TEXAS INSTRUMENTS

PROGRAMMABLE

TI-74

USER'S GUIDE

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USER'S GUIDE

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Key Reference Chart

The chart below lists each calculator key and the page that describes it.

Left Area of the Keyboard

[hyp]	2-5	[STAT]	2-3	[MODE]	1-8			[$x \rightleftarrows y$]	2-37
[sin]	2-30	[cos]	2-30	[tan]	2-30	[π]	2-8	[ln$x$]	2-26
[DMS▸DD]	2-32	[DRG]	2-29	[DRG▸]	2-29	[P▸R]	2-38	[n!]	2-40
[PRINT]	2-51	[STO]	2-24	[RCL]	2-24	[SUM]	2-24	[EXC]	2-24
[INV]	2-4	[Δ%]	2-36						

Central Area of the Keyboard

[←]	2-7	[EE]	2-8	[(]	2-16	[)]	2-16	[CE/C]	2-7
[log]	2-26	[x^2]	2-23	[$\sqrt{x}$]	2-23	[1/x]	2-23	[y^x]	2-20
[nPr]	2-42	[nCr]	2-42	[Frq]	2-43	[(x,y)]	2-37	[Σ+]	2-43
[Intg]	2-28	[Frac]	2-28	[%]	2-34	[INV]	2-4	[=]	2-13

Right Area of the Keyboard

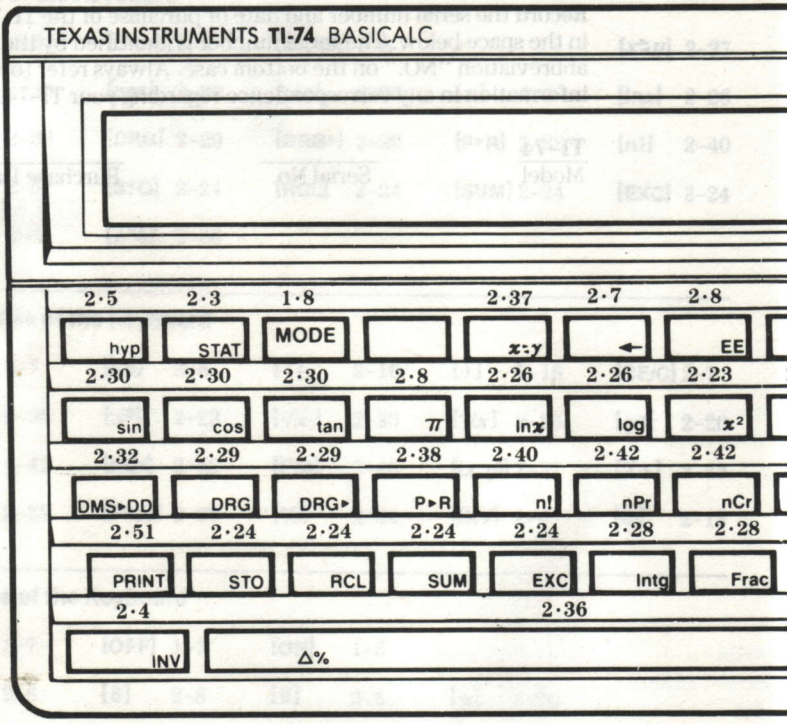
[RESET]	2-7	[OFF]	1-7	[ON]	1-6		
[7]	2-8	[8]	2-8	[9]	2-8	[÷]	2-20
[Σx^2]	2-50	[Σy^2]	2-50	[Σxy]	2-50	[$\bar{x}$]	2-51
[4]	2-8	[5]	2-8	[6]	2-8	[×]	2-20
[Σx]	2-50	[Σy]	2-50	[n]	2-50	[$\bar{y}$]	2-51
[1]	2-8	[2]	2-8	[3]	2-8	[−]	2-20
[r]	2-51	[a]	2-51	[b]	2-51	[sx]	2-51
[+/−]	2-8	[0]	2-8	[.]	2-8	[+]	2-20
[CSR]	2-43	[x']	2-51	[y']	2-51	[sy]	2-51

Record the serial number and date of purchase of the TI-74 in the space below. The serial number is identified by the abbreviation "NO." on the bottom case. Always refer to this information in any correspondence regarding your TI-74.

TI-74		
Model	Serial No.	Purchase Date

Key Reference Diagram

The following diagram shows page numbers you can referen this guide for information about each calculator key.



nce in

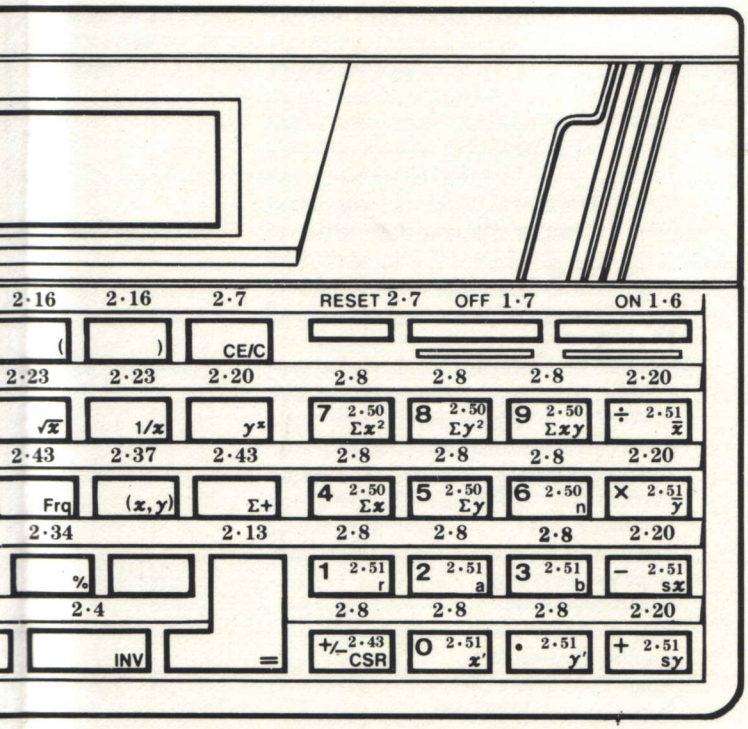

2·16
2·16
2·7
RESET 2·7
OFF 1·7
ON 1·6
(
)
CE/C
2·23
2·23
2·20
2·8
2·8
2·8
2·20
√x
1/x
y^x
7 2·50 Σx²
8 2·50 Σy²
9 2·50 Σxy
÷ 2·51 x̄
2·43
2·37
2·43
2·8
2·8
2·8
2·20
Frq
(x,y)
Σ+
4 2·50 Σx
5 2·50 Σy
6 2·50 n
× 2·51 ȳ
2·34
2·13
2·8
2·8
2·8
2·20
%
1 2·51 r
2 2·51 a
3 2·51 b
− 2·51 sx
2·4
2·8
2·8
2·8
2·20
INV
=
+/− 2·43 CSR
0 2·51 x'
• 2·51 y'
+ 2·51 sy

Table of Contents

This guide contains instructions for using the Texas Instruments TI-74 BASICALC™ calculator. You can find reference material in the TI-74 Programming Reference Guide and on the Quick Reference Card supplied with the TI-74.

Introduction

The Texas Instruments TI-74 BASICALC™ calculator is a dual-purpose calculating device that can function as a calculator and as a computer. The manuals accompanying the TI-74 explain its operation.

TI-74 Features

The TI-74 features include:

- Extensive calculator functions.
- Advanced BASIC language.
- Portable operation. The TI-74 uses four AAA alkaline batteries that provide many hours of operation.
- A typewriter-like keyboard. Any key repeats when you hold it down.
- A cartridge port. Using this port, you can insert a software cartridge or a memory cartridge.
- A peripheral port. Using this port, you can attach accessories such as a printer and a cassette interface cable.

TI-74 Manuals

The TI-74 is packaged with two manuals, as well as a card for quick reference.

- The *TI-74 User's Guide* (this manual) gets you started using the TI-74. It presents fundamental concepts of operating the TI-74, how to use the TI-74 as a calculator (including a calculator reference section), and how to use the TI-74 as a BASIC language computer.

- The *TI-74 Programming Reference Guide* is a reference for using TI-74 BASIC. It provides explanations of the main operations available with BASIC. An alphabetical reference section includes a detailed explanation of each BASIC command, statement, and function.

- The *Quick Reference Card* contains summaries of information you may need frequently.

Additional Assistance

If you experience a problem in using your calculator, you can contact Consumer Relations to discuss the problem and possible solutions. You can write to:

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

or call toll free at **1-800-TI-CARES** (1-800-842-2737) within the United States. From outside the United States, call 806-741-4800. (We regret that we cannot accept collect calls at this number.)

FCC Information Concerning Radio Frequency Interference

The TI-74 calculator generates and uses radio frequency energy. If not installed and used properly, as described in this guide, the calculator may cause interference to radio and television reception.

The TI-74 has been tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Sub-part J of Part 15 of Federal Communications Commission (FCC) Rules, which are designed to provide reasonable protection against radio/TV interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

If the TI-74 causes interference, which you can determine by turning it off and on, try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna for the radio or TV that is receiving interference.
- Change the position of the calculator or move it away from the radio or TV that is receiving interference.
- If you are using the optional PC-324 printer and adapter with the TI-74, plug it into a different wall outlet so that the calculator and the equipment receiving interference are on different branch circuits.

If these measures do not eliminate the interference, please consult your dealer or an experienced radio/TV technician for additional suggestions. The FCC has prepared a helpful booklet, *How to Identify and Resolve Radio-TV Interference Problems*. Please specify Stock Number 004-000-00345-4 when ordering this booklet from

The US Government Printing Office
Washington, D.C. 20402

Chapter 1: Getting Started

Read this chapter to familiarize yourself with how to take care of the TI-74, how to install batteries, how to turn the TI-74 on and off, and how to select calculator or BASIC operation.

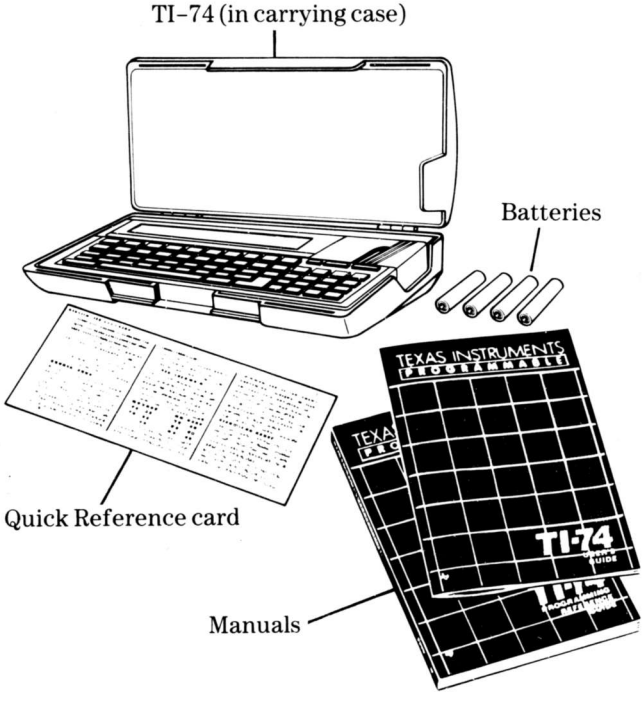
Table of Contents

Unpacking the TI-74

When you unpack the TI-74, you should inspect the items and familiarize yourself with the parts of the TI-74.

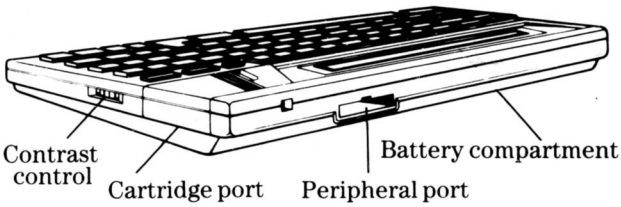
Package Contents

The TI-74 package contains the items shown here. Inspect each item for evidence of damage. If an item is damaged, contact your dealer or Texas Instruments Consumer Relations (see page A-13).



Parts of the TI-74

The illustration below shows the main parts of the TI-74. The accompanying table describes each part.



Part	Description
Peripheral port	Provides a way to connect external peripherals.
Contrast control	Allows you to adjust the display for various lighting conditions.
Battery compartment	Holds batteries that power the TI-74.
Cartridge port	Provides a connection for a software (ROM) or memory (RAM) cartridge.

Note: The TI-74 comes with a port protector, labeled "ROM/RAM," in the cartridge port. The port protector does not contain any memory or programs; it is installed to protect the port from dust. Keep the port protector or a cartridge in the port at all times.

Before Using the TI-74

Before using the TI-74, you need to install the batteries that are supplied in the package. You also need to know some guidelines for taking care of the TI-74.

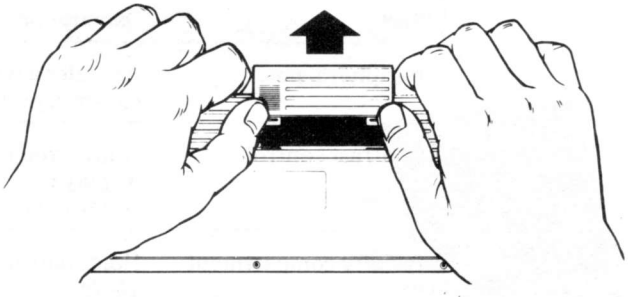
CAUTION

Electronic equipment can be damaged by static electricity discharges. To remove static charges, touch a metal object (such as a doorknob, a desk lamp, etc.) before working with your TI-74, connecting peripherals, or handling a cartridge. Failure to take this precaution can damage the equipment.

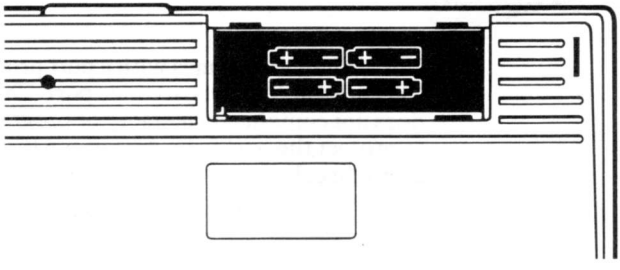
Installing Batteries

The TI-74 is shipped from the factory with four AAA alkaline batteries. To install the batteries, follow these steps.

1. Open the battery compartment by sliding the cover as indicated.



2. Install new batteries as shown. Be sure each battery is positioned correctly; installing a battery backwards may damage the TI-74.



3. Slide the battery compartment cover into place.

Replacing Batteries

After many hours of use, the batteries become low on power. When the batteries have only a few more hours of operation, the LOW indicator appears in the display. The batteries should be replaced with new AAA alkaline batteries.

The *Constant Memory* ™ feature retains stored information for a short time after the batteries are removed. As a precaution, however, you may want to save any important programs and data on a storage device (such as a cassette) before replacing batteries.

