amount by n%.

Percentage Examples

What is 2.5% of 15?

Enter	Press	Display
15	\times	15.
2.5	2^{nd} [%] [=]	0.375

What is the total cost of a \$15 item with a 5% sales tax?

Enter	Press	Display
15	$+$	15.
5	2^{nd} [%] [=]	15.75

How much is paid for a \$5 item that is discounted 2%?

Enter	Press	Display
5	$-$	5.
2	2^{nd} [%] [=]	4.9

25 is 15% of what number?

Enter	Press	Display
25	$+$	25.
15	2^{nd} [%] [=]	166.6666667

Memory Operations

[STO] — Store Key

This key stores the displayed number in memory, replacing the previous memory contents. To clear the memory, press **[STO]** when 0 is displayed.

[RCL] — Recall Key

This key displays (recalls) the number stored in memory, without affecting the memory contents.

Example: Store and recall 45.68.

Enter	Press	Display
45.68	[STO]	M 45.68
	[CE/C] [CE/C]	M 0.
	[RCL]	M 45.68

[2nd] [EXC] — Exchange Key Sequence

This key sequence exchanges the number in the display with the number in memory.

Example: Store 55.4 in memory and use **[2nd] [EXC]** to exchange a displayed value with the stored value.

Enter	Press	Display
55.4	[STO]	M 55.4
67	[2nd] [EXC]	M 55.4
	[2nd] [EXC]	M 67.

SUM — Sum Key

This key adds the number in the display to the number in memory. For example, if 5 is in memory and you press 3 **SUM**, the number in memory is then 8. The 3 remains in the display.

Note: If you want to add to the current contents of memory, use **SUM**. However, if you are beginning a new problem, be sure to use **STO** to store the first number in memory. (This clears the previous contents.) You can then use **SUM** to add subsequent numbers.

Example: $28.3 \times 7 = 198.1$

$$173 + 16 = 189$$

$$312 - 42 + 7.8 = 277.8$$

$$\text{Total } 664.9$$

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Enter	Press	Display	Memory
28.3	×	28.3	0.
7	= STO	M 198.1	198.1
173	+	M 173.	198.1
16	= SUM	M 189.	387.1
312	−	M 312.	387.1
42	+	M 270.	387.1
7.8	= SUM	M 277.8	664.9
	RCL	M 664.9	664.9

Reciprocals, Powers, and Roots

The $\boxed{1/x}$, $\boxed{x^2}$, $\boxed{2nd} \boxed{\sqrt{x}}$, and $\boxed{2nd} \boxed{\sqrt[3]{x}}$ keys calculate the reciprocal, square, square root, and cube root of the displayed number. These are immediate functions that operate only on the displayed number.

Example: Calculate $\sqrt{3^2 + 4^2}$

Enter	Press	Display
3	$\boxed{x^2} \boxed{+}$	9.
4	$\boxed{x^2}$	16.
	$\boxed{=}$	25.
	$\boxed{2nd} \boxed{\sqrt{x}}$	5.

$\boxed{y^x}$ —Universal Power Key

This key raises any positive number to any power (within the range of the calculator).

1. Enter the number (y) that you want to raise to a power.
2. Press $\boxed{y^x}$.
3. Enter the power (x).
4. Press $\boxed{=}$ or any key that completes the operation.

Example: $2.86^{-.42} = 0.643170721$

Enter	Press	Display
2.86	$\boxed{y^x}$	2.86
.42	$\boxed{+/-}$	- 0.42
	$\boxed{=}$	0.643170721

[2nd] [$\sqrt[x]{y}$]—Universal Root Key Sequence

This key sequence calculates any root of any positive number (within the range of the calculator).

1. Enter the number (y) whose root you want to find.
2. Press **[2nd] [$\sqrt[x]{y}$]**.
3. Enter the root (x).
4. Press **[=]** or any key that completes the operation.

