The TI-54 Quick Reference Guide

A handy pocket-guide to the most used operations of your calculator

- Complex Number Operations
- Statistical Operations
- Mathematical Functions
- Powers and Roots
- Conversions
- Constants
- Trigonometry
- And more
TI-54 QUICK REFERENCE GUIDE

Always refer to the Scientific Calculator Sourcebook for complete details and examples of calculator operation.

TI-54 FUNCTIONS

Standard Functions

Calculator Control — Clear, Clear Entry, and APD™ Automatic Power Down. 3
Data Entry — Change Sign, x Exchange y, Pi, and AOS™ Algebraic Operating System (up
3 6

to 15 parentheses and 4 pending
operations).

Display Control — Fix/Floating Decimal, Scientific Notation, and Engineering
Notation.

Mathematical Functions — +, −, ×, ÷, x², √x,
1/x, yˣ, ¹⁄² y, x!, Absolute Value,
Permutations, Combinations, Integer,
and Fraction.

Percentage Functions — Percent to Decimal
Percent, Add-on Percent, Discount
Percent, Percentage, Percent Ratio,
and Percent Change (Δ%).

Trigonometric Functions — Sine, Cosine, Tangent,
and Inverses in Degrees, Radians, or
Grads.

Hyperbolic Functions — Sine, Cosine, Tangent,
and Inverses.

Logarithmic Functions — Common Log, Natural
Log, and Inverses (10^x and e^x)
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AOSTM ALGEBRAIC OPERATING SYSTEM

AOSTM algebraic operating system (in statistical and normal calculation modes) allows entering numbers and combined operations in the same order in which they are written mathematically. Operations are performed in the following descending order of priority:

1. The following are performed immediately:
   - Trigonometric, hyperbolic, square, square root, factorial, reciprocal, and conversions, combinations, permutations, percent, and logarithmic keys
2. The percent change key
3. The universal powers and roots keys
4. Multiplication and division keys
5. Addition and subtraction keys
6. The equals key completes all pending operations

The calculator allows up to four pending operations and 15 open parentheses.

CLEARING

The following are the effects of the clearing keys.

- $\text{Cl}$ following a digit — clears the display.
- $\text{Cl}$ following an operation — clears the display and pending operations.
- $\text{Cl}$ — clears the display and pending operations.
- $\text{AC}$ — clears the user data memories.
- $\text{AC}$ — clears the statistical registers and removes STAT from the display.
DISPLAY FORMATS
The internal display register holds calculated results to 11 digits. The value displayed is rounded to eight digits.

EE — Scientific notation allows numbers as small as $1 \times 10^{-39}$ and as large as $9.99999999 \times 10^{39}$. Numbers smaller than $1 \times 10^{-7}$ and larger than $9.9999999 \times 10^7$ must be entered into the calculator in scientific notation. If calculations exceed these limits, the results are automatically displayed in scientific notation. Leave scientific notation with the ON, EE, INV, EE, or OFF keys.

((n)) — Numbers expressed in engineering notation are displayed as a mantissa times 10 raised to a power that is a multiple of three. Leave engineering notation with the ON, EE, INV, or OFF keys.

((n)) — Pressing the fix decimal key directs the calculator to round the display to n decimal places. The internal display register still retains the full 11 digit accuracy for use in subsequent calculations. Reset to floating decimal mode with the ON, EE, INV, 8, 9, or OFF and then ON keys.

MEMORY OPERATIONS
The calculator may have a maximum of seven user data memories, numbered 0 through 6. User data memories 0 through 6 are available in normal calculation mode, 0 through 2 are available in complex number mode, and 0 and 1 are available in statistics mode. The following keys and operations...
allow manipulation of the numbers in the user data memories in the normal calculation and statistics modes.

M cl — clears all the user data memories.

STO m — stores the value shown in the display in user data memory m.

RCL m — recalls the display the number in user data memory m.

XEx m — exchanges the value in the display with the value in user data memory m.

Operations on a number stored in a user data memory with the result stored back in the same memory may be performed by following a calculation with STO, the operation to be performed, and the number of the user data memory in which to store the result. The displayed number and calculations in progress are not affected. The following keys may be used in conjunction with STO: +, −, ×, ÷, 2y, NV √x, and (m) INV.