To replace batteries, follow these steps.

1. If a BASIC program is running, press the **[BREAK]** key.
2. Turn the TI-74 off by pressing the **[OFF]** key.
3. Disconnect any peripherals and remove any cartridge that may be installed in the cartridge port.
4. Remove the old batteries and dispose of them properly.
5. Install the fresh batteries as described earlier.

Care and Cleaning

The TI-74 requires minimal maintenance. Use these guidelines to keep your TI-74 in good condition.

- Treat your TI-74 and cartridges with the same care you give other precision electronic products.
- Avoid exposing your TI-74 to moisture, extreme temperatures, or dust.
- Use a damp lint-free cloth to clean your TI-74. Do not use solvents; they can damage the TI-74.
- Do not place objects other than cartridges in the cartridge port.

The information displayed when you turn the TI-74 on depends on whether it is in the calculator mode or the BASIC mode and on the results of a self-test that it performs.

Indications At Power Up

You turn the TI-74 on by pressing the **[ON]** key. Either the CALC or the BASIC indicator is displayed to show the current mode. The TI-74 then checks for any changes in the contents of memory since the last time you turned it off.

If changes in memory contents are detected, you see one of two messages.

- The message W27 contents may be lost indicates that you should check any values stored in the calculator memories and verify any stored program lines in BASIC. (Usually nothing has changed in the areas of memory available to you—the areas reserved for internal use are probably the cause of the message.)

- The message W30 Initialized indicates that the memory has been completely cleared. The TI-74 contains no stored values in calculator memory and no stored program lines in BASIC.

You can clear either of these messages by pressing the **[CLR]** key.

Manual and Automatic Power Down

Although the TI-74 consumes very little power, you can extend the life of the batteries by turning the TI-74 off manually when you finish using it. If you forget to turn the TI-74 off, the Automatic Power Down™ (APD) feature turns it off for you.

- To turn the TI-74 off, press the **[OFF]** key. (If a BASIC program is running, you will first have to press the **[BREAK]** key.)
- The APD feature turns the TI-74 off automatically if you do not press any keys for approximately ten minutes. (If a BASIC program is running, the APD feature does not turn the TI-74 off.)

Disabling the Automatic Power Down

In some cases, you may want to disable the APD feature so you can retain displayed information for longer than ten minutes.

To disable the APD feature, simultaneously press the keys labeled **[FN]**, **[CTL]**, **[SHIFT]**, and **[/]**. This combination of keys works in either the CALC or the BASIC mode.

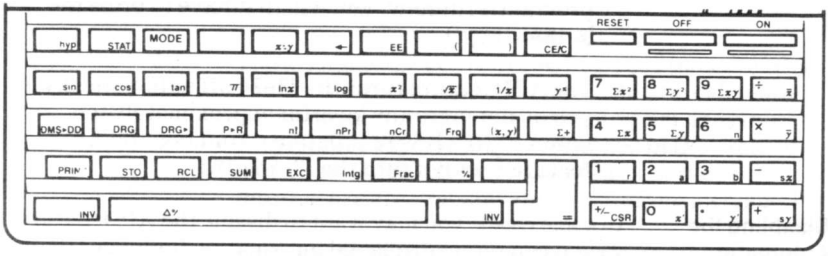
When you turn the TI-74 off and on again, the APD feature is reactivated.

Operating Modes of the TI-74

The TI-74 operates in one of two modes—CALC or BASIC. The [MODE] key lets you switch between these modes. In the CALC mode, the TI-74 operates as a scientific calculator. In the BASIC mode, it operates as a computer with built-in BASIC programming language. The functions available on the TI-74 keyboard depend on which mode is active.

Key Functions in CALC Mode

You identify the function of a key in CALC (calculator) mode by the small symbol at the bottom of the key. (You can use the digit keys 0–9 both for entering numeric data and for performing certain calculator functions.) Each calculator key is explained in detail in Chapter 2 of this guide.



Effects of Leaving the CALC Mode

When you turn the TI-74 off while in CALC mode or exit the CALC mode by selecting the BASIC mode, certain calculator conditions are retained and other conditions are cancelled.

The following calculator conditions are retained.

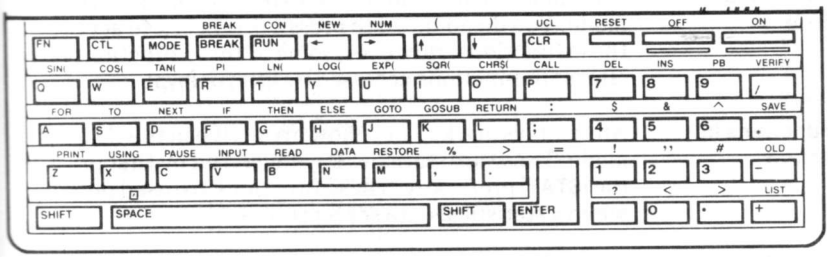
- The contents of each calculator memory
- STAT mode and statistics registers, if in use
- The current setting of the angle units (You can change this while in the BASIC mode.)

The following calculator conditions are cancelled.

- Any multiple-key sequence you have not completed
- Any pending arithmetic operation or partial entry
- The contents of the display

Key Functions in BASIC Mode

In BASIC mode, you identify the function of a key by the larger print on the key and by the symbol printed above the key. Each BASIC key is explained in detail in Chapter 3.



Effects of Leaving the BASIC Mode

When you turn the TI-74 off while in BASIC mode or exit the BASIC mode by selecting the CALC mode, certain BASIC conditions are retained and other conditions are cancelled. (If a program is running, you must press the **[BREAK]** key before you can turn the TI-74 off or select the CALC mode.)

The following BASIC conditions are retained.

- Any stored program lines
- The current setting of the angle units (You can change this while in the CALC mode.)
- Any text you have assigned to the digit keys

The following BASIC conditions are cancelled.

- Any multiple-key sequence you have not completed
- Any variable assignments and array dimensions
- Any operation that uses a device connected to the peripheral port
- The current contents of the display

Color Purposes on the Keyboard

The symbols on the TI-74 keyboard are color-coded and positioned so you can determine how to access them. Each symbol stands for a character, a group of characters, or an action for the TI-74 to perform.

Keys Common to All Modes

The keys **[MODE]**, **[RESET]**, **[ON]**, and **[OFF]** are common to all modes. Regardless of the mode of operation, the action of these keys is always the same.

Functions in Blue

All symbols marked in blue are the keys of the CALC mode. You do not need to press a prefix key to access these functions. However, some of these functions have alternate functions accessed by **[INV]** or **[hyp]**.

Functions in Yellow

All symbols marked in yellow are active in the CALC mode. These are statistics keys accessed by first pressing the **[STAT]** prefix key. These functions are used only when a statistical data set is present.

Functions in Gray

All symbols marked in gray are keys of the BASIC mode. These keys are accessed by first pressing the **[FN]** prefix key.

Symbols in White Above a Key

The symbols marked in white above a key are used in the BASIC mode to enter a character or perform an action. These functions are accessed by first pressing the **[SHIFT]** key.

Symbols in White On the Keypad

The symbols marked in white on a key of the numeric keypad are directly accessible in both calculator and BASIC modes. (The exception is **[+/−]**, which is not available in BASIC mode.) You do not need to press a prefix key to use one of these digits or operators.

Single Letters in White

The lower-case version of a letter is directly accessible in the BASIC mode. The upper-case version of a letter is available in the BASIC mode by first pressing the **[SHIFT]** key. To make the upper-case letters directly accessible, you can use the **[SHIFT]** **[UCL]** (upper-case lock) key sequence.

Other Symbols in White

The characters marked in white on a key outside the numeric keypad and not a single letter (such as **[BREAK]**) are directly accessible in the BASIC mode.

Chapter 2: The Calculator Mode

Before using the TI-74 as a calculator, switch to the calculator mode by pressing the [MODE] key until the CALC indicator appears. Use the information in this chapter to learn about the operation of the calculator.

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Calculator Characteristics

In the calculator mode, the TI-74 performs general-purpose arithmetic as well as many specialized mathematical operations.

Characteristics in CALC Mode

As a calculator, the TI-74 includes:

- 13 digits of accuracy
- A numeric range exceeding that of most other calculators (see Appendices B and C)
- AOS ™ Algebraic Operating System
- Logarithmic, hyperbolic, and trigonometric functions
- Conversions of angles, two-dimensional coordinates, and degrees/minutes/seconds
- Percent and delta percent functions
- Permutation and combination computations
- One- and two-variable statistics, including regression analysis

Alternate Functions

A key normally performs the function marked at the bottom of the key. To provide a variety of operations without overcrowding the keyboard, many keys perform alternate functions when pressed following a prefix key.

Accessing Alternate Functions

You access the alternate functions of a key by pressing a prefix key (**[STAT]**, **[INV]**, or **[hyp]**) and then the key whose alternate function is needed. If you press a prefix key and then a key that has no alternate function, the calculator disregards the prefix and performs the key's normal function.

[STAT]—Statistics Prefix

To perform a statistical function, press **[STAT]** and then the appropriate key. Only the keys in the numeric keypad have statistics functions. Note that the statistics function keys are marked in the same color as the **[STAT]** key.

Although **[+/−]** and **[CSR]** are actually the same key, this book uses key symbols that represent the function you are performing. When a key sequence begins with **[STAT]**, you locate that function on the calculator by looking at the symbols in the numeric keypad color-coded to match the **[STAT]** key. For information on statistical functions, refer to "Statistics Keys."

Note: If you accidentally press **[STAT]**, you can

- Change it to another prefix by pressing the desired prefix key.
- Cancel its effect by pressing **[STAT]** again.

If another prefix is in effect, you can change it by pressing the **[STAT]** key.

[INV]— Inverse Prefix

To perform an inverse function, press **[INV]** and then press the appropriate function key.

Key	Function	Inverse Function
[EE]	enter scientific notation	remove scientific notation
[sin]	sine	arcsine
[cos]	cosine	arccosine
[tan]	tangent	arctangent
[ln$x$]	natural logarithm	e^x
[log]	common logarithm	10^x
[x^2]	square of x	square root of x
[$\sqrt{x}$]	square root of x	square of x
[y^x]	y to the xth power	the xth root of y
[SUM]	sum to memory	subtract from memory
[DRG]	switch angle units setting ahead	switch angle units setting back
[DRG▸]	switch angle units setting ahead and convert angle	switch angle units setting back and convert angle
[P▸R]	polar to rectangular conversions	rectangular to polar conversions
[DMS▸DD]	deg/min/sec to decimal degrees	decimal degrees to deg/min/sec
[Σ+]	enter statistics data element	remove data element

[INV]— Inverse Prefix (Continued)

Note: If you accidentally press **[INV]**, you can

- Change it to another prefix by pressing the desired prefix key.
- Cancel its effect by pressing **[INV]** again.

[hyp]— Hyperbolic Prefix

To perform a hyperbolic function, press **[hyp]** and then press the appropriate key. Only the keys **[sin]**, **[cos]**, and **[tan]** have hyperbolic functions. The trigonometric keys also have inverse hyperbolic functions, which you access by pressing **[INV]** and **[hyp]** simultaneously and then pressing the appropriate key.

For example, all the functions of the **[sin]** key are accessed as follows.

- Press **[sin]** to find the sine.
- Press **[INV]** **[sin]** to find the arcsine.
- Press **[hyp]** **[sin]** to find the hyperbolic sine.
- Press **[INV]** and **[hyp]** together; then press **[sin]** to find the hyperbolic arcsine.

Note: If you accidentally press **[hyp]**, you can

- Change it to another prefix by pressing the desired prefix key.
- Cancel its effect by pressing **[hyp]** again.

If you accidentally press **[INV]** **[hyp]**, you can

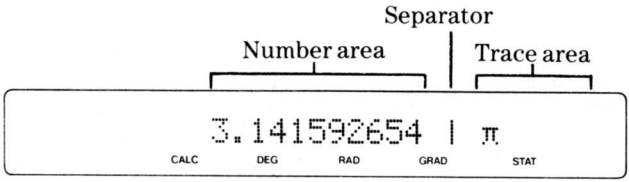
- Change to the statistics prefix by pressing **[STAT]**.
- Cancel its effect by pressing **[hyp]**.
- Cancel its effect by pressing **[INV]**.

The Display

The display has three separate areas. The number area shows the entries and results of calculations. The trace area shows the operations and functions you perform. The bottom of the display shows calculator status indicators.

Display Indicators

The calculator informs you of its status by turning on display indicators. For example, CALC appears when the TI-74 is in calculator mode and BASIC appears when the TI-74 is in BASIC mode. Other indicators in calculator mode may appear as shown below.



Indicator	Meaning
DEG RAD GRAD	The angle units are set to degrees, radians, or grads, respectively.
STAT	The calculator is in the statistics mode.

Angle Unit Setting

The angle unit setting changes when you switch to degrees, radians, or grads. You can also switch this setting in the opposite order.

Statistics Mode Access

The calculator goes into the statistics mode when you enter the first of a set of statistical data and leaves the statistics mode when you clear the statistical data.

Display Messages

The dot-matrix characters can display messages and symbols. The error conditions have descriptive messages that can occupy the display's number and trace areas. Calculation keystrokes usually cause symbols to appear only in the trace area. Messages and symbols are listed in Appendix A.

Clearing the Calculator

Pressing the [←] key, pressing the [CE/C] key once in certain circumstances, and pressing the [CE/C] key twice cause various degrees of clearing in the calculation areas of the calculator. (If you want to clear the memory or statistical registers, refer to "Memory Operations" and "Statistics Keys" later in this chapter.)

[←]—Character Removal

This key enables you to delete an entry's last character, either a digit or a decimal point. You can keep deleting characters until the entire entry is cleared. Before you enter a scientific notation exponent, this key removes mantissa characters. While you are entering a scientific notation exponent, this key removes exponent characters or returns to the mantissa entry if the exponent is 000.

This key also enables you to edit the result of a calculation.

[CE/C]—Clear Entry/Clear

The **[CE/C]** key clears pending operations, incorrect entries, or error conditions as shown below.

- To clear an incorrect numerical entry while the cursor is flashing, press **[CE/C]** once. You can then enter the correct number and continue with your calculation.
- To clear the display and all pending operations, press **[CE/C]** twice or press **[CE/C]** once if the cursor is not flashing.
- To clear an error condition (indicated by an appropriate message in the display), press **[CE/C]** once. A list of error conditions is in Appendix B.

[RESET]—Reset

The **[RESET]** key is used as a "last resort" to restart the calculator when a problem occurs that prevents you from entering information from the keyboard. This key is flush with the case of the TI-74 so that you will not press it accidentally. (Pressing the **[RESET]** key usually causes the message `W27 contents may be lost` to be displayed. This message is described on page 1-6.)

Data Entry Keys

The data entry keys enable you to enter the numerical data needed to perform calculations. Up to 13 digits can be entered for use in calculations. However, results are shown to 10 digits. You can enter numbers in either standard or scientific notation.