Example: $^{3.12}\sqrt{1460} = 10.33274375$

Enter	Press	Display
1460	[2nd] [$\sqrt[x]{y}$]	1460.
3.12	[=]	10.33274375

Logarithms and Antilogarithms

The logarithm key sequences perform common and natural logarithms and common and natural antilogarithms.

Key Sequence	Function
LOG	Calculates the common logarithm (base 10) of the number in the display.
LN	Calculates the natural logarithm (base e) of the number in the display. (The value of e is 2.718281828.)
2nd [10^x]	Calculates the common antilogarithm of the number in the display (10 raised to the power of the number).
2nd [e^x]	Calculates the natural antilogarithm of the number in the display (e raised to the power of the number).

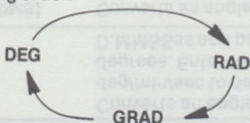
Examples: Calculate $\log 15.32$, $\ln 203.451$, and $e^{-.69315}$

Enter	Press	Display
15.32	LOG	1.185258765
203.451	LN	5.31542519
.69315	+/- 2nd [e^x]	0.49999859

Angle Units

The angle units setting is important when you are performing trigonometric calculations and polar/rectangular conversions. The current angle setting is indicated by **DEG**, **RAD**, or **GRAD** in the display.

The calculator is automatically set to degree angle units when you press **[AC/ON]**. Each time you press **[DRG]** or **[2nd] [DRG▶]**, the setting advances from one unit to the next in the following order:



Key Sequence	Function
[DRG]	Changes the angle setting without affecting the angle in the display.
[2nd] [DRG▶]	Changes the angle setting and converts the angle in the display to the new units.

Example: Convert 90° to radians, grads, and then back to degrees.

Note: If necessary, press **[DRG]** until **DEG** is displayed before performing this example.

Enter	Press	Display	Comment
90		90.	Degrees
	[2nd] [DRG▶]	1.570796327	Radians
	[2nd] [DRG▶]	100.	Grads
	[2nd] [DRG▶]	90.	Degrees

Deg/Min/Sec and Decimal Degrees

In deg/min/sec, angles are represented by the D.MMSSss format.

Integer degrees **D.°** **M M'** **S S''** **s s**
Minutes
Seconds
Fractional part of a second

When you enter minutes and seconds, remember to include zeros where needed to place the digits in the proper positions. For example, the angle $9^{\circ} 7' 50''$ is entered as 9.075.

In decimal degrees, angles are represented by the D.ddddddddd format.

Integer degrees **D . d d d d d d d d d**
Fractional part of a degree

Note: The key sequences below also apply to hours/min/sec and decimal hours.

Key Sequence	Function
[>DD]	Converts an angle from deg/min/sec to decimal degrees. Enter the angle as D.MMSSss and press [>DD].
[2nd] [>DMS]	Converts an angle from decimal degrees to deg/min/sec. Enter the angle as D.ddddddddd and press [2nd] [>DMS]. The result is rounded to six decimal places and is displayed with degree, minute, and second symbols (for example, $5.^{\circ}07'11''11$).

Note: The calculator can perform these conversions in any angle units setting.

Trigonometric Functions

[SIN], [COS], [TAN]—Trig Keys

These keys calculate the sine, cosine, and tangent of the angle in the display.

Note: The calculator interprets the angle in the units (**DEG**, **RAD**, or **GRAD**) selected by the **[DRG]** or **[2nd] [DRG▶]** key sequence. Also, if you enter an angle in deg/min/sec format, you must convert it to decimal degrees before using these functions.

[2nd] [SIN⁻¹], [2nd] [COS⁻¹], [2nd] [TAN⁻¹]— Inverse Trig Key Sequences

These keys calculate the angle (in the units selected) whose sine, cosine, or tangent is in the display.

Examples: Find $\sin 30^\circ$ and arctangent 1.

Note: If necessary, press **[DRG]** until **DEG** is displayed before performing this example.

Enter	Press	Display
30	[SIN]	0.5
1	[2nd] [TAN⁻¹]	45.