POWERS AND ROOTS

2y — The universal power key raises any positive number to any power. To use this key:
- Enter the number to be raised to a power ("y")
- Press 2y
- Enter the power ("x")
- Press (=)

NV 2y — the universal root key takes any root of any positive number. To use this key:
- Enter the number to take the root of ("y")
- Press NV 2y
- Enter the root to be taken ("x")
- Press (=)
CONSTANT OPERATIONS
The \( \times \) key stores a number and an operation for use in repetitive calculations. Here is how it works:
- Enter the operation
- Enter the repetitive number \( m \)
- Press \( \times \)
- Press \( \equiv \)

From then on:
- Enter the number to be operated on
- Press \( \equiv \)

The \( \times \) feature works with the following keys: \( \pm \), \( \times \), \( ÷ \), \( \% \), and \( \equiv \).

Pressing \( \equiv \) after \( \pm \), \( \times \), \( ÷ \), \( \% \), and \( \equiv \) any of the above operation keys, or the close parenthesis key removes the automatic constant.

MATHEMATICAL FUNCTIONS
The following keys perform the indicated operations on the number in the display:
- \( \text{Abs} \) — Absolute value
- \( \text{Int} \) — Integer portion
- \( \text{Frq} \) — Fractional portion
- \( \sqrt{\text{X}} \) — Square root
- \( \sqrt{\text{X}} \) — Square
- \( \text{Rec} \) — Reciprocal
- \( \% \) — Percent

TRIGONOMETRIC OPERATIONS
\( \text{deg} \) — Pressing the angular mode key changes from degree mode to radian mode to grad mode and back to degree mode. You may also go through the modes in reverse order by pressing the \( \text{deg} \) \( \text{rad} \) \( \text{grad} \) key.
FACTORS, FACTORS, AND

The trigonometric keys calculate the sine, cosine, tangent, arcsine, arccosine, and arctangent of the number in the display.

FACTORS, FACTORS, AND

The factorial of any integer less than 70. The factorial key (!) determines the permutations of n items taken r at a time. The key! determines the combinations of n items taken r at a time. To determine permutations and combinations, the values of n and r are entered as n.r.r.

CONVERSION KEYS

These keys are used to convert from one system to another. To convert in the opposite direction, precede the key with !. ! ! — The angular mode conversion key changes the mode displayed and converts the number in the display to the new units. You may also go through the modes and values in reverse order by pressing the ! key. ! ! — Degrees/minutes/seconds, expressed as DD.MMSSSs, are converted to decimal degrees, expressed as DD.ddddd, with the ! key. Conversion from decimal degrees to degrees/minutes/seconds is with the ! key.
Polar/rectangular conversions are entered as follows:

**Polar to Rectangular**
- Enter the r value
- Press \( \boxed{xy} \)
- Enter the \( \theta \) value
- Select the proper mode with \( \boxed{pm} \)
- Press \( \boxed{xy} \)

The \( y \)-coordinate is displayed.
- Press \( \boxed{xxy} \)

The \( x \)-coordinate is displayed.

**Rectangular to Polar**
- Enter the \( x \)-coordinate
- Press \( \boxed{xy} \)
- Enter the \( y \)-coordinate
- Select the proper mode with \( \boxed{pm} \)
- Press \( \boxed{xy} \)

The \( \theta \) value is displayed.
- Press \( \boxed{xxy} \)

The \( r \) value is displayed.

**COMPLEX NUMBER KEYS**

When \( \boxed{cmplx} \) or \( \boxed{cmplx2} \) is pressed, the complex number mode is entered with the CMPLX indicator in the display. If \( \boxed{cmplx} \) has been pressed the \( r \theta \) indicator is also displayed showing that the complex number is in polar form. The real and imaginary parts are exchanged by pressing \( \boxed{rec} \) \( \boxed{imag} \). If the complex number is in polar form, press \( \boxed{rec} \) \( \boxed{imag} \) to exchange the \( r \) and \( \theta \) values. If the CMPLX indicator is blinking, the imaginary part or \( \theta \) value is in the display. Be sure to have the real part or \( r \) value in the display before performing any operation.

Pressing \( \boxed{re} \) \( \boxed{im} \) or \( \boxed{im} \) \( \boxed{re} \) returns the calculator to normal calculation mode with the CMPLX and \( r \theta \) indicators, any pending operations, and imaginary parts of complex numbers stored in memory cleared.
Clearing Keys
The following are the effects of the clearing keys in the complex number mode:
- **CE**: following a digit — clears the display.
- **C**: following **CE** or **M.C.** — clears the display and pending operations.
- **M.C.**: following an operation — clears the display and pending operations.
- **AC**: clears the display and pending operations.
- **MC** — clears the real and imaginary parts of complex numbers stored in the user data memories.