[0]-[9]—Digits

The digit keys enter numbers into the display. In standard notation, you can enter up to 13 digits and a decimal point. In scientific notation, you can enter up to 13 digits and a decimal point along with three digits for the exponent.

[.]—Decimal Point

The **[.]** key enters a decimal point. The exponent of scientific notation cannot include a decimal point. If the result of a calculation is shown as an integer with a decimal point, the number is not internally an integer but is rounded to an integer for the display. The decimal is not shown for true integers.

[+/−]—Change Sign

The **[+/−]** key changes the sign of the number in the display, making it easy to enter negative numbers and negative exponents. To enter a negative number, first enter the number as a positive value and then press **[+/−]**.

[π]—Pi

The **[π]** key enters the value of pi to 13 significant digits, with a value of 3.141592653590. The display shows the value of pi rounded to ten digits, 3.141592654.

[EE]—Scientific Notation

The **[EE]** key enables you to enter numbers in scientific notation. You can enter numbers as small as $\pm 1 \times 10^{-128}$ and as large as $\pm 9.999999999999 \times 10^{127}$.

Note: If the result of a calculation is outside the range −9999999999 to −.0000000001, zero, or .0000000001 to 9999999999, the calculator automatically displays the number in scientific notation even though you may not have pressed **[EE]**.

Scientific Notation

Scientific calculations often involve very large or small numbers. Scientific notation can make these numbers easier to handle. Once you use scientific notation in a calculation, all results are displayed in this format until you remove scientific notation.

Principle

Standard notation is the way numbers are written for everyday use. The table at the bottom of this page has examples of standard notation.

Scientific notation separates a number into two components:

- The digits (mantissa) whose decimal is related to the true decimal by the exponent
- 10 raised to some power (exponent)

These components multiplied together are equivalent to the standard notation for the number. The scientific notation equivalent of a number such as one trillion (1,000,000,000,000) becomes easier to manipulate in scientific notation (1×10^{12}).

The sign (+ or −) of the exponent indicates the direction the decimal point is shifted to convert it to standard notation (+ to the right; − to the left). The value of the exponent gives the number of places the decimal point is shifted.

The following table shows numbers expressed in both standard and scientific notation.

Standard Notation	Scientific Notation
6789	6.789×10^{3}
0.0000021	2.1×10^{-6}
−16389043	-1.6389043×10^{7}
8.775	8.775×10^{0}

Entering Scientific Notation

To enter a number in scientific notation:

1. Enter the mantissa. If it is negative, press **[+/–]**.
2. Press **[EE]**. (Note that E+000 appears in the display.)
3. Enter the exponent. If it is negative, press **[+/–]**. If you press a wrong digit key when entering the exponent, press the correct digits. The calculator replaces the old digits with the last three digits entered.

Regardless of how you enter a mantissa, the calculator normalizes the number when you press a function or operation key. (That is, the calculator displays a single digit to the left of the decimal point and adjusts the exponent accordingly.)

Example

Enter 66.732×10^{-12}, but "accidentally" enter the wrong exponent. Correct the exponent and normalize the number to 6.6732×10^{-11}.

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Enter value with incorrect exponent	**66.732 [EE] 45**	66.732E+045
Correct the exponent	**012 [+/–]**	66.732E–012
Normalize	**[=]**	6.6732E–011

Removing Scientific Notation

After you press **[EE]** to enter a number in scientific notation, the results of all subsequent calculations are automatically displayed in scientific notation, even when the calculations are entered in standard notation. Before the calculator can display the results in standard notation, you must first remove scientific notation.

To remove scientific notation:

- Press **[INV] [EE]**. Note that this key sequence also converts a number to standard notation.
- Clear the calculator by pressing **[CE/C]** twice or once when the cursor is not flashing.

Combining Notations

You can enter data with a combination of both standard and scientific notation. In addition to entering an exponent of scientific notation, the **[EE]** key can select results to be shown in scientific notation.

Example

Select scientific notation, calculate $3.2 \times 10^3 + 12575.321$, and then remove scientific notation.

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Select scientific notation	**[EE]**	0E+000
Enter the problem	**3.2 [EE] 3 [+] 12575.321 [=]**	1.5775321E+004
Remove scientific notation	**[INV] [EE]**	15775.321

Converting Notations

Your calculator also enables you to convert numbers from standard to scientific notation and vice versa.

- To convert a number from standard to scientific notation, press **[EE]** when the cursor is not flashing.
- To convert a number from scientific to standard notation, press **[INV] [EE]**.

Note: If the number is not in the range of standard notation, the display format does not change until you enter a number that is within range.

Example

Convert 55.555555 to scientific notation and then back to standard notation.

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Convert to scientific notation	**55.555555 [=] [EE]**	5.555555E+001
Convert to standard notation	**[INV] [EE]**	55.555555

AOS™ Algebraic Operating System

The AOS™ Algebraic Operating System enables you to enter numbers and combined operations into the calculator in a simple, straightforward sequence. To make sure your calculations are performed in the correct order, the AOS™ uses widely accepted algebraic rules to assign priorities to the various mathematical operations.

Purpose

Without a fixed set of algebraic rules, a problem such as $16 - 8 \div 2 + 6$ may have several possible answers, depending on the order in which the operations are completed. However, the Algebraic Operating System solves this problem by completing the division first $(8 \div 2)$ and then completing the subtraction and addition. Therefore, $16 - 8 \div 2 + 6 = 18$.

Pending Operations

In a problem such as $4 \times 5 = 20$, simply entering 4 **[×]** 5 does not produce the answer. The operation must be completed by pressing an appropriate key such as **[=]**. (Note that multiplication can be completed by any operation that has equal or lower priority in the algebraic hierarchy.) Until completed, 4 **[×]** 5 creates a pending operation.

Note: Immediate functions complete themselves and do not need to be completed by pressing another key.

Algebraic Hierarchy

The AOS algebraic hierarchy completes operations according to the following categories, which are listed in descending priority.

1. Immediate functions—**[sin]**, **[cos]**, **[tan]**, **[INV] [sin]**, **[INV] [cos]**, **[INV] [tan]**, **[hyp] [sin]**, **[hyp] [cos]**, **[hyp] [tan]**, **[INV] [hyp] [sin]**, **[INV] [hyp] [cos]**, **[INV] [hyp] [tan]**, **[P▸R]**, **[INV] [P▸R]**, **[nPr]**, **[nCr]**, **[n!]**, **[Intg]**, **[Frac]**, **[%]**, **[DRG▸]**, **[INV] [DRG▸]**, **[DMS▸DD]**, **[INV] [DMS▸DD]**, **[log]**, **[INV] [log]**, **[ln$x$]**, **[INV] [ln$x$]**, **[+/−]**, **[1/x]**, **[x^2]**, **[$\sqrt{x}$]**
2. Delta percent—**[Δ%]**
3. Universal powers and roots—**[y^x]**, **[INV] [y^x]**
4. Multiplication and division—**[×]**, **[÷]**
5. Addition and subtraction—**[+]**, **[−]**
6. Equals—**[=]**

With the AOS hierarchy, lower-priority operations are delayed until higher-priority operations are complete.

- Operations in priority 1 are immediate functions. These functions are performed as soon as you press the operation keys.
- Operations in priorities 2, 3, 4, and 5 are completed by any operation with the same priority or with a lower priority. For example, multiplication and division are completed by another **[×]** or **[÷]** operation or by **[+]**, **[−]**, or **[=]**.
- The **[=]** key completes all operations.

Example

The following calculation illustrates the algebraic hierarchy and pending operations.

$4 + 8 \div 2^5 - 2 = 2.25$

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Enter pending addition	**4 [+]**	4
Enter pending division (addition is also pending)	**8 [÷]**	8
Enter pending exponentiation (addition and division are also pending)	**2 [y^x]**	2
Complete pending operations and set up pending subtraction	**5 [−]**	4.25
Complete calculation	**2 [=]**	2.25

Parentheses

Some calculations require you to group operations differently from the order of completion provided by AOS. A series of numbers and 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 the algebraic hierarchy.

[(],[)]—Parentheses

The [(] key opens a parenthetical expression, and the [)] key closes a parenthetical expression. There is a maximum of 22 levels of parentheses and operations available.

If you press [)] when there are no pending parentheses, the calculator completes all pending operations as if you had pressed [=].

Example

$7 \times (3 + 5) = 56$

Procedure	Press	Value Displayed
Clear	[CE/C][CE/C]	0
Enter pending multiplication	7[×]	7
Begin expression in parentheses	[(]3	3
Enter pending addition	[+]5	5
Evaluate expression in parentheses	[)]	8
Complete pending operations	[=]	56

If this calculation is performed without parentheses, the algebraic heirarchy completes the multiplication before the addition. Without parentheses, the result is 26.

[(], [)]— Parentheses (Continued)

You do not need to press [)] when the parenthetical expression is at the end of a calculation. Pressing [=] evaluates the expression in the proper order.

Example

$10^{(1/3 \times (\text{Log } 135 - \text{Log } 5))} = 3$

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Enter first pending operation	10 [y^x]	10
Begin expression in parentheses	[(] 3 [1/x]	.3333333333
Enter pending multiplication	[×] [(] 135 [log]	2.130333768
Enter pending subtraction	[−] 5 [log]	.6989700043
Complete pending operations	[=]	3.

To show intermediate results, end the calculation with close parentheses. The calculation evaluates back to the most recent pending open parenthesis when you press [)].

If an open parenthesis is followed by a pending operation key or function key, the display value is repeated as the first value within the parentheses.

Correcting Entry Errors

You may occasionally enter an incorrect number or press the wrong function key. To clear the calculation and begin again, you can press [CE/C] twice. In many instances, however, you can correct an entry error without clearing the entire calculation.

Correcting Numbers and Immediate Functions

The **[CE/C]** key has two purposes. While the cursor is flashing, one press of this key clears only the entry. Press **[CE/C]** twice or press it once while the cursor is not flashing to clear all calculations.

- Press **[CE/C]** once to clear the display if you enter an incorrect number. Then you can enter the correct number and continue with the problem.
- If the cursor is no longer flashing (you press an immediate function key such as **[x^2]** or **[sin]**), press **[←]** as needed to clear the display. Then you can enter the correct number and function and continue with the problem.

Example

Calculate 10.6 + 12.7 = 23.3

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Enter problem (with incorrect entry)	**10.6 [+] 12.4**	12.4
Clear the display	**[CE/C]**	0
Enter correct number and continue	**12.7 [=]**	23.3

Note: If you press **[CE/C]** once while the cursor is not flashing, the entire calculation is cleared.

You can press the **[←]** key to delete an entry's last character, either a digit or a decimal point. You can keep deleting characters until the entire entry is cleared.

Correcting Pending Operations

If you press an incorrect pending operation key, you may or may not be able to correct the operation without clearing the calculation. The pending operation keys are: **[Δ%]**, **[y^x]**, **[INV]** **[y^x]**, **[÷]**, **[×]**, **[−]**, and **[+]**.

- 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 your 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 existing pending operations, pressing a lower-priority operation key completes the previous pending operations. In this case, you should press **[CE/C]** twice to clear the calculation and begin again.

Example

Calculate $7 + 6 \times 5 = 37$

Procedure	Press	Value Displayed
Clear	**[CE/C]** **[CE/C]**	0
Enter problem (with incorrect function key)	**7** **[+]** **6** **[÷]**	6
Press the correct key and continue	**[×]** **5** **[=]**	37

In the example above, suppose you accidentally press **[−]** instead of **[÷]**. Because **[−]** has the same priority as **[+]**, the calculator completes the pending addition first and displays the result incorrectly as 65.

Arithmetic Keys

The arithmetic keys enable you to perform the most commonly used mathematical operations: addition, subtraction, multiplication, division, raising a number to a power and taking a root of a number.

[+], [−], [×], [÷], [y^x], [INV] [y^x], [Δ%]— Arithmetic Functions

These keys all operate on two numbers. Basically, you

- Enter a value.
- Press an operation key(s).
- Enter another value.
- Complete the operation with an operation of the same or lower priority.

The x and y values combine as follows.

y [+] x	Adds x to y.
y [−] x	Subtracts x from y.
y [×] x	Multiplies y by x.
y [÷] x	Divides y by x.
y [y^x] x	Raises y to the x power.
y [INV] [y^x] x	Takes the x root of y.
y [Δ%] x	Subtracts x from y, divides the difference by x, and multiplies the result by 100.

The equals key completes all pending operations and prepares the calculator for new calculations. In the above discussion, entering a value can consist of recalling the value from a memory, arriving at the value through calculations, or just keying in the digits.

Example Evaluate the expression $6 + 9 + 4^3$.

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Enter pending addition	**6 [+] 9**	9
Complete with same priority	**[+]**	15
Enter pending addition	**4**	4
Enter exponentiation (Because addition has a lower priority than exponentiation, the operation remains pending)	**[y^x] 3**	3
Complete all operations	**[=]**	79

[INV] [y^x]— Universal Roots

The **[INV] [y^x]** key sequence calculates the root of a positive number. To use this key sequence:

1. Enter the number (y) whose root you want to find.
2. Press **[INV] [y^x]**.
3. Enter the root (x).
4. Press a key that completes the operation.

Example

Calculate $\sqrt[3.871]{21.496}$

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Enter y value	**21.496 [INV] [y^x]**	21.496
Enter x value	**3.871**	3.871
Calculate $\sqrt[x]{y}$	**[=]**	2.208968514

Reciprocal, Square, and Square Root Keys

The functions of reciprocal, square, and square root occur frequently in calculations. You can perform these calculations with the universal power and root key, but the reciprocal, square, and square root keys reduce the number of keystrokes needed.

[1/*x*]— Reciprocal

The **[1/*x*]** key raises the displayed value to the −1 power, which is the same as dividing the number into 1. The number can be any value in the range of the calculator.

[x^2]— Square Function

The **[x^2]** key raises the displayed number to the 2nd power, which is the same as multiplying the number by itself. The number can be any value whose square is in the range of the calculator.

[$\sqrt{x}$]— Square Root Function

The **[$\sqrt{x}$]** key raises the displayed number to the 1/2 power, which is the same as taking the number's square root. The square root of a number (x) is another number (labeled $\sqrt{x}$) such that $\sqrt{x}$ times $\sqrt{x}$ equals x. The displayed number must be positive; otherwise, an error condition occurs. The result is always a positive number.

Example

Find the hypotenuse of a triangle whose legs have lengths of .12 and 1/20. For leg lengths of A and B, the hypotenuse is $\sqrt{A^2 + B^2}$.

Procedure	Press	Value Displayed
Clear	**[CE/C][CE/C]**	0
Add squares of leg lengths	**[(].12[x^2][+]20 [1/*x*][x^2][)]**	.0169
Find hypotenuse	**[$\sqrt{x}$]**	.13

Memory Operations

You can store a value in memory for comparison with the result of a later calculation or for use several times during a calculation. The memories are numbered 0 through 9. Statistics values occupy memories 4 through 9 if the STAT mode is in effect.