Polar/Rectangular Conversions

2nd [P \rightarrow R]—Polar to Rectangular Key Sequence

To convert from polar to rectangular:

1. Select the correct angle units.
2. Enter the r-coordinate and press **2nd** [$x \rightarrow y$].
3. Enter the θ -coordinate.
4. Press **2nd** [P \rightarrow R] to convert the coordinates and display the x-coordinate.
5. Press **2nd** [$x \rightarrow y$] to display the y-coordinate.

Note: To recall the x-coordinate, press **2nd** [$x \rightarrow y$] again. You can use **2nd** [$x \rightarrow y$] to alternately display the x- and y-coordinates until you press **CE/C**, **CE/C**, **AC/ON**, or **=**, or use **MODE** to change the mode.

Example: Convert the polar coordinates ($r = 10$, $\theta = -45^\circ$) to rectangular coordinates.

Note: If necessary, press **DRG** until **DEG** is displayed before performing this example.

Enter	Press	Display
10	2nd [$x \rightarrow y$]	0.
45	+/- 2nd [P \rightarrow R]	7.071067812
	2nd [$x \rightarrow y$]	- 7.071067812

[R►P] — Rectangular to Polar Key

To convert from rectangular to polar:

1. Select the correct angle units.
2. Enter the x-coordinate and press **[2nd] [x↔y]**.
3. Enter the y-coordinate.
4. Press **[R►P]** to convert the coordinates and display the r-coordinate.
5. Press **[2nd] [x↔y]** to display the θ -coordinate.

Note: To recall the r-coordinate, press **[2nd] [x↔y]** again. You can use **[2nd] [x↔y]** to alternately display the r- and θ -coordinates until you press **[CE/C]**, **[AC/ON]**, or **[=]**, or use **[MODE]** to change the mode.

Example: Convert the rectangular coordinates ($x = 5$, $y = 6$) to polar coordinates.

Note: If necessary, press **[DRG]** until **DEG** is displayed before performing this example.

Enter	Press	Display
5	[2nd] [x↔y]	0.
6	[R►P]	7.810249676
	[2nd] [x↔y]	50.19442891

Statistics and Probability

[2nd] [x!]—Factorial Key Sequence

Factorials are used in some types of probability calculations. The **[2nd] [x!]** key sequence calculates the factorial of the displayed value. The displayed value must be an integer in the range of 0 to 69.

[MODE] [STAT]—Statistics Mode Key Sequence

This key sequence selects the statistics mode, indicated by **STAT** in the display. In this mode, you are limited to a maximum of three pending operations.

Clearing the Statistical Registers

Before beginning a new statistics problem, you must clear the statistical registers.

Caution: Simply pressing **[MODE] [STAT]** does not always clear the registers. The registers are cleared only when you use the **[MODE]** key to **change from one mode to another** or when you press **[AC/ON]**. If the calculator is already in the statistics mode when you press **[MODE] [STAT]**, the registers are not cleared.

To make sure the registers are properly cleared, use the following key sequence.

[MODE] [DEC] [MODE] [STAT]

This sequence clears the registers but does not affect the calculator's memory.

Entering Statistical Data

To enter statistical data values:

1. Press **MODE** **DEC** **MODE** **STAT** to clear the statistical registers and enter the statistics mode.
2. Enter a data value and press the **$\Sigma+$** key. Continue until all the data values are entered. If you enter an incorrect value, remove it by re-entering the value and pressing **2nd** **$\Sigma-$** .

Each time you press **$\Sigma+$** or **2nd** **$\Sigma-$** , the display shows the number of data values currently in the registers.

Analyzing the Data

After entering the data values, you can perform any of the following calculations.

Calculation	Key Sequence
Mean	2nd \bar{x}
"n weighted" population standard deviation	2nd σ_n
"n - 1 weighted" sample standard deviation	2nd σ_{n-1}
Sum of data values	2nd Σx
Sum of squares	2nd Σx^2
Number of data values	2nd [n]

(continued)

Statistics and Probability (Continued)

Example: Analyze the following test scores: 96, 81, 87, 70, 93, and 77, assuming that the six students are the entire population.