**Data Entry**

### Rectangular Form
- Enter imaginary value: Press \( \text{Im} \)
- Enter real value: Press \( \text{R} \)
- To display imaginary part: Press \( \text{Im} \)
- (\( \text{CMPLX} \) blinks)
- To return real part: Press \( \text{R} \)

### Polar Form
- Select angular mode: Enter \( \theta \) value
- Enter \( r \) value: Press \( \text{R} \)
- To display \( \theta \) value: Press \( \text{R} \)
- (\( \text{CMPLX} \) blinks)
- To return \( r \) value: Press \( \text{R} \)

The entry of values in complex number mode is the opposite of the entry of paired data in the other modes of the calculator. Complex numbers with an imaginary part only and real numbers only may also be entered in the complex number mode.
Chain Arithmetic
As each of the binary operations (\( +, -, \times, +, -\)) is keyed it completes the previously entered operation. Data in polar form may be mixed with data in rectangular form. Complex numbers entered in polar form are converted to rectangular form when any operation key, unary or binary, is pressed. The results of calculations are always in rectangular form.
The following list shows how the functions operate in the complex number mode.

Functions Valid in the Complex Number Mode
Completes Pending Operation
\(+, -, \times, +, -\)

Does Not Complete Pending Operation
\(1/x, x^y, \sin, \cos, \tan, \ln, \exp, \sqrt{x}, \text{sgn}, x^y\)
Functions Not Valid in the Complex Number Mode

Ignored Operations
- sin, cos, tan, hyp, 2nd sin, cos, tan, 2nd hyp
- 2nd sin^2, cos^2, tan^2, hyper^2
- all STAT keys

Error Producing
- | | |

Be sure that the real part or r value is in the display before pressing any operation key. When $\text{sin}$ or $\text{cos}$ conversions are performed in the complex number mode, they operate on the displayed value only. If conversion of the $x$ value is needed, press $\text{sin}$ or $\text{cos}$ before pressing the $\text{sin}$ or $\text{cos}$ key.

Memory Operations

Three paired user data memories are available in the complex number mode. When a complex number is stored, the real part is stored in one memory and the imaginary part is stored in a memory which has been paired to it. When you leave the complex number mode, only the imaginary part is cleared. The real values remain in the user data memories in which they were stored. The following keys allow manipulation of the complex numbers stored in the paired user data memories. Memory arithmetic is not available in the complex number mode.
— clears both the real and imaginary parts of complex numbers stored in all memories (0, 1, and 2).

Stores the complex number entered in the paired user data memory m. Complex numbers may be entered in either rectangular or polar form, however, numbers in polar form are converted to rectangular form when the key is pressed and stored in their rectangular form.

Recalls the complex number stored in the paired user data memory m. The value in the display is the real part of the complex number. To display the imaginary part, press (xy).

Exchanges the complex number whose real part is in the display with the complex number in the paired user data memory m. If the displayed complex number is in polar form, it is converted to rectangular form first and then the numbers are swapped real for real and imaginary for imaginary.

STATISTICAL KEYS
When the key is pressed, the statistics mode is entered, memories 2 through 6 are cleared and STAT is displayed.
The key returns the calculator to normal calculation mode. The STAT indicator is removed and memories 2 through 6 are cleared.
The procedures to obtain statistical data are shown in the following charts.

**SINGLE-VARIABLE DATA ENTRY**

1. To Enter Single Occurrence Data Points
   - Enter data point
   - Press \( \times \)
   - Repeat for next data point

2. To Remove Single Occurrence Data Points Entered
   - Press \( \text{DEL} \)
   - Enter unwanted data point
   - Press \( \text{DEL} \)

3. To Enter Multiple Occurrence Data Points
   - Enter data point
   - Press \( \frac{1}{n} \)
   - Enter number of repetitions
   - Press \( \times \)
   - Repeat for next data points

4. To Remove Multiple Occurrence Data Points Entered
   - Press \( \text{DEL} \)
   - Enter unwanted data point
   - Press \( \text{DEL} \)
   - Enter number of repetitions
   - Press \( \text{DEL} \)
### TWO-VARIABLE DATA ENTRY

**1. To Enter Single Occurrence Data Points**
- Enter "x" data point
- Press $\text{Enter}$
- Enter "y" data point
- Press $\text{Enter}$
- Repeat for next data point