[STO] m—Store

The **[STO]** m key sequence replaces the number in memory m with the currently displayed number. For instance, the key sequence 22 **[STO]** 3 stores the number 22 in memory 3.

Note: You clear a memory by pressing **[STO]** m when 0 is in the display.

[RCL] m—Recall

The **[RCL]** m key sequence displays (recalls) the number stored in memory m, without affecting the memory contents. The value previously in the display is cleared.

[EXC] m—Exchange

The **[EXC]** m key sequence exchanges the number in the display with the number in memory m. For instance, the key sequence 33 **[EXC]** 2 stores the number 33 and displays the number previously stored in memory 2. You can use this key to check the contents of a memory without losing the previously displayed number. Pressing **[EXC]** m again restores the original values to the memory and the display.

[SUM] m—Sum in Memory

The **[SUM]** m key sequence adds the number in the display to the number in memory m. For instance, if 5 is in memory 1 and you press 3 **[SUM]** 1, the number in memory 1 is then 8. The 3 is still displayed.

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

[INV] [SUM] m—Deduct from Memory

The **[INV] [SUM]** m key sequence subtracts the number in the display from the number in memory m. For instance, if 5 is in memory 0 and you press 3 **[INV] [SUM]** 0, the number in memory 0 is then 2. The 3 is still displayed.

Example

To show you how the memory keys operate, perform the following steps.

1. Store 50 in memory 1 and add 14.8.
2. Enter 84.42 into the display, and exchange it with the result in memory 1.
3. Return 84.42 to the display and add it to the result just shown.
4. Recall the number in memory 1.

Procedure	Press	Value Displayed	Memory 1
Clear	**[CE/C] [CE/C]**	0	0
Store 50 in memory	**50 [STO] 1**	50	50
Add 14.8 to the number in memory	**14.8 [SUM] 1**	14.8	64.8
Enter 84.42. Then, exchange the display and memory	**84.42 [EXC] 1**	64.8	84.42
Restore the displayed number and add it to memory	**[EXC] 1 [SUM] 1**	84.42	149.22
Recall the current number in memory	**[RCL] 1**	149.22	149.22

Logarithmic Keys

A variety of technical and theoretical calculations require the use of logarithms, which form an important part of many mathematical "models" of natural phenomena. The logarithmic keys give you access to natural and common logarithms or antilogarithms.

[ln*x*], [log]—Logarithms

The **[ln*x*]** key calculates the natural logarithm (base e, e = 2.718281828459) of the number in the display. The number must be positive; otherwise, an error condition occurs.

The **[log]** key calculates the common logarithm (base 10) of the number in the display. The number must be positive; otherwise, an error condition occurs.

[INV] [ln*x*], [INV] [log]—Antilogarithms

The **[INV] [ln*x*]** key sequence calculates the value of e raised to the power of the number in the display.

The **[INV] [log]** key sequence calculates the value of 10 raised to the power of the number in the display.

Example

Find the result of $e^{(\ln 2 \times 10^{(\log 3 + \log 2)})}$.

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Solve expression	[( ] 2 [ln*x*] [×] [( ] 3 [log] [+] 2 [log] [ )] [INV] [log] [ )] [INV] [ln*x*]	64.

Example

Find the result of $(e^3 - e^{-3})/2$.

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Solve expression	[( ] 3 [INV] [ln*x*] [−] 3 [+/−] [INV] [ln*x*] [ )] [÷] 2 [=]	10.01787493

Hyperbolic Functions

Three functions that mathematicians have named because of their similarities to trig functions are hyperbolic sine, hyperbolic cosine, and hyperbolic tangent. These functions are defined in terms of natural antilog, e^x. The angle units setting does not affect the result of these functions.

[hyp] [sin], [hyp] [cos], [hyp] [tan]— Hyperbolic Functions

The hyperbolic keys calculate the hyperbolic function of the number in the display. **[hyp] [sin]** calculates the sinh, **[hyp] [cos]** calculates the cosh, and **[hyp] [tan]** calculates the tanh. These functions are defined as follows:

$$\sinh x = (e^x - e^{-x})/2 \qquad \cosh x = (e^x + e^{-x})/2$$

$$\tanh x = (e^x - e^{-x})/(e^x + e^{-x})$$

As tangent is sine divided by cosine, tanh also is sinh divided by cosh.

[INV] [hyp] [sin], [INV] [hyp] [cos], [INV] [hyp] [tan]— Inverse Hyperbolic Functions

The inverse hyperbolic keys calculate the inverses of the hyperbolic functions. **[INV] [hyp] [sin]** calculates arcsinh, **[INV] [hyp] [cos]** calculates arccosh, and **[INV] [hyp] [tan]** calculates the arctanh. These functions are defined as:

$$\text{arcsinh } x = \ln(x + (x^2 + 1)^{.5})$$

$$\text{arccosh } x = \ln(x + (x^2 - 1)^{.5})$$

$$\text{arctanh } x = \ln((1 + x)/(1 - x))/2$$

Note: You must press **[INV]** and **[hyp]** simultaneously when accessing inverse hyperbolic functions.

Example

Find the result of sinh(3) and arctanh(.5).

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Find result	**3 [hyp] [sin]**	10.01787493
Enter value	**.5**	.5
Press the prefix keys simultaneously and find result	**[INV] [hyp] [tan]**	.5493061443

Number Portion Keys

The number portion keys discard the part of a number on either side of the decimal point. These keys enable you to make a value suitable for functions requiring integer input and to isolate the fractional portion of a number.

[Intg]—Integer Portion

This key truncates the displayed number at the decimal point. The result is an integer.

Example

Find the antilog of 3 and make the result an integer.

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Enter problem	3 [INV] [log]	1000.
Take integer	[Intg]	999

[Frac]—Decimal Portion

This key deletes the displayed number's digits to the left of the decimal. The result is between −1 and 1.

Example

Enter the problem 10000 ÷ 7 and delete the integer portion of the result.

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Enter problem	10000 [÷] 7 [=]	1428.571429
Remove digits	[Frac]	.5714285714

Example

10 raised to the fractional part of a number's log returns the mantissa. Convert 1234.1234 to its mantissa.

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Convert to mantissa	1234.1234 [log] [Frac] [INV] [log]	1.2341234

Angle Units Selection

The calculator handles a variety of calculations involving angles: the trigonometric functions and polar/rectangular conversions. To set the calculator for the correct angle units, you can select any of three angle unit settings—degrees, radians, or grads. You can also convert angles from one unit to another while changing this setting.

Angle Units

The three angle units—degrees, radians, and grads—are defined below.

- One degree equals 1/360 of a circle. A right angle equals 90°.
- One radian equals $1/2\pi$ of a circle. A right angle equals $\pi/2$ radians.
- One grad equals 1/400 of a circle. A right angle equals 100 grads.

[DRG]—Angle Mode Change

The **[DRG]** key changes the angle units without affecting the angle in the display. Each time you press **[DRG]**, the angle units advance in the following order: radian (RAD is displayed), grad (GRAD is displayed), and then back to degree (DEG is displayed). By pressing **[INV] [DRG]**, you change the angle units in reverse order.

[DRG▸]—Angle Conversion

The **[DRG▸]** key changes the angle units and converts the angle in the display to the new units.

For example, set the calculator to degrees and enter 90.

1. Press **[DRG▸]** once to advance the angle units to radians. The angle is converted to 1.570796327 ($\pi/2$) radians.
2. Press **[DRG▸]** again to advance the angle units to grads. The angle is converted to 100 grads.
3. Press **[DRG▸]** a third time to return the angle units to degrees. The angle is converted back to 90°.

By pressing **[INV] [DRG▸]**, you change the angle units and convert in reverse order.

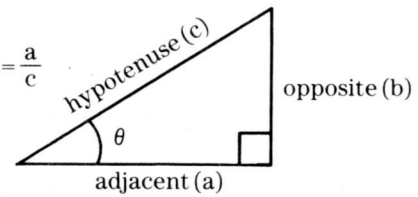
Trigonometric Functions

You can easily perform trigonometric calculations involving sine, cosine, tangent, and their inverses. Because all angles are interpreted according to the current setting of the angle units, be sure the calculator is set to the correct angle units before you begin your calculation.

[sin], [cos], [tan]— Trig Functions

The trigonometric keys **[sin]**, **[cos]**, and **[tan]** calculate the sine, cosine, and tangent of the angle in the display. The calculator interprets the angle in the units (DEG, RAD, or GRAD) selected by the **[DRG]** or **[DRG▸]** key.

$$\sin\theta = \frac{b}{c} \quad \cos\theta = \frac{a}{c} \quad \tan\theta = \frac{b}{a}$$



Note: The tangent of 90° (or any odd-numbered multiple of 90°, such as 270°) is undefined. If you attempt to calculate the tangent of such an angle, an error condition occurs.

[INV] [sin], [INV] [cos], [INV] [tan]— Inverse Trig Functions

The inverse trig keys calculate the angle (in the units selected) whose sine, cosine, or tangent is in the display. **[INV] [sin]** calculates the arcsine ($\sin^{-1}$), **[INV] [cos]** calculates the arccosine ($\cos^{-1}$), and **[INV] [tan]** calculates the arctangent ($\tan^{-1}$).

The ranges of angles resulting from inverse trigonometric functions are given in Appendix C.

Example

Find the length of the shortest leg of a right triangle whose hypotenuse is 10 inches and smallest angle is 14°. The leg length is given by $y = r \sin \theta$.

Check that the calculator is set to degrees before working this example.

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Find the length	10 [×] 14 [sin] [=]	2.419218956

Example

Find the smallest angle of a right triangle whose legs have length of 4 and 8. The angle is given by $\theta = \arctan(4/8)$.

Check that the calculator is set to degrees before working this example.

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Find θ	[(] 4 [÷] 8 [)] [INV] [tan]	26.56505118

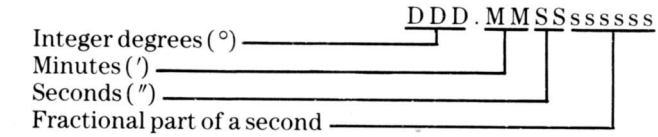
Deg/Min/Sec and Decimal Degrees Conversions

Angles in navigation and astronomy are often measured in degrees/minutes/seconds. However, before you can add these angles or use them in trigonometric calculations, you must convert them to decimal degrees. You can also apply these conversions to hours/minutes/seconds and decimal hours.

Entering Degrees, Minutes, and Seconds

To input a value as degrees, minutes, and seconds, follow these steps:

1. Key in the number of whole degrees.
2. Key in a decimal.
3. Key in the number of whole minutes as two digits.
4. Key in the number of whole seconds as two digits.
5. If there is a fractional part of a second to enter, key in those digits as if the decimal point for seconds is four places to the right of the decimal point for degrees.



When you enter minutes and seconds, remember to include zeros where needed to place the digits in the proper positions. (Note that you do not need to enter trailing zeros.) For example, the angle 9°7′50″ is entered as 9.075 in the degrees/minutes/seconds format.

To input a value as decimal degrees, key in the value as it is written.

[DMS▸DD], [INV] [DMS▸DD]— Deg/Min/Sec Conversion

The **[DMS▸DD]** key converts from the degrees/minutes/seconds format to decimal degrees.

The **[INV] [DMS▸DD]** key sequence converts from the decimal degrees format to degrees/minutes/seconds. The result includes °, ′, and ″ symbols to label the degrees, minutes, and seconds.

Note: Although these angles are expressed in degrees, you do not need to set angle units to degrees when using the **[DMS▸DD]** and **[INV] [DMS▸DD]** key sequences. You can perform these conversions at any angle units setting.

Example Convert 3° 1′ 30.456″ to decimal degrees and back.

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Convert to decimal degrees	**3.0130456 [DMS▸DD]**	3.025126667
Convert to deg/min/sec	**[INV] [DMS▸DD]**	3°1′30.456″

The ° ′ ″ symbols are removed by the next key press.

Example The **[DMS▸DD]** and **[INV] [DMS▸DD]** key sequences can also be used to convert hours/minutes/seconds to decimal hours and vice versa. In this format, the digits to the left of the decimal represent hours instead of degrees.

Convert 1 hour and 90 minutes to decimal hours and back.

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Convert to decimal hours	**1.9 [DMS▸DD]**	2.5
Convert to hours/min/sec	**[INV] [DMS▸DD]**	2°30′0″

Note: If you use **[DMS▸DD]** to convert a value with 60 or more minutes or seconds, the reverse conversion (with **[INV] [DMS▸DD]**) may express the original value in a different form. In the example above, notice that 1 hour and 90 minutes is the same as 2 hours and 30 minutes.

Percentage Calculations

A percentage represents a specific number of hundredths. For example, 50% is 50/100, which equals 1/2. Percentage calculations are useful in a wide variety of business and everyday applications.

[%]— Percent Function

The **[%]** key automatically divides the number in the display by 100, which converts the number into a decimal percent. For example, if you enter 43.9 and press **[%]**, .439 is displayed.

You can use **[%]** to calculate percentages, add-ons, discounts, and percentage ratios.

Percentages	
[×] n [%] [=]	multiplies the principal amount by n%
Add-ons	
[+] n [%] [=]	adds n% to the principal amount
Discounts	
[−] n [%] [=]	subtracts n% from the principal amount
Percentage Ratios	
[÷] n [%] [=]	divides the principal amount by n%

Note that the principal amount is the number in the display immediately after you press **[×]**, **[+]**, **[−]**, or **[÷]**.

Percentage Example

4% of 453 = 18.12

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Calculate percentage	**453 [×] 4 [%] [=]**	18.12

Add-on Example

1450 + 15% add-on = 1667.5

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Calculate add-on amount	1450 [+] 15 [%]	217.5
Calculate result	[=]	1667.5

Discount Example

69.95 – 10% discount = 62.955

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Calculate discount amount	69.95 [–] 10 [%]	6.995
Calculate result	[=]	62.955

Ratio Example

29.5 is what percent of 25?

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Calculate result	29.5 [÷] 25 [%] [=]	118

[Δ%]—Delta Percent Function

You can find the percent change in two values using the [Δ%] key. The calculation is

$$100(y - x)/x$$

which gives you true sales tax charged or percent improvement resulting from an adjustment. You enter y [Δ%] x and press a completing key.

Example: Add-on % Unknown

The cost of a $1450 purchase is $1667.50. What is the actual tax charged? (Note the similarity to the Add-on example given earlier.)

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Calculate result	**1667.50 [Δ%]** **1450 [=]**	15

The tax is 15%.

Example: % of Change Unknown

Your car gets 27 miles per gallon before a tune-up and 29.7 after. What percent improvement resulted?

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Calculate result	**29.7 [Δ%] 27 [=]**	10

The fuel economy improved 10%.