Enter	Press	Display	Comments
	MODE DEC MODE STAT	0	Clear
96	$\Sigma +$		1. 1st entry
81	$\Sigma +$		2. 2nd entry
97	$\Sigma +$		3. 3rd entry (incorrect)
97	2nd $[\Sigma -]$		2. 3rd entry removed
87	$\Sigma +$		3. 3rd entry (correct)
70	$\Sigma +$		4. 4th entry
93	$\Sigma +$		5. 5th entry
77	$\Sigma +$		6. 6th entry
	2nd $[\bar{x}]$		84. Mean (class average)
	2nd $[\sigma n]$	9.018499506	Standard deviation
	x^2	81.33333333	Variance
	2nd $[\Sigma x]$	504.	Sum of the data values
	2nd $[\Sigma x^2]$	42824.	Sum of the squares

Hyperbolic Functions

[HYP] — Hyperbolic Key

[HYP] [2nd] — Inverse Hyperbolic Key Sequence

The **[HYP]** key enables you to use the trigonometric keys to perform hyperbolic functions. The **[HYP] [2nd]** key sequence enables you to perform inverse hyperbolic functions.

Key Sequence	Function
[HYP] [SIN]	\sinh
[HYP] [2nd] [SIN⁻¹]	\sinh^{-1}
[HYP] [COS]	\cosh
[HYP] [2nd] [COS⁻¹]	\cosh^{-1}
[HYP] [TAN]	\tanh
[HYP] [2nd] [TAN⁻¹]	\tanh^{-1}

Example: Calculate $\sinh 3$ and $\tanh^{-1} 0.5$.

Enter	Press	Display
3	[HYP] [SIN]	10.01787493
.5	[HYP] [2nd] [TAN⁻¹]	0.549306144

Fractions

Entering Fractions

To enter a pure fraction (such as $1/6$) as a/b :

1. Enter as many as six digits for **a**.
2. Press $\boxed{a^{b/c}}$. The display shows “ $\frac{_}{_}$ ” to separate **a** from **b**.
3. Enter as many as three digits for **b**.

If you enter an improper fraction (such as $15/4$), the calculator changes it to a proper fraction (such as $3 \frac{3}{4}$) when you press an operation key.

To enter a mixed fraction (such as $3 \frac{1}{6}$) as $a \frac{b}{c}$:

1. Enter as many as three digits for **a**.
2. Press $\boxed{a^{b/c}}$. The display shows “ $\frac{_}{_}$ ” to separate **a** from **b**.
3. Enter as many as three digits for **b**.
4. Press $\boxed{a^{b/c}}$. The display shows “ $\frac{_}{_}$ ” to separate **a** from **b** and “ $\frac{_}{_}$ ” to separate **b** from **c**.
5. Enter as many as three digits for **c**.
(**a**, **b**, and **c** together cannot exceed eight digits.)

Converting Fractions

To convert a mixed, proper fraction to an improper fraction, press $\boxed{2\text{nd}} \boxed{[d/c]}$.

To convert a fraction to a decimal value, press $\boxed{=}$ $\boxed{a^{b/c}}$. Press $\boxed{a^{b/c}}$ again to change the result back into a fraction.

To convert a decimal value to a fraction, follow these steps. (The decimal value must be in the range ± 0.01 to ± 999.99 , with one or two digits after the decimal point.)

1. Enter all the digits but omit the decimal point.
2. Press $\boxed{a^{b/c}}$.
3. If there is a single digit after the decimal, enter 10. If there are two digits after the decimal, enter 100.
4. To get a mixed fraction, press $\boxed{=}$. To get an improper fraction, press $\boxed{2\text{nd}} \boxed{[d/c]}$.