**2. To Remove Single Occurrence Data Points Entered**
- Enter unwanted "x" data point
- Press $\text{Delete}$
- Enter unwanted "y" data point
- Press $\text{Delete}$

**3. To Enter Multiple Occurrence Data Points**
- Enter "x" data point
- Press $\text{Enter}$
- Enter "y" data point
- Press $\text{Enter}$
- Enter number of repetitions
- Press $\text{Enter}$
- Repeat for next data points

**4. To Remove Multiple Occurrence Data Points Entered**
- Enter unwanted "x" data point
- Press $\text{Delete}$
- Enter unwanted "y" data point
- Press $\text{Delete}$
- Enter number of repetitions
- Press $\text{Delete}$

The procedures to obtain statistical data are shown in the following charts.
### SINGLE-VARIABLE DATA RESULTS

1. **Mean**
   - Press \( \text{[Sx]} \)  

2. **Population Standard Deviation**
   - Press \( \text{[Sp]} \)  

3. **Sample Standard Deviation**
   - Press \( \text{[Sv]} \)  

### TWO-VARIABLE DATA RESULTS

1. **Mean**
   - "y" data points: Press \( \text{[Sxy]} \)
   - "x" data points: Press \( \text{[Sx]} \) \( \times \) \( \text{[Sv]} \)

2. **Population Standard Deviation**
   - "y" data points: Press \( \text{[Sp]} \)
   - "x" data points: Press \( \text{[Sp]} \) \( \times \) \( \text{[Sp]} \)

3. **Sample Standard Deviation**
   - "y" data points: Press \( \text{[Sv]} \)
   - "x" data points: Press \( \text{[Sv]} \) \( \times \) \( \text{[Sv]} \)

4. **Intercept and Slope**
   - Press \( \text{[Sxy]} \) to obtain the intercept
   - Press \( \text{[Sx]} \) \( \times \) \( \text{[Sv]} \) to obtain the slope

5. **One Value Given Another**
   - Enter the x value and press \( \text{[Sx]} \) \( \times \) \( \text{[Sv]} \) to obtain a "y" value
   - Enter the y value and press \( \text{[Sv]} \) \( \times \) \( \text{[Sv]} \) to obtain an "x" value

6. **Correlation**
   - Press \( \text{[Cor]} \)
ACCURACY INFORMATION

For more accuracy information see the Accuracy Appendix in the Scientific Calculator Sourcebook.

Each calculation produces an 11-digit result which is rounded to an 8-digit standard display. The 5/4 rounding technique used adds 1 to the least significant digit in the display if the next non-displayed digit is five or more. If this digit is less than five, no rounding occurs. The higher order mathematical functions use iterative calculations. Most calculations are accurate to ±1 in the last displayed digit. There are a few instances in the solution of high order functions where display accuracy begins to deteriorate as the function approaches a discontinuous or undefined point. For example, the tangent of 67° is accurate for all displayed digits. However, the tangent of 89.99999° is accurate to only three places. Another example is when the $y^x$ function has a y value that approaches 1 and an x value that is a very large positive or negative number. The displayed result for 1.05^{-160} is accurate for all displayed digits, while 1.0000005^{-1600} is accurate to only five places.
In rectangular to polar conversions in all modes, variables more than five orders of magnitude apart display an angle of 0° or 90°. When converting the ordered pair of numbers (0,0), the θ value has arbitrarily been chosen as 90°, or π/2 radians, or 100 grads.

As long as the trigonometric function result is displayed in normal form rather than in scientific or engineering notation, all displayed digits are accurate for any angle from −36,000° to 36,000° and −40,000 to 40,000 grads. The equivalent range in radians (±200r) is comparable to degrees and grads in accuracy except at rotational multiples of π and π/2. The rounded value of π limits accuracy at these points. In general, the accuracy decreases one digit for each decade outside this range.

BATTERY INFORMATION

The calculator uses 2 of any of the following batteries for up to 750 hours of operation: Panasonic LR-44, Ray-O-Vac RW-82, Union Carbide (Eveready) A-78, or the equivalent. For up to 2000 hours of operation use Mallory 10L14, Union Carbide (Eveready) 357, Panasonic WL-14, Toshiba G-13, Ray-O-Vac RW-42, or the equivalent. Refer to the Appendix of the Scientific Calculator Sourcebook for battery replacement instructions.