Paired Data Input

Some of the calculator's functions rely on a pair of values being entered. The two keys [(*x*, *y*)] and [*x*⇆*y*] enable you to enter data pairs in forward or reverse order. Refer to "Polar/Rectangular Conversions," "Factorial, Permutations, and Combinations," and "Statistics Keys" for ways the calculator can use paired data.

[(*x*, *y*)]— Pair Entry

The [(*x*, *y*)] key enters the first of two values in a pair. If you intend to use the pair (2, 6), enter 2 and press [(*x*, *y*)]. The trace area shows (x , y ?) to prompt you for the second value. Then enter 6 as the second value.

Note: You can enter a pair of values with so many digits that both numbers do not fit in the display, which is indicated by ◀ at the left of the display. However, both numbers are completely present.

[*x*⇆*y*]— x Exchange y

The [*x*⇆*y*] key enables you to reverse the values of x and y in paired inputs. Suppose again that you intend to use the pair (2, 6) but 6 is in the display from earlier calculations. Press [(*x*, *y*)] 2 [*x*⇆*y*] and the pair switches from (6, 2) to (2, 6). Also, you could use the 6 in the display as the second part of the pair by pressing [*x*⇆*y*] 2, which enters (2, 6).

The [*x*⇆*y*] key also enables you to look at both parts of a paired answer. This type of answer occurs with polar/rectangular conversions.

If you enter a data pair but do not use a function that requires paired data, the first number (x) of the pair remains unused.

Example

Enter the pair (3, 4) and add 5. Then check that the 3 is still there.

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Enter data pair	3 [(*x*, *y*)] 4	3 , 4
Add 5	[+] 5 [=]	9
Check other part of data pair	[*x*⇆*y*]	3

Polar/Rectangular Conversions

In the rectangular coordinate system, the coordinates (x,y) locate a point x units along the x-axis and y units along the y-axis. In the polar coordinate system, the coordinates (r,θ) locate a point r units from the origin and at an angle θ from a reference line.

[P▸R]—Polar to Rectangular Conversion

To convert from polar (r,θ) to rectangular (x,y) coordinates, follow these steps.

1. Set the calculator to the correct angle units (degrees, radians, or grads) using the **[DRG]** key.
2. Enter the polar coordinate pair as r **[(*x*,*y*)]** θ.
3. Press **[P▸R]**. The x coordinate is displayed and x= precedes the number.
4. Press **[*x*⇆*y*]**. The y coordinate is displayed and y= precedes the number.

[INV] [P▸R]—Rectangular to Polar Conversion

To convert from rectangular (x,y) to polar (r,θ) coordinates, follow these steps.

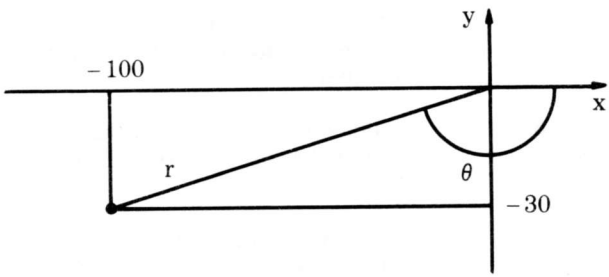
1. Set the calculator to the correct angle units (degrees, radians, or grads).
2. Enter the rectangular coordinate pair as x **[(*x*,*y*)]** y.
3. Press **[INV] [P▸R]**. The r coordinate is displayed (in the current angle units) and r= precedes the number.
4. Press **[*x*⇆*y*]**. The θ coordinate is displayed and θ= precedes the number.

[INV] [P▸R]—Rectangular to Polar Conversion (Continued)

Note that the **[INV] [P▸R]** key sequence enables you to enter rectangular coordinates with negative values for x and y. When you convert to polar coordinates, the value of θ indicates the correct quadrant. θ is calculated in the range of $-180°$ to $+180°$, $-\pi$ to π radians, or -200 to 200 grads.

Example

Convert the rectangular coordinates (x = −100, y = −30) to polar coordinates.



Be sure the calculator is set to degrees before you begin the problem.

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Enter x and y coordinates	**100 [+/−] [(*x*,*y*)]** **30 [+/−]**	−100 , −30
Convert and display r	**[INV] [P▸R]**	r=104 . 4030651
Display θ	**[*x*⇆*y*]**	θ=−163 . 3007558

The rectangular coordinates (−100, −30) convert to the polar coordinates (104.4030651, −163.3007558°).

Factorial, Permutations, and Combinations

In probability calculations, you often need to multiply a series of consecutive integers or find the number of possible arrangements of items (permutations or combinations). The [n!] (factorial) key enables you to multiply consecutive integers quickly, and the [nPr] and [nCr] keys calculate permutations and combinations.

[n!]—Factorial

The **[n!]** key calculates the factorial of the displayed number. The displayed number must be a non-negative integer less than or equal to 84; otherwise, an error condition occurs.

Note: A value that is within 5×10^{-10} of an integer other than zero looks like that integer. To ensure a valid argument for factorial of a calculated value, press **[Intg] [n!]** to find its factorial.

The factorial of any integer (n) is written n! and is equal to the product of all integers from 1 to n. By definition, 0! is equal to 1.

Example

Calculate the probability that at least two people in a randomly selected group of four were born on the same day of the week.

Either the day is shared or no two people are born on the same weekday. The sum of probabilities of these two situations is 1. Consider how you would calculate the probability that no two people in the room were born on the same weekday. Subtract that probability from 1 to get the probability that two people share a day.

Think through the problem by starting with one person.

- One day is the weekday on which this person was born.
- Six days are left for everyone else. The probability that another person was not born on the same weekday is 6/7.
- When two people are born on different days, five days are left for everyone else.
- When three people are born on different weekdays, four days are left for everyone else.
- The remaining people repeat the pattern.

Example (Continued)

The product of the individual probabilities results in the combined probability that no two people share a day: $6/7 \times 5/7 \times 4/7 \times 3/7$. A shortcut to multiplying $6 \times 5 \times 4 \times 3$ is the factorial key. To cancel the consecutive integers below these four, divide by $(6-4)!$. The combined probability is $6!/(6-4)!/7^4$. Subtracting this probability from 1 gives the desired probability.

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C]	0
Calculate Probability	1 [−] 6 [n!] [÷] [( ] 6 [−] 4 [ )] [n!] [÷] 7 [y^x] 4 [=]	0.850062474

There is approximately an 85% chance two of the people were born on the same weekday.

Possibilities for an Arrangement

The number of permutations or combinations is a number of possible arrangements. An arrangement is formed by placing items into positions. There must be at least as many items as there are positions.

To decide whether a permutation or combination is applicable, check to see if the order of an arrangement matters. With spellings, you must place the letters in a specific order or the spelling is different: order is important. With cards, you can receive the cards that form your hand in any order and they still form the same hand: order does not matter. Permutations apply to order-dependent situations and combinations apply to order-independent situations.

The greatest number of permutations results when there is one less position than items, for which the calculator's limit is 84 items. The greatest number of combinations results when there are half as many positions as there are items, for which the calculator's limit is 428 items.

[nPr]—Permutations

To find the number of permutations of n items taken r at a time, use the **[nPr]** key. Enter n, press **[(x,y)]**, enter r, and press **[nPr]**.

$$nPr = n!/(n-r)!$$

Example

You have six large appliances with approximately the same width and want to put them at a wall in your kitchen that has just enough room for three. Find the number of ways you can arrange the appliances at this wall.

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Calculate permutations	**6 [(x,y)] 3 [nPr]**	120

[nCr]—Combinations

To find the number of combinations of n items taken r at a time, use the **[nCr]** key. Enter n, press **[(x,y)]**, enter r, and press **[nCr]**.

$$nCr = n!/((r!(n-r)!)$$

Example

A royal flush is the ace, king, queen, jack, and ten of the same suit. Only four possible hands qualify. What is the probability of being dealt a royal flush from a deck of 52 cards?

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]**	0
Calculate the probability	**4 [÷] 52 [(x,y)] 5 [nCr] [=]**	1.539077E-006

Statistics Keys

The statistics keys help you compile and analyze sets of data. After you enter all the data values into the statistical registers, you can analyze the data for tendencies and trends.

Order of Statistics

You perform a statistical analysis by a two-stage process.

- Enter the data.
- Use the **[STAT]** prefixed functions to show results.

[STAT] [CSR]— Clear Statistical Registers

The **[STAT] [CSR]** key sequence clears the statistical registers. You should always press **[STAT] [CSR]** before entering a new set of data. You also need to press **[STAT] [CSR]** when you are finished analyzing data.

[Σ+], [Frq], [INV] [Σ+]— Data Entry and Removal

Whether you use single-value data or paired data depends on the situation to which your data applies. An example of single-value data is grades. An example of paired data is experimental results you can plot on a two-dimensional graph.

It is possible for a data element to occur more than once. Also, it is reasonable to bracket data and state the frequency within the bracket when there is a large number of data elements. To accomodate these situations, statistics data entry has an option to repeat a data element.

The sequence **[Frq]** *reps* repeats an entry the number of times of *reps*. The number of repetitions must be a positive integer entered by pressing digit keys (cannot be recalled from memory). You cannot enter more than 9,999,999,999,999 occurrences of a data value at a time.

Each time you enter or remove data, the display shows the number of data values currently in the statistical registers.

Entering Data

The following table covers the key sequences for entering data into the statistical registers.

Type of Data	Key Sequence
Single-value data, single occurrence of element	x [Σ+]
Single-value data, repeated occurrence of element	x [Frq] *reps* [Σ+]
Paired data, single occurrence of element	x [(*x*,*y*)] y [Σ+]
Paired data, repeated occurrence of element	x [(*x*,*y*)] y [Frq] *reps* [Σ+]

Removing Data

The following table covers the key sequences for removing data from the statistical registers. If you want to remove specific data or correct an entry error, you can correct the data without starting over.

Type of Data	Key Sequence
Single-value data, single occurrence of element	x [INV] [Σ+]
Single-value data, repeated occurrence of element	x [Frq] *reps* [INV] [Σ+]
Paired data, single occurrence of element	x [(*x*,*y*)] y [INV] [Σ+]
Paired data, repeated occurrence of element	x [(*x*,*y*)] y [Frq] *reps* [INV] [Σ+]

Note: Removing a data value that was not entered previously may cause misleading results.

Analyzing the Data

After you enter data values, you can analyze the data in the statistical registers by performing any of the following statistical calculations.

Key Sequence	Result
[STAT] [$\bar{x}$]	mean of x
[STAT] [$\bar{y}$]	mean of y
[STAT] [sx]	x standard deviation
[STAT] [sy]	y standard deviation
[STAT] [Σx]	sum of x
[STAT] [Σy]	sum of y
[STAT] [Σx^2]	sum of squares of x
[STAT] [Σy^2]	sum of squares of y
[STAT] [Σxy]	sum of xy products
[STAT] [n]	number of data entries
[STAT] [a]	regression line intercept
[STAT] [b]	regression line slope
[STAT] [r]	correlation coefficient
y [STAT] [x']	new x value for a desired y value
x [STAT] [y']	new y value for a desired x value

Statistical Calculations

This section shows you how to perform statistical calculations. Note that when you press [Σ+] to enter the first data value, the calculator enters the statistics mode and STAT appears in the display.

Example: Single-Variable Data

A machine packages breakfast cereal in 12-ounce containers. To check the machine, you measure ten of the cereal boxes and find they contain the following amounts of cereal.

12.2, 12.2, 12.5, 12.5, 12.4, 12.1, 12.1, 12.1, 12.0, 12.3

Check the mean and standard deviation for the entire sample. Then discard the high and low values and recalculate the mean and standard deviation.

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C] [STAT] [CSR]**	0
Enter the amounts	**12.2 [Frq] 2 [Σ+] 12.5 [Frq] 2 [Σ+] 12.4 [Σ+] 12.1 [Frq] 3 [Σ+] 12 [Σ+] 12.3 [Σ+]**	10
Calculate the mean	**[STAT] [$\bar{x}$]**	12.24
Calculate the standard deviation	**[STAT] [sx]**	.1776388346
Remove the high and low values	**12.5 [Frq] 2 [INV] [Σ+] 12 [INV] [Σ+]**	7
Calculate the mean	**[STAT] [$\bar{x}$]**	12.2
Calculate the standard deviation	**[STAT] [sx]**	.1154700538
Clear the statistics mode	**[STAT] [CSR]**	.1154700538

Linear Regression

In many applications, paired data applies to a linear system. A plot of measurements should theoretically be along a line. However, the points usually tend to be somewhat out of line. The error occurs partly because of shortcomings in the measurement process and partly because of non-ideal properties of the system. Linear regression gives the line that best fits the points.

Note: The highest and lowest recorded data values define the interval in which you can use the regression line. Even though the correlation coefficient (r) of a data set may be close to 1 in the interval, you cannot be certain that data taken outside this interval follows the same linear relationship.

Example

The force a spring exerts and the distance the spring is shortened or lengthened is a linear system. The force is a constant multiple of the deformation written $F = kx$. In an experiment, the following measurements are taken.

Spring Length (cm)	Force (N)
27	99
32	152
23	81
25	98
31	151
28	112

If some force is applied, how long is the spring? How much force is needed to give the spring a certain length? You can answer these questions by trying different values along the regression line. The spring is at rest length when the applied force is zero.

Example (Continued)

Procedure	Press	Value Displayed
Clear	[CE/C] [CE/C] [STAT] [CSR]	0
Enter data	27 [(x,y)] 99 [Σ+] 32 [(x,y)] 152 [Σ+] 23 [(x,y)] 81 [Σ+] 25 [(x,y)] 98 [Σ+] 31 [(x,y)] 151 [Σ+] 28 [(x,y)] 112 [Σ+]	6
Check correlation	[STAT] [r]	.9697571933
Find k	[STAT] [b]	8.325842697
Find rest length	0 [STAT] [x']	13.79419703

Although r = 1 is desired, the correlation coefficient of .9697571933 shows that error is not excessive.

If you were to measure the spring with no force applied, you may find it to be different from the calculated rest length. This difference is partly because the rest length is outside the interval of measured data and partly because of the relative unreliability of one measurement.

The calculated rest length reflects the spring's linear behavior determined from all the measurements, and the observed rest length is only one measurement. The purpose of a regression analysis is to avoid relying on a small number of measurements and instead find the consensus of many measurements.

Statistical Sums

The standard deviation keys calculate the sample standard deviation, the type that is usually needed. However, when you need to find the population standard deviation, the following equations apply.

$$sn_x = \sqrt{((n\,\Sigma x^2 - (\Sigma x)^2)/n^2)}$$

$$sn_y = \sqrt{((n\,\Sigma y^2 - (\Sigma y)^2)/n^2)}$$

Example

A student has the following grades on daily assignments (ten point scale). Find the mean and standard deviation of the grades. Because the measurements constitute the entire population, use the population standard deviation.