Example	Press	Display
Calculate $3\frac{1}{6} - \frac{7}{8}$	3 $\boxed{a^{b/c}}$ 1 $\boxed{a^{b/c}}$ 6 $\boxed{-}$ 7 $\boxed{a^{b/c}}$ 8 $\boxed{=}$	2_7 J24.
Convert $2\frac{5}{8}$ to decimal.	2 $\boxed{a^{b/c}}$ 5 $\boxed{a^{b/c}}$ 8 $\boxed{=}$ $\boxed{a^{b/c}}$	2.625
Convert 3.42 to a mixed fraction.	342 $\boxed{a^{b/c}}$ 100 $\boxed{=}$	3_21 J50.
Convert $1\frac{1}{2}$ to an improper fraction.	1 $\boxed{a^{b/c}}$ 1 $\boxed{a^{b/c}}$ 2 $\boxed{a^{b/c}}$ $\boxed{2\text{nd}} \boxed{[d/c]}$	3 J2.

Number-System Modes

MODE **DEC** — Decimal Mode Key Sequence

This key sequence selects the decimal mode. When you press **MODE** **DEC**, the number in the display is automatically converted to its decimal equivalent.

Note: Normally, you should keep the calculator in the decimal mode. Some of the calculator's operating features are limited in the other modes.

MODE **BIN** — Binary Mode Key Sequence

This key sequence selects the binary mode and shows the **BIN** indicator. In this mode, you can only perform arithmetic operations with binary numbers (integers only).

When you press **MODE** **BIN**, the integer portion of the number in the display is automatically converted to its binary equivalent. (If you attempt to convert a number that is outside the range of binary numbers, an error condition occurs.)

You can enter positive binary numbers as large as 11111111 (9 digits). Numbers beyond this are interpreted as negative (two's complement) numbers.

[MODE] [OCT]—Octal Mode Key Sequence

This key sequence selects the octal mode and shows the **OCT** indicator. In this mode, you can only perform arithmetic operations with octal numbers (integers only).

When you press **[MODE] [OCT]**, the integer portion of the number in the display is automatically converted to its octal equivalent. (If you attempt to convert a number that is outside the range of octal numbers, an error condition occurs.)

You can enter positive octal numbers as large as 3777777777. Numbers beyond this are interpreted as negative (two's complement) numbers.

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[MODE] [HEX]—Hexadecimal Mode Key Sequence

This key sequence selects the hexadecimal mode and shows the **HEX** indicator. In this mode, you can only perform arithmetic operations with hexadecimal numbers (integers only).

When you press **[MODE] [HEX]**, the integer portion of the number in the display is automatically converted to its hexadecimal equivalent. (If you attempt to convert a number that is outside the range of hexadecimal numbers, an error condition occurs.)

[MODE] [HEX] (continued)

(continued)

Number System Modes (Continued)

MODE HEX (Continued)

You can enter positive hexadecimal numbers as large as 2540BE3FF. Numbers from FDABF41C01 through FFFFFFFF are interpreted as negative (two's complement) numbers.

Note: Hexadecimal numbers between 2540BE3FF and FDABF41C01 are equivalent to decimal values that are outside the range of the calculator. An attempted calculation with these numbers causes an error condition.

To enter the hexadecimal digits A through F, use the keys shown below. In the hexadecimal mode, the calculator reassigns these six keys so that the letters A through F are their only functions.

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$\sqrt[3]{x}$



P►R



►DMS



SIN⁻¹



COS⁻¹



TAN⁻¹



Although B and D are shown as uppercase letters on the keyboard, they are displayed as lowercase **b** and **d**. If you enter ABCD, for example, the display shows **AbCd**.

Two's Complement

To display the two's complement of the number in the display, press **+/-** (**NEG**)

Boolean Logic Operations

The **AND**, **OR**, **XOR**, **XNOR**, and **NOT** keys operate in the binary, octal, and hexadecimal modes.

Except for **NOT**, these keys operate on two values. The calculator compares corresponding bits of the two values and displays the result in the current number base.