8, 6, 9, 9, 10, 9, 10, 8

Procedure	Press	Value Displayed
Clear	**[CE/C] [CE/C]** **[STAT] [CSR]**	0
Enter the amounts	**8 [Frq] 2 [Σ+] 9** **[Frq] 3 [Σ+] 6** **[Σ+] 10 [Frq] 2** **[Σ+]**	8
Calculate the mean	**[STAT] [$\bar{x}$]**	8.625
Calculate the standard deviation	**[(] [(] [STAT] [n]** **[×] [STAT] [Σx^2]** **[−] [STAT] [Σx]** **[x^2] [)] [÷]** **[STAT] [n] [x^2]** **[)] [$\sqrt{x}$]**	1.218349293
Clear the statistics mode	**[STAT] [CSR]**	1.218349293

Statistics Definitions

Although 15 statistics are available for the entered data, six of the statistics are the basis for all the others. These six are defined first.

Data Set Summary

The calculator reduces a data set to six values. If you have entered a data set that you may need in the future, write down the values stored in memories 4 through 9. When you want to recreate that set of data later, you just store the six values in the appropriate memories while in STAT mode instead of re-entering the data individually.

Memory	Content	Memory	Content
4	Σx	7	Σx^2
5	Σy	8	Σy^2
6	n	9	Σxy

[STAT] [Σx], [STAT] [Σy]— Sum of Data

The sum of x entries and the sum of y entries are calculated according to the following equations.

$$\Sigma x = \sum_{i=1}^{n} x_i \qquad \Sigma y = \sum_{i=1}^{n} y_i$$

[STAT] [n]— Number of Entries

The calculator keeps track of n by the number of entries and deletions you make and the repetitions of data specified by the **[Frq]** key.

[STAT] [Σx^2], [STAT] [Σy^2]— Sum of Squares

The sum of squares of x entries and the sum of squares of y entries are calculated according to the following equations.

$$\Sigma x^2 = \sum_{i=1}^{n} x_i^2 \qquad \Sigma y^2 = \sum_{i=1}^{n} y_i^2$$

[STAT] [Σxy]— Sum of Products

The sum of products of x and y entries is calculated according to the following equation.

$$\Sigma xy = \sum_{i=1}^{n} x_i y_i$$

[STAT] [$\bar{x}$], [STAT] [$\bar{y}$]— Data Mean

The mean (average) of x entries and the mean of y entries are calculated according to the following equations.

$$\bar{x} = \Sigma x/n \qquad \bar{y} = \Sigma y/n$$

[STAT] [sx], [STAT] [sy]— Standard Deviation

The standard deviation of x entries and the standard deviation of y entries are calculated according to the following equations.

$$sx = \sqrt{\frac{n\Sigma x^2 - (\Sigma x)^2}{n(n-1)}} \qquad sy = \sqrt{\frac{n\Sigma y^2 - (\Sigma y)^2}{n(n-1)}}$$

The **[STAT] [sx]** and **[STAT] [sy]** key sequences apply to data taken from a sample of a population. They are "n – 1 weighted."

[STAT] [a]— Intercept

The regression line intercept is calculated according to the following equation.

$$a = \Sigma x(\Sigma x\Sigma y/n - \Sigma xy)/(n\Sigma x^2 - (\Sigma x)^2) + \Sigma y/n$$

[STAT] [b]— Slope

The regression line slope is calculated according to the following equation.

$$b = (n\Sigma xy - \Sigma x\Sigma y)/(n\Sigma x^2 - (\Sigma x)^2)$$

[STAT] [r]— Correlation Coefficient

The correlation coefficient is calculated according to the following equation.

$$r = b\,sx/sy$$

y [STAT] [x']— New X

The new x value for a desired y value is calculated according to the following equation.

$$x' = (y - a)/b$$

x [STAT] [y']— New Y

The new y value for a desired x value is calculated according to the following equation.

$$y' = a + bx$$

The print key sends the displayed number and trace symbols to the printer (sold separately) if the printer is connected. Pressing the print key does not affect calculations. No trace symbol is provided for the print function so the most recent operation's trace symbol is sent to the printer.

[PRINT]—Print Function

With the compatible printer connected and ready, you can have the calculator send it a number to be printed. When the display shows a value you want to record, press **[PRINT]** to print the value. Symbols in the display's trace area are also printed. If the printer is not connected, this key has no effect.

For values and symbols requiring more than 20 characters, the value is printed first and the trace symbols are printed on the next line.

See the *TI-74 Programming Reference Guide* for more printer information.

Chapter 3: The BASIC Mode

This chapter describes the BASIC display and keyboard, and includes short practice sessions to familiarize you with some BASIC operations on the TI-74. To use the practice sessions, you need to first select the BASIC mode by pressing the [MODE] key.

Table of Contents

The TI-74 as a BASIC Computer

When you select the BASIC mode, the TI-74 functions as a portable computer with a built-in BASIC (Beginner's All-Purpose Symbolic Instruction Code) programming language.

Characteristics in BASIC Mode

As a BASIC computer, the TI-74 includes:

- A typewriter-like key arrangement and separate numeric keypad.
- A cartridge port for software cartridges and Constant Memory™ RAM expansion cartridges.
- The ASCII (American Standard Code for Information Interchange) character set, including both upper- and lower-case alphabetic characters.
- Special display characters including Greek, Japanese, and graphic characters.
- 8K bytes (approximately 8000 characters) of Constant Memory RAM (Random Access Memory).

Learning BASIC Programming

The manuals that come with the TI-74 assume that you are already familiar with the BASIC programming language. Texas Instruments offers the *TI-74 Learn BASIC Guidebook* (sold separately) that teaches BASIC programming at the beginner level.

If the book is not available from your local dealer, you may purchase a copy by contacting Consumer Relations. You can write to:

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

or call toll free at **1-800-TI-CARES** (1-800-842-2737) within the United States. From outside the United States, call 806-741-4800. (We regret that we cannot accept collect calls at this number.)

Uses of BASIC

With the TI-74 in the BASIC mode, you can:

- Perform immediate computation of BASIC expressions, such as 3 ^ 9 + 2 and SIN(X).
- Execute BASIC commands, such as LIST and RUN.
- Run BASIC programs. (These can be programs you enter from the keyboard or BASIC programs accessible through plug-in cartridges and cassette tape.)
- Save programs and data using a storage device such as a cassette tape recorder.
- Store the contents of the built-in RAM to a Constant Memory cartridge.

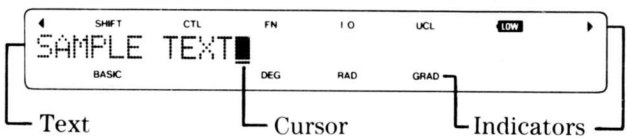
The BASIC Display

When the TI-74 is in the BASIC mode, the display shows different information than it does in the calculator mode.

Types of Information Displayed

Three types of information can be displayed when the TI-74 is in the BASIC mode. These are:

- Text
- Cursor
- Status indicators



Text

Typically, text consists of instructions that you type or messages that are displayed as a program runs. A line of text may contain as many as 80 characters, 31 of which are visible in the display at a time.

Cursor

The cursor is displayed in one of two forms: a block (as shown above) or an underline.

- The block cursor flashes to indicate that you can type text in the display. As you type each character, it is displayed at the cursor position and the cursor moves one position to the right. When viewing a line, you can bring undisplayed portions of the line into view by moving this cursor right or left.
- The underline cursor may appear when a BASIC program is running. It indicates the program is waiting for you to acknowledge a pause by pressing **[ENTER]** or **[CLR]**.

Indicators

In addition to the BASIC indicator, which tells you the TI-74 is in BASIC mode, other indicators are provided to inform you of the status of the TI-74.

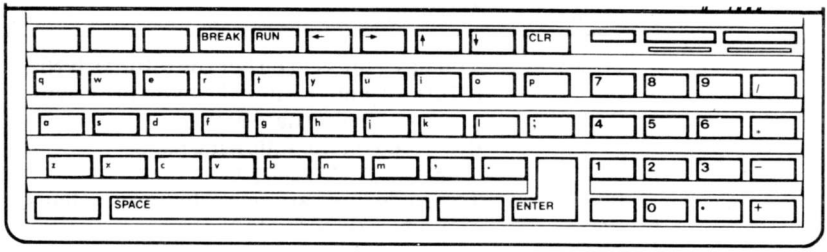
Indicators	Meaning
SHIFT FN CTL	You have pressed either the **[SHIFT]**, **[FN]** or **[CTL]** key, and the next key you press will produce an alternate action or character as described on the following pages.
DEG RAD GRAD	The angle units are set to degrees, radians, or grads, respectively.
I/O	An operation is in progress that exchanges information with a peripheral device, such as a cassette interface.
UCL	Upper-Case Lock is active.
LOW	Battery power is low.
◀	Text has moved off the display to the left.
▶	Text has moved off the display to the right.

The BASIC Keyboard

When the TI-74 is in the BASIC mode, its keys serve different purposes than they do in the calculator mode. The symbol in the upper left corner of each key indicates the primary purpose of the key in BASIC mode. [SHIFT], [FN], and [CTL] are special keys that change the character or action produced by other keys.

Primary Keys

The following illustration shows the character or action normally associated with each key. The accompanying table gives a brief description of those keys that cause an action instead of displaying a character.

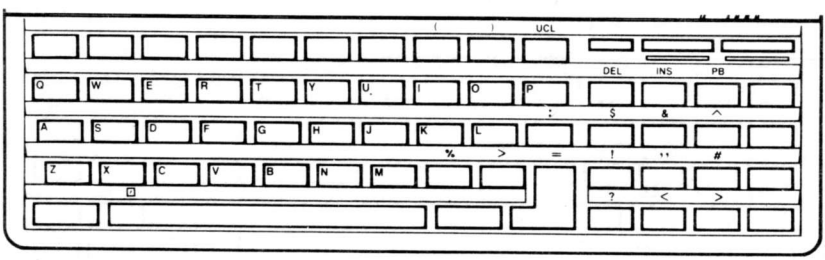


Key	Action
[CLR]	Clears characters from the display
[BREAK]	Interrupts execution of a BASIC program
[RUN]	Begins execution of a BASIC program
[ENTER]	Instructs the computer to accept a line you type
[→]	Moves the cursor to the right
[←]	Moves the cursor to the left
[↑]	Displays the preceding line of a program
[↓]	Displays the next line of a program

Use of the [SHIFT] Keys

You use **[SHIFT]** in conjunction with other keys. When you press and release either of the two **[SHIFT]** keys, the SHIFT indicator is displayed. This shows that the next key you press will produce an alternate character or action. (If you press **[SHIFT]** by mistake, you can cancel the SHIFT indicator by pressing **[SHIFT]** a second time.) As on a typewriter, the **[SHIFT]** key may be held down while you press other keys.

The following illustration shows the characters and actions available through the **[SHIFT]** key. The accompanying table gives a brief description of those keys that cause an action instead of displaying a character.



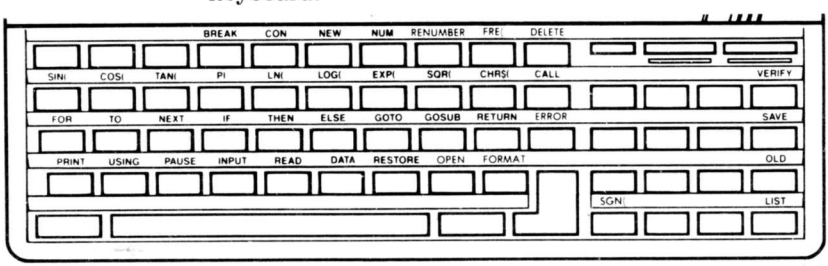
Key	Action
[UCL]	Activates and deactivates Upper Case Lock
[DEL]	Deletes a character from the display
[INS]	Allows insertion of text
[PB]	Exchanges the line last displayed with the line currently displayed

The [FN] (FunctioN) key and the [CTL] (ConTroL) key are used similarly to [SHIFT], but produce a different set of alternate characters or actions. Keys used with [FN] place text (such as frequently-used BASIC keywords) in the display. Keys used with [CTL] produce characters and cursor movements that are not marked on the keyboard.

Use of the [FN] Key

You use **[FN]** in conjunction with another key to place text (such as a BASIC keyword) in the display without typing the text. When you press and release the **[FN]** key, the FN indicator is displayed. This shows that the next key you press will display text assigned to the key. (If you press **[FN]** by mistake, you can cancel the FN indicator by pressing **[FN]** a second time.) The **[FN]** key may be held down while you press other keys. (A section of this chapter describes how to assign text to other keys.)

The following illustration shows the BASIC keywords that are permanently assigned to many of the keys. The accompanying table shows BASIC keywords that are permanently assigned but not marked on the TI-74 keyboard.

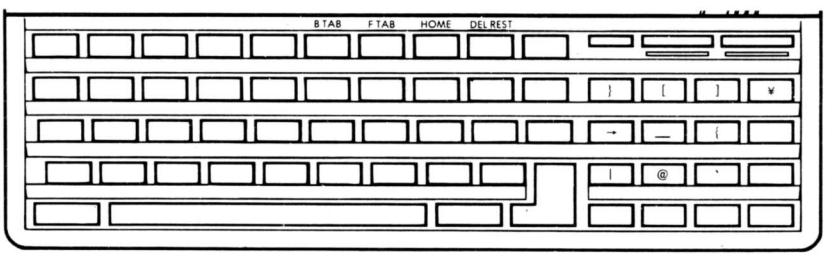


Key	Assigned Keyword
;	ERROR
.	FORMAT
,	OPEN
[↑]	RENUMBER
[↓]	FRE(
[CLR]	DELETE
[+/−]	SGN(

Use of the [CTL] Key

You use **[CTL]** in conjunction with other keys. When you press and release the **[CTL]** key, the CTL indicator is displayed. This shows that the next key you press will produce an alternate character or action. (If you press **[CTL]** by mistake, you can cancel the CTL indicator by pressing **[CTL]** a second time.) The **[CTL]** key may be held down while you press other keys.

The following illustration shows the characters and actions available through the **[CTL]** key. The accompanying table gives a brief description of those keys that cause an action instead of displaying a character. (Characters and actions associated with **[CTL]** are not marked on the TI-74 keyboard.)



Key	Action
[→]	Moves the cursor to the next tab position
[←]	Moves the cursor to the previous tab position
[↑]	Moves the cursor to the first character in the line
[↓]	Deletes text, starting at the current position of the cursor

Capitalization of Letters

The [UCL] (Upper-Case Lock) key is useful when you want to type a series of capital letters without holding down the [SHIFT] key. In certain instances, BASIC automatically converts lower-case letters of a program line to upper case when you enter the line.

Use of the [UCL] Key

You activate Upper-Case Lock by pressing **[SHIFT] [UCL]**. The UCL indicator appears in the display to indicate that Upper-Case Lock is active.

The effect of UCL is similar to that of the shift-lock key on a typewriter—it causes any letter you type to be interpreted as upper case. Unlike the shift-lock key on a typewriter, however, Upper-Case Lock affects only letter keys, not punctuation or number keys. You do not have to cancel UCL to type numbers or punctuation symbols marked on the keys.

When you finish typing capital letters, you cancel UCL by pressing **[SHIFT] [UCL]** a second time.

Automatic Capitalization

Some lower-case letters you type in a BASIC program line are automatically converted to upper case when you enter the line. These include:

- Letters that make up a BASIC keyword, such as PRINT or GOTO
- Names of BASIC variables, such as X or D$

For example, if you type a line as **100 print "hello"; a$** and display the line after entering it, the line is displayed as

```
100 PRINT "hello";A$
```

The BASIC keyword and the variable are converted to upper case.

Keys Used to View the Display Line

When working with a line that is longer than 31 characters, you may need to view a part of the line that is not visible in the display. You can use the cursor-movement keys described in this table to view any part of a line.

Key	Action
[→]	Moves the cursor one position to the right. When the cursor reaches the right side of the display, holding down [→] moves displayed characters to the left until the end of the 80-character line is reached.
[←]	Moves the cursor one position to the left. (If the cursor is at the beginning of a line, [←] has no effect.)
[CTL] [→] (Tab right)	Moves the cursor to the next tab position. (Tab positions are preset at 1, 25, and 50.) The left arrow display indicator appears to show that text has moved off the display to the left.
[CTL] [←] (Tab left)	Moves the cursor to the previous tab position. (Tab positions are preset at 1, 25, and 50.)
[CTL] [↑] (Home)	Moves the cursor to the first character of the line.
[SHIFT] [PB] (Playback)	Exchanges the line last displayed with the line currently displayed. (The line last displayed may be a line you typed or a line that was displayed by a BASIC program.)

Keys Used to Alter a Display Line

You may need to alter the contents of a line, either to correct an error or produce a different result. You can use the editing keys described in this table to make such changes.

Key	Action
[SHIFT] [INS]	Allows you to insert characters. As you type each subsequent character, it is inserted at the current cursor position, and all characters to the right of the inserted character are shifted to the right. Insertion continues with each character you type until you press either **[ENTER]**, **[CLR]**, **[BREAK]**, **[←]**, or **[→]**. (If you insert a character that causes the line to exceed its 80-character limit, the last character in the line is lost.)
[SHIFT] [DEL]	Deletes the character at the current position of the cursor. Any characters to the right of the cursor are moved one position to the left.
[CTL] [↓]	Deletes the rest of the line, starting with the character at the current position of the cursor.
[CLR]	Clears characters from the display. ► When no program is running, **[CLR]** clears all characters from the display. ► When a program is waiting for you to type information, only the characters you have typed are cleared.

Keys Used for Control

Four of the TI-74 keys are useful for controlling the execution of a BASIC program and controlling the operation of the computer.

Key	Action
[ENTER]	Tells the computer to process the currently displayed line. ► When the display contains a BASIC command, **[ENTER]** executes the command. ► When the display contains a BASIC program line, **[ENTER]** stores the line in memory. ► When a program is waiting for you to type information, **[ENTER]** causes the information you type to be accepted. ► When you are using the LIST command to view program lines, **[ENTER]** displays the next line of the program.
[RUN]	Places the word RUN in the display. Normally, you press **[RUN]** **[ENTER]**. This begins the program, starting with the lowest numbered program line. (**[RUN]** can also be followed by other options, as described in the *TI-74 Programming Reference Guide*.)
[BREAK]	Interrupts a program that is in progress. (Depending on what changes you make while the program is interrupted, you may be able to resume program execution using the CONTINUE command.)
[RESET]	Restarts the computer. This key is used as a "last resort" if a problem occurs that prevents you from entering information from the keyboard. This key is flush with the case of the TI-74 so that you will not press it accidentally. (**[RESET]** usually causes the message `W27 contents may be lost` to be displayed. This message is described on page 1-6.)

Performing Calculations in BASIC

When the TI-74 is in the BASIC mode with the block cursor flashing, you can either perform calculations, type instructions to be executed immediately, or enter a line to be stored as a BASIC program line. Calculations in the BASIC mode are similar to those in the calculator mode.

Relative Advantages

Similar to the calculator mode of the TI-74, the BASIC mode lets you calculate the result of an expression. Each mode, however, has relative advantages over the other.

With the TI-74 in the BASIC mode, you can:

- Correct errors in a lengthy expression before you press **[ENTER]** to calculate the result.
- Use both constants and variables in an expression.

With the TI-74 in the calculator mode, you can:

- Examine intermediate results as you enter the elements of the expression.
- Use familiar key notations that are traditional for calculator operations.

Example of Performing Calculations

To see an example of performing calculations in the BASIC mode, follow these steps.

1. Press **[CLR]** to clear the display.
2. Type the following expression.

   48 + 275 – 34

3. Press **[ENTER]** to calculate the result.

   The display shows 289 (48 plus 275 minus 34).

4. Type **– EXP(3)** to subtract e^3 from the displayed value.
5. Press **[ENTER]** to display the new result.

   The display shows 268.9144631 (289 minus e^3).

Executing Instructions in BASIC

You can execute BASIC instructions by typing the instructions and pressing the [ENTER] key. This feature lets you quickly verify how a particular instruction operates before using the instruction in your program.

Example of Executing Instructions

When you press **[ENTER]** after typing a line that consists of a BASIC instruction (or several instructions separated by colons), the TI-74 examines the line for errors. If no errors are detected, the instructions are carried out.

To see an example of executing instructions, follow these steps. (The example lets you quickly compute the reciprocals of the numbers 20 through 25 using a FOR/NEXT loop.)

1. PRESS **[CLR]**, if necessary, to clear the display.

2. Type the following line.

   FOR X = 20 TO 25:PRINT 1/X:NEXT X

3. Press **[ENTER]**.

   The display shows .05, the reciprocal of the number 20.

4. Press **[ENTER]** a second time.

   The display shows .0476190476, the reciprocal of the number 21.

5. If you want to complete the FOR/NEXT loop, continue to press **[ENTER]** until all the reciprocals are displayed and the cursor reappears.

   If you want to interrupt execution of the FOR/NEXT loop, press **[BREAK]**. Then press **[CLR]** to clear the display.

Practice Session: Working With a BASIC Program

The practice sessions in this book demonstrate some of the procedures you follow when entering, modifying and testing a program. These sessions do not teach programming—if you are unfamiliar with BASIC programming, other books are available to help you, such as the *TI-74 Learn BASIC Guidebook*.

Structure of a Program Line

Unlike commands that you want performed by the computer as soon as you enter them, a BASIC program consists of a series of instructions to be performed in sequence at a later time. So that the computer can store a program line instead of executing it immediately, a program line has a distinct structure that sets it apart from a command.

When you want to specify that a line is to be stored as a program line, you start the line with a line number followed by a space.

Entering a Sample Program

A sample program is shown here that calculates the surface area of a sphere after you specify the sphere's radius. Follow the steps given below to store the sample program in memory.

Note: If a program is already in program memory, you may need to delete it before entering the sample program by using the NEW command.

1. With the TI-74 in the BASIC mode, type the following line exactly as shown, including spaces. (If you make a mistake typing, use the editing keys to correct the line, or press **[CLR]** to start over.)

   ```
   100 INPUT "Enter the sphere's radius: ";R
   ```

2. Press **[ENTER]** to instruct the computer to store the program line.

   The line is stored and the display is cleared.

3. Type the remaining lines as shown, pressing **[ENTER]** after each line.

   ```
   110 AREA = 4*PI*R^2
   120 PRINT "Press <ENTER> to see the area.":PAUSE
   130 PRINT "surface area =  ";AREA:PAUSE
   140 END
   ```

Viewing the Sample Program

To view the program you entered, follow these steps.

1. Type **100** (the starting line number) and press **[↓]**.

   The TI-74 displays the first 31 characters of line 100.

2. Press **[CTL] [→]** to show the rest of the line.

3. Press **[↓]** to display each subsequent program line. (When you press **[↓]** with the last program line in the display, the flashing cursor appears at the beginning of a blank line to indicate that there are no additional program lines.)

4. Press **[↑]** to redisplay the last line of the program.

Running the Sample Program

To run the sample program you have entered, follow these steps.

1. Press **[CLR]** to clear the display.

2. Press **[RUN] [ENTER]** to begin the program.

   The program requests you to enter the sphere's radius.

3. Type the sphere's radius as **20** and press **[ENTER]**

   The program requests you to press **[ENTER]** to see the sphere's radius.

4. Press **[ENTER]**

   The program displays `surface area= 5026.548246`

5. Press **[ENTER]** once again to end the program.

Several features allow you to make changes to a program stored in memory.

Editing a Program Line

You may need to edit a line you have stored. To edit line 130 of the sample program so it will display "area of sphere" instead of "surface area", follow these steps.

1. Clear the display, if necessary, by pressing **[CLR]**.
2. Display line 130 by typing **130** and pressing **[↓]**.

   The display shows
   ```
   130 PRINT "surface area= ";AREA:PAUSE
   ```
3. Delete the word "surface" by moving the cursor to the first letter of the word and pressing **[SHIFT] [DEL]** eight times.

   The display shows
   ```
   130 PRINT "area= ";AREA:PAUSE
   ```
4. Insert the words " of sphere" following the word "area" by moving the cursor to the equals sign, pressing **[SHIFT] [INS]**, and typing a space followed by **of sphere**.

   The edited line should now read

   ```
   130 PRINT "area of sphere= ";AREA:PAUSE
   ```
5. Press **[ENTER]** to enter the edited line.

Replacing an Existing Program Line

You may need to substitute a new program line for an existing program line. To replace line 100 of the sample program, type the following line and press **[ENTER]**.

100 INPUT "Radius of sphere in meters = ";R

The display is cleared, and the old line 100 is replaced by the line you typed.

Deleting a Program Line

You may decide to erase a program line you no longer need. To delete line 120 of the sample program, type the following line and press **[ENTER]**.

```
DELETE 120
```

The display is cleared, and line 120 of the sample program is deleted.

Inserting a New Program Line

If you think of an extra feature to include in a program, you usually need to insert new lines in the program. To insert a line that repeats the sample program, type the following line and press **[ENTER]**.

```
135 GOTO 100
```

If you display the lines of the program, you will notice the new line has been inserted in correct numeric sequence—between lines 130 and 140.

Running the Edited Program

To run the edited version of the sample program, follow these steps.

1. Press **[CLR]**, if necessary, to clear the display.
2. Press **[RUN] [ENTER]** to run the edited program.

   The edited program runs similarly to the original version, but displays a different message and repeats.
3. When you finish using the program, press **[BREAK] [CLR]** to interrupt the program and clear the display.

Practice Session: Encountering Errors

This exercise introduces you to three general types of errors: those detected by the computer when you first enter a line, those detected by the computer when you run a program, and those that are not automatically detected by the computer. This session uses the edited program from the previous session.

Errors Detected When You Enter a Line

Some errors in a line are automatically detected by the computer when you press the **[ENTER]** key. When this happens, the computer displays an error message and the line is not stored in your program. You can, however, correct the error without retyping the entire line.

1. Type the following line and press **[ENTER]**.

   2GOTO 100

   The computer displays the error message `E1 Syntax`.

2. Press **[SHIFT]** **[PB]** to redisplay the line you typed.

3. Correct the line by using the editing keys to insert a space before the word "`GOTO`" and press **[ENTER]** to store the corrected program line in memory.

Errors Detected When You Run a Program

An error may not be detected until the computer attempts to execute an instruction in the line. When this happens, you can display the line that contains the error and correct it.

1. Type the following line and press **[ENTER]**.

   2 GOTO 1000

   The line is accepted as a valid program line.

2. Run the program by pressing **[RUN]** and **[ENTER]**.

   The computer displays the message `E11 at 2 Line number error`.

3. Press **[↑]** to display the line in which the error was detected.

4. Correct the line by changing the referenced line number from 1000 to 100 and press **[ENTER]** to store the corrected program line in memory.

Errors That Are Not Automatically Detected

Not all errors can be detected by the computer. For example, typing a mathematical formula incorrectly may produce an incorrect result, but the computer will not detect the error. To see an example of this type of error using the sample program, follow these steps.

1. Press **[CLR]** to clear the display.
2. Type **110** and press **[↓]** to edit line 110.

   The computer displays `110 AREA = 4*PI*R^2`.
3. Use the editing keys to change the "2" at the end of the line to a "3".

   The line should now read `110 AREA = 4*PI*R^3`
4. Run the program by pressing **[RUN] [ENTER]**.
5. When the program requests you to enter the radius, type **20** and press **[ENTER]**.

   The computer displays the erroneous result as

   ```
   area of sphere = 100530.9649
   ```
6. Use the editing keys to correct the error, and test the corrected program.

Practice Session: Assigning Text to a Key

A feature of the TI-74 enables you to assign text, such as often-used numbers or expressions, to each of the number keys 0 through 9. After assigning text to a key, you can redisplay the text by pressing only two keys.

Assigning The Text

By assigning text to a key, you can instantly display such things as phone numbers, phrases that you use frequently in your programs, or commands that are not permanently assigned to any keys. Although you can redisplay the assigned text only in the BASIC mode, it is retained when you turn the TI-74 off or select the calculator mode.

Suppose you have stored a program that has lower line numbers than the sample program. To work with the sample program, you might have to frequently type **RUN 100** so that execution will begin at the correct line number. You can save time by assigning the text **RUN 100** to a key.

To assign the text **RUN 100** to the **[6]** key, follow these steps.

1. Press **[CLR]**, if necessary, to clear the display.

2. Type **RUN 100** (do not press **[ENTER]**).

3. Hold down **[SHIFT]** and press **[FN]**

   Both the SHIFT and FN indicators appear in the display.

4. Release the **[SHIFT]** and **[FN]** keys.

5. Press **[6]** to assign the displayed text to the **[6]** key.

   The display is blanked, and the SHIFT and FN display indicators are turned off.

You can now redisplay the command **RUN 100** any time you want to quickly run the sample program. The method for redisplaying the text is described on the next page.

Redisplaying Assigned Text

After assigning text to a digit key, you can redisplay the text at any time by pressing **[FN]** followed by the key to which you assigned the text. The text is placed in the display, starting at the current position of the cursor.

To redisplay and use the text you assigned to the **[6]** key, follow these steps.

1. Clear the display, if necessary, by pressing **[CLR]**.

2. Press **[FN][6]**.

   The display shows RUN 100.

3. To execute the displayed text as a BASIC command, press **[ENTER]**.

   The computer executes the sample program, beginning execution at line 100.

Deleting Assigned Text

You can delete text you have assigned to a key by assigning a blank line to the key. To delete the text you assigned to the **[6]** key, follow these steps.