Operator	Effect	Summary
AND	Resulting bit = 1 only if both compared bits are 1.	$0 \text{ AND } 0 = 0$ $0 \text{ AND } 1 = 0$ $1 \text{ AND } 1 = 1$
OR	Resulting bit = 1 if either or both compared bits are 1.	$0 \text{ OR } 0 = 0$ $0 \text{ OR } 1 = 1$ $1 \text{ OR } 1 = 1$
XOR	Resulting bit = 1 only if the compared bits are different.	$0 \text{ XOR } 0 = 0$ $0 \text{ XOR } 1 = 1$ $1 \text{ XOR } 1 = 0$
XNOR	Performs an XOR, then reverses each bit of the result.*	$0 \text{ XNOR } 0 = 1$ $0 \text{ XNOR } 1 = 0$ $1 \text{ XNOR } 1 = 1$
NOT	Complements each bit of the displayed value.*	$\text{NOT } 0 = 1$ $\text{NOT } 1 = 0$

*In the binary, hexadecimal, and octal modes, the calculator treats all numbers as 10-bit numbers. The logical NOT of zero, for example, is 1111111111_{BIN} , because $\text{zero} = 0000000000_{\text{BIN}}$.

(continued)

Boolean Logic Operations (Continued)

Examples

What is the result of FF_{Hex} AND $F2_{Hex}$?

Procedure	Press	Display
Select mode.	MODE HEX	HEX 0.
Find result.	FF AND F2 =	HEX F2.

What is the result of 101_{Bin} OR 010_{Bin} ?

Procedure	Press	Display
Select mode.	MODE BIN	BIN 0.
Find result.	101 OR 10 =	BIN 111.

What is the binary result of $9F_{Hex}$ XOR 01_{Hex} ?

Enter	Press	Display
Select mode.	MODE HEX	HEX 0.
Find hex result.	9F XOR 1 =	HEX 9E.
Convert to binary.	MODE BIN	BIN 10011110.

Error Conditions

When an error condition occurs, an **E** appears in the left side of the display. The calculator will not accept a keyboard entry until you press **CE/C** to clear the error condition. (Pressing **CE/C** twice clears the condition and all pending operations.)

General Error Conditions

The error conditions listed in this section can occur in most calculator modes. Errors occur when you attempt to:

- ▶ Calculate a result larger than $\pm 9.999999999 \times 10^{99}$.
- ▶ Divide a number by zero.
- ▶ Use more than 15 levels of open parentheses or more than six pending operations. (You can use only three pending operations in the statistics mode.)
- ▶ Calculate **LOG**, **LN**, or **1/x** of zero.
- ▶ Calculate **LOG**, **LN**, or **2nd** [**√x**] of a negative number.
- ▶ Use **2nd** [**√y**] to find an even root of a negative number.
- ▶ Use **y^x** to raise zero to the 0th power, or use **2nd** [**√y**] to calculate the 0th root of any number.

(continued)

Error Conditions (Continued)

General Error Conditions (Continued)

- ▶ Use **R►P** when both x and y are zero or when the sum of the squares of x and y exceeds the upper limit of the calculator.
- ▶ Calculate **TAN** of 90° or 270° , $\pi/2$ or $3\pi/2$ radians, 100 or 300 grads, or their rotational multiples, such as 450° .
- ▶ Calculate **2nd** **[SIN⁻¹]** or **2nd** **[COS⁻¹]** when the absolute value of the displayed number is greater than 1.
- ▶ Calculate **HYP** **2nd** **[TAN⁻¹]** when the absolute value of the displayed number is greater than or equal to 1.
- ▶ Calculate **2nd** **[x!]** of a number that is not a positive integer less than or equal to 69.

Statistical Error Conditions

The error conditions listed in this section occur only when the calculator is in the statistics mode. Errors occur when you attempt to:

- ▶ Use $\boxed{\Sigma+}$ to enter a data value (x) such that $|x| > 1 \times 10^{50}$
- ▶ Use $\boxed{2nd} \boxed{\Sigma-}$ when there are no data values in the statistical registers.
- ▶ Calculate $\boxed{2nd} \boxed{\bar{x}}$, $\boxed{2nd} \boxed{\sigma_n}$, or $\boxed{2nd} \boxed{\sigma_{n-1}}$ when there are no data values.
- ▶ Calculate $\boxed{2nd} \boxed{\sigma_{n-1}}$ with only one data value.
- ▶ Enter a series of data points (x_i) such that $\Sigma(x_i)$ exceeds the upper or lower limit of the calculator.
- ▶ Use more than three pending operations.