1. Press **[CLR]** to clear the display.

2. Press **[SHIFT][FN][6]**.

In two circumstances, all text you have assigned to keys is cleared. This happens when:

- You execute the BASIC command **NEW ALL**.
- The message W30 Initialized is displayed.

Appendices

Use the information in the appendices for resolving problems you may encounter when using the calculator.

Table of Contents

Appendix A: Display Symbols and Messages

The calculator's display shows not only numbers but also symbols and messages. Calculator operations have identifying symbols displayed to the right of the corresponding entry. This helps you to keep track of calculations as you perform them.

Display Symbols

Symbol	Key Sequence	Action
acos	**[INV] [cos]**	Arccosine
acosh	**[INV] [hyp] [cos]**	Hyperbolic arccosine
asin	**[INV] [sin]**	Arcsine
asinh	**[INV] [hyp] [sin]**	Hyperbolic arcsine
atan	**[INV] [tan]**	Arctangent
atanh	**[INV] [hyp] [tan]**	Hyperbolic arctangent
CE	**[CE/C]**	Clear Entry (if pressed once with the cursor flashing)
CLR	**[CE/C] [CE/C]**	Clear
<--	**[←]**	Character delete
cos	**[cos]**	Cosine
cosh	**[hyp] [cos]**	Hyperbolic cosine
CSR	**[STAT] [CSR]**	Clear statistical registers
DMS>DD	**[DMS▸DD]**	Decimal degrees
DD>DMS†	**[INV] [DMS▸DD]**	Degrees/minutes/seconds
DRG	**[DRG]**	Set angle units forward
INVDRG	**[INV] [DRG]**	Set angle units back
DRG>	**[DRG▸]**	Convert angle forward
<DRG	**[INV] [DRG▸]**	Convert angle back
EE	**[EE]**	Enter exponent
INV EE	**[EE]**	Remove scientific notation
e^x	**[INV] [ln*x*]**	Natural antilogarithm
EXC	**[EXC]**	Memory exchange
Frac	**[Frac]**	Fractional portion
hyp	**[hyp]**	Hyperbolic prefix
Intg	**[Intg]**	Integer portion
INV	**[INV]**	Inverse prefix
INVhyp	**[INV] [hyp]**	Inverse hyperbolic prefix
lnx	**[ln*x*]**	Natural logarithm
log	**[log]**	Common logarithm

†The display shows the result with the symbols ° ′ ″.

Display Symbols (Continued)

Symbol	Key Sequence	Action
n!	**[n!]**	Factorial
%	**[%]**	Percent
Δ%	**[Δ%]**	Delta percent
RCL	**[RCL]**	Memory recall
sin	**[sin]**	Sine
sinh	**[hyp] [sin]**	Hyperbolic sine
STAT	**[STAT]**	Stat prefix
STO	**[STO]**	Memory store
SUB	**[INV] [SUM]**	Memory subtract
SUM	**[SUM]**	Memory sum
tan	**[tan]**	Tangent
tanh	**[hyp] [tan]**	Hyperbolic tangent
10^x	**[INV] [log]**	Common antilogarithm
x^2	**[x^2]**	Square
$\sqrt{x}$	**[$\sqrt{x}$]**	Square root
π	**[π]**	Value of pi
1/x	**[1/x]**	Reciprocal
y^x : x?	**[y^x]**	Universal power
$\sqrt[x]{y}$: x?	**[INV] [y^x]**	Universal root
x : x⇄y	**[$x\rightleftarrows y$]**	x exchange y before pair entry
x⇄y	**[$x\rightleftarrows y$]**	x exchange y after pair entry
/	**[÷]**	Divide
*	**[×]**	Multiply
−	**[−]**	Subtract
+	**[+]**	Add
=	**[=]**	Equals
(	**[(]**	Open parenthesis
)	**[)]**	Close parenthesis
+/−	**[+/−]**	Change sign

Symbol	Key Sequence	Action
(x, y?)	[(x,y)]	xy pair entry
P→R	[P▸R]	Polar to rectangular
y=	[x⇆y]	y coordinate
x=	[x⇆y]	x coordinate
R→P	[INV] [P▸R]	Rectangular to polar
θ=	[x⇆y]	Theta coordinate
r=	[x⇆y]	Radius coordinate
nPr	[nPr]	Permutations
nCr	[nCr]	Combinations
Σ+	[Σ+]	Sigma plus
Σ−	[INV] [Σ+]	Sigma minus
Frq	[Frq]	Frequency
Σx	[STAT] [Σx]	Sum of x values
Σy	[STAT] [Σy]	Sum of y values
Σxy	[STAT] [Σxy]	Sum of xy products
Σx^2	[STAT] [Σx^2]	Sum of x^2 values
Σy^2	[STAT] [Σy^2]	Sum of y^2 values
$\overline{x}$	[STAT] [$\overline{x}$]	Mean of x values
$\overline{y}$	[STAT] [$\overline{y}$]	Mean of y values
sx	[STAT] [sx]	x standard deviation
sy	[STAT] [sy]	y standard deviation
n	[STAT] [n]	Number of data points
r	[STAT] [r]	Correlation coefficient
a	[STAT] [a]	Regression y intercept
b	[STAT] [b]	Regression slope
x′	[STAT] [x′]	x for a trial y
y′	[STAT] [y′]	y for a trial x

Calculator Display Messages

Messages appearing in the display have the following meanings.

E23 Bad argument	The calculator detected unsuitable input for the attempted function such as **6 [+/−] [ln*x*]** or **.5 [n!]**.
E4 Bad value	The calculator's method of calculation revealed unsuitable input such as **[( ] 6 [+/−] [y^x] .5 [ )]**.
E2 Complex	A calculation caused more than 22 levels of open parentheses and pending operations.
E26 Division by zero	A calculation included division by zero such as **[( ] 4 [÷] 1 [log] [ )]**, **0 [1/*x*]**, or **0 [(*x*, *y*)] 0 [INV] [P▸R]**.
E25 Overflow	A calculation result is out of the calculator's range such as **400 [INV] [log]** or **[( ] 150 [y^x] 150 [ )]**.

System Messages

The following messages appear in either CALC or BASIC mode and are described in detail in the *TI-74 Programming Reference Guide*.

W27 contents may be lost	When the power was turned on, the computer determined that the contents of the constant memory were not the same as when the power was turned off.
W30 Initialized	Circumstances forced the complete initialization of the system.

Appendix B: Numeric Error Conditions

The display indicates an error condition when overflow occurs or when an operation is attempted with unsuitable input. When this occurs, no entry from the keyboard is accepted. Pressing [CE/C] clears the error condition and all pending operations. You must then determine the cause of the error and rekey the entry to avoid the problem.

Types of Error Conditions

The following section lists the general error conditions. They affect both CALC and BASIC modes unless the function is available only in CALC mode. The section of errors due to statistical operations lists those that you may encounter while entering statistical data. An error condition does not affect values in memory or statistical data elements that have been entered.

General Error Conditions

1. Number entry or calculation result (including memory) is outside the range

   $-9.999999999999 \times 10^{127}$ to $9.999999999999 \times 10^{127}$.

2. Dividing a number by zero.

3. Calculating reciprocal of zero or the 0th root of any number.

4. Raising a negative number to a non-integer power.

5. Calculating any root of a negative number.

6. Calculating the tangent of 90° or 270°, $\pi/2$ radians or $3\pi/2$ radians, 100 grads or 300 grads, or their rotational multiples, such as 450°.

7. Having a combination of open parentheses and pending operations in excess of 22 levels.

8. Calculating rectangular to polar conversions with values for x and y such that the sum of their squares exceeds the upper limit of the calculator or when both x and y are equal to zero.

9. Using an argument outside the range given by "Input Ranges" for the functions listed on the following page.

Input Ranges

Because some functions can return a much greater value than the input value, an overflow may occur even for an input that may seem moderate.

The following gives the limits within which the display must be when calculating certain functions.

Function	Limit
$\sin x, \cos x, \tan x$	$0 \leq \lvert x \rvert \leq 3.6 \times 10^{92}$ degrees $0 \leq \lvert x \rvert \leq 1.570796327 \times 10^{10}$ radians $0 \leq \lvert x \rvert < 10^{128}$ grads
$\sin^{-1} x, \cos^{-1} x$	$-1 \leq x \leq 1$
$\sinh x, \cosh x$	$0 \leq \lvert x \rvert \leq 295.1040919$
$\cosh^{-1} x$	$1 \leq x < 10^{128}$
$\sinh^{-1} x$	$0 \leq \lvert x \rvert < 10^{128}$
$\tanh^{-1}$	$-1 < x < 1$
$\ln x, \log x$	$10^{-128} \leq x < 10^{128}$
e^x	$\lvert x \rvert \leq 294.7308919$
10^x	$-128 \leq x < 128$
$n!$	$0 \leq n \leq 84$ where n is an integer

Statistical Error Conditions

1. Entering a data value such that $|x| \geq 1 \times 10^{64}$.
2. Entering a series of data values such that the sum of their squares exceeds the upper or lower limit of the calculator.
3. Entering data pairs such that the sum of their products exceeds the upper or lower limit of the calculator.
4. Entering 10^{14} or more data elements.

Note: You can cause the statistics registers to be cleared by removing data elements with **[INV] [Σ+]** until there are zero data elements. If you attempt to remove more data elements than have been entered, the calculator removes only the existing elements.

Appendix C: Output Ranges

The mathematical definitions of inverse trigonometric functions make possible many output values for the same input. However, the calculator returns values in predetermined ranges for inverse trigonometric functions.

Inverse Trigonometric Functions

The following gives the range of results of the inverse trigonometric functions.

Arc Function	Range of Resultant Angle
arcsin x	0 to 90°, π/2 radians, or 100 grads (first quadrant)
arcsin −x	0 to −90°, −π/2 radians, or −100 grads (fourth quadrant)
arccos x	0 to 90°, π/2 radians, or 100 grads (first quadrant)
arccos −x	90° to 180°, π/2 to π radians, or 100 grads to 200 grads (second quadrant)
arctan x	0 to 90°, π/2 radians, or 100 grads (first quadrant)
arctan −x	0 to −90°, −π/2 radians, or −100 grads (fourth quadrant)

Appendix D: In Case of Difficulty

If you have difficulty with your calculator, consult the following instructions for help in correcting the problem.

Handling a Difficulty

1. Be sure the batteries are installed properly.
2. Move the contrast control on the upper right side of the calculator to see if the display becomes visible.
3. If the difficulty involves calculation errors or the calculator does not respond to keyboard entries:
   - Press **[CE/C]** if there is an error condition or press **[ON]** if the APD™ feature has powered down the calculator.
   - Press **[RESET] [CE/C]** and check that the TI-74 is in calculator mode. Check the value in each memory and repeat the calculations.
   - Review the operating instructions to be certain that the calculations have been performed in the manner described in this book. Improper key sequences may give unexpected results.
4. If the difficulty involves computer errors or the computer does not respond to keyboard entries:
   - If the I/O indicator is on, **[BREAK]** is inoperable. If the I/O indicator is not on, press the **[BREAK]** key to try to halt the computer. If the word BREAK appears in the display, press **[CLR]** and enter **CON** to continue executing the program in memory.
   - If the **[BREAK]** key is inoperable, press the reset key. The message `W27 contents may be lost` should be displayed. Press the **[CLR]** key to clear the display. Then check if your program is still stored.
   - If pressing the **[RESET]** key does not cause the cursor to reappear, the batteries should be removed for a few minutes. Normally, the system is initialized and any program in memory is erased.

Handling a Difficulty (Continued)

5. If there is a problem when using a peripheral:

- Check the I/O indicator. If the indicator is on and I/O operations are in progress, wait for all peripheral activity to cease.
- Check that all peripherals are properly connected to the TI-74 and turned on. The cables should be those made to work with TI-74 peripherals. Check that the cables are plugged in securely and that there are no loose or broken leads or connectors. These checks may reveal some obvious problem that is readily cleared.
- Press **[RESET]** and turn the system off. Isolate the computer by disconnecting the peripheral cable. Turn the computer on.
- If the flashing cursor appears in the display, turn the computer off and attach one peripheral. Turn the peripheral on first, then the computer.
- If the flashing cursor appears, turn the computer off and continue attaching one peripheral at a time to the computer. If the flashing cursor does not reappear after one of the peripherals is attached, either the cable or the peripheral may be the source of the difficulty. Disconnect the peripheral and reattach it with a cable that you know is good. Turn the computer on and you can then determine if the difficulty is in the cable or the peripheral.

If the Difficulty Persists

If these procedures do not correct the difficulty, see Appendix E for information on servicing the calculator.

Suggestions from Customers

Because of the number of suggestions that come to Texas Instruments from many sources, containing both new and old ideas, Texas Instruments will consider such suggestions only if they are freely given to Texas Instruments. It is the policy of Texas Instruments to refuse to receive any suggestions in confidence. Therefore, if you wish to share your suggestions with Texas Instruments, or if you wish us to review any calculator key sequence that you have developed, please include the following in your letter:

"All of the information forwarded herewith is presented to Texas Instruments on a nonconfidential, nonobligatory basis; no relationship, confidential or otherwise, expressed or implied, is established with Texas Instruments by this presentation. Texas Instruments may use, copyright, distribute, publish, reproduce, or dispose of the information in any way without compensation to me."

Appendix E: Calculator Servicing

If the solutions suggested by "In Case of Difficulty" do not correct a problem you may have with your calculator, please call or write Consumer Relations to discuss the problem.

For Service and General Information

If you have questions about service or the general use of your calculator, please call Consumer Relations **toll-free** within the United States at:

1-800-TI CARES (842-2737).

From outside the United States, call 1-806-741-4800. (We cannot accept collect calls at this number.)

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 or programming applications, 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 at 1-800-TI CARES (842-2737) for information.

Calculator Accessories

If you are unable to purchase calculator accessories (such as carrying cases or adapters) from your local dealer, you may order them from Texas Instruments. Please call Consumer Relations at 1-800-TI CARES (842-2737) for information.

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 Repair

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

Out-of-Warranty Repair

For an out-of-warranty calculator, a flat-rate fee by model is charged for service. Estimates are not provided prior to repair; to obtain the service charge for a particular model, please call Consumer Relations before returning the calculator to the Service Facility.

Texas Instruments Service Facilities

U.S. Residents
(U.S. Postal Service)
Texas Instruments
P.O. Box 2500
Lubbock, Texas 79408

U.S. Residents
(other carriers)
Texas Instruments
2305 N. University
Lubbock, Texas 79415

Canadian Residents Only
Texas Instruments
41 Shelley Road
Richmond Hill, Ontario, Canada L4C 5G4

Appendix F: 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.

Appendix G: Index

Use this list of items to find a topic of reference. Also see the Key Reference Diagram at the front of this book.

Important Notice

Texas Instruments makes no warranty, either expressed or implied, including but not limited to any implied warranties of merchantability and fitness for a particular purpose, regarding these programs or book materials or any programs derived therefrom and makes such materials available solely on an "as-is" basis.

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