Number Mode Error Conditions

The error conditions listed in this section occur only when the calculator is in the binary, octal, or hexadecimal number mode. Errors occur when you attempt to:

- ▶ Calculate a result that is outside the calculator's range for that number mode.
- ▶ Use $\boxed{MODE} \boxed{BIN}$, $\boxed{MODE} \boxed{OCT}$, or $\boxed{MODE} \boxed{HEX}$ to convert a number that is outside the calculator's range for that number mode.

In Case of Difficulty

1. If the digits fail to appear in the display, be sure that all of the solar panel is exposed to an adequate light source.
2. Press **AC/ON** to reset the calculator. Then try the calculation again. Review the operating instructions to be certain the calculations were performed properly.

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Service Information

Service and General Information

If you have questions about service or the general use of your calculator, please call Consumer Relations at:

1-806-747-1882.

Please note that this is a toll number, and collect calls are not accepted.

You may also write to the following address:

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

Please contact Consumer Relations:

- ▶ Before returning the calculator for service
- ▶ For general information about using the calculator

For Technical Information

If you have technical questions about the operation of the calculator, call 1-806-741-2663. We regret that we cannot accept collect calls at this number. As an alternative, you can write Consumer Relations at the address given above.

Express Service

Texas Instruments offers an express service option for fast return delivery. Please call Consumer Relations for information.

(continued)

Service Information (Continued)

Returning Your Calculator for Service

A defective calculator will be either repaired or replaced with the same or comparable reconditioned model (at TI's option) when it is returned, postage prepaid, to a Texas Instruments Service Facility.

Texas Instruments cannot assume responsibility for loss or damage during incoming shipment. For your protection, carefully package the calculator for shipment and insure it with the carrier. Be sure to enclose the following items with your calculator:

- ▶ Your full return address
- ▶ Any accessories related to the problem
- ▶ A note describing the problem you experienced
- ▶ A copy of your sales receipt or other proof of purchase to determine warranty status

Please ship the calculator postage prepaid; COD shipments cannot be accepted.

In-Warranty Service

For a calculator covered under the warranty period, no charge is made for service.

Out-of-Warranty Service

A flat-rate charge by model is made for out-of-warranty service. To obtain the service charge for a particular model, call Consumer Relations **before** returning the product for service. (We cannot hold products in the Service Facility while providing charge information.)

Texas Instruments Service Facilities

U.S. Residents (U.S. Postal Service)

Texas Instruments
P.O. Box 2500
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2305 N. University
Lubbock, Texas 79408

Canadian Residents Only

Texas Instruments
41 Shelley Road
Richmond Hill, Ontario L4C 5G4

One-Year Limited Warranty

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

Warranty Duration: This calculator is warranted to the original consumer purchaser for a period of one (1) year from the original purchase date.

Warranty Coverage: This calculator is warranted against defective materials or workmanship. **This warranty is void if the product has been damaged by accident, unreasonable use, neglect, improper service, or other causes not arising out of defects in material or workmanship.**

Warranty Disclaimers: Any implied warranties arising out of this sale, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, are limited in duration to the above one-year period. Texas Instruments shall not be liable for loss of use of the calculator or other incidental or consequential costs, expenses, or damages incurred by the consumer or any other user.

Some states do not allow the exclusion or limitations of implied warranties or consequential damages, so the above limitations or exclusions may not apply to you.

Legal Remedies: This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

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

The repaired or replacement calculator will be in warranty for the remainder of the original warranty period or for six months, whichever is longer. Other than the postage requirement, no charge will be made for such repair or replacement.

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

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