Getting to Know Your TI-84 Plus Silver Edition

Turning Your TI-84 Plus Silver Edition On and Off

To turn on your TI-84 Plus Silver Edition, press [ON].

- If you had previously turned off your TI-84 Plus Silver Edition by pressing [2nd] [OFF], it will display the home screen as it was when you last used it.

To turn off your TI-84 Plus Silver Edition manually, press [2nd] [OFF].

- All settings and memory contents are retained by Constant Memory™.

To prolong the life of the batteries, **Automatic Power Down™ (APD™)** turns off your TI-84 Plus Silver Edition automatically after about five minutes without any activity.

Using the [2nd] and [ALPHA] Keys

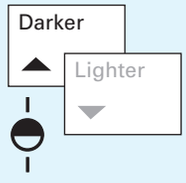
The secondary function of each key is printed in blue above the key. When you press the blue [2nd] key, the character, abbreviation, or word printed in blue above the other keys becomes active for the next keystroke. For example, when you press [2nd] and then [MATH], the TEST menu is displayed.

The alpha function of each key is printed in green above the key. When you press the green [ALPHA] key, the alpha character printed in green above the other keys becomes active for the next keystroke. For example, when you press [ALPHA] and then [MATH], the letter A is entered.

Adjusting the Display Contrast

To adjust the contrast, follow these steps:

1. Press and release the [2nd] key.
2. Press and hold [▲] or [▼] (which are above and below the contrast symbol).
   - [▲] Darkens the screen
   - [▼] Lightens the screen

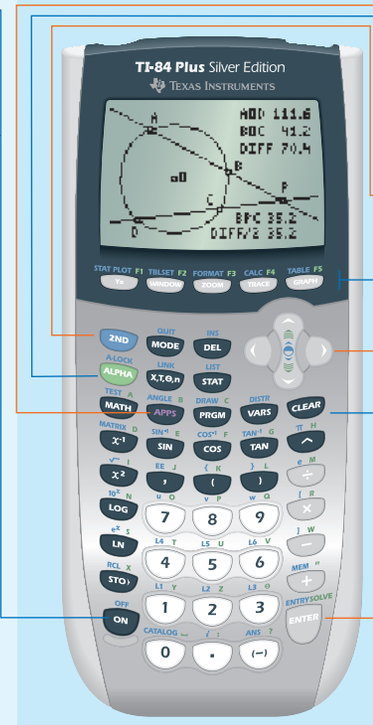


Home Screen

The home screen is the primary screen of the TI-84 Plus Silver Edition. On this screen, you can enter instructions to execute and expressions to evaluate. The answers are displayed on the same screen.

To return to the Home Screen from any other screen, press [2nd] [QUIT].

TI-84 Plus Silver Edition Keyboard



[APPS] key accesses the Handheld Software Applications (Apps) loaded on your TI-84 Plus Silver Edition

[ALPHA] accesses the alpha function printed in green above each key

[2nd] accesses the second function printed in blue above each key

Operations keys

[▲][▶][▼][◀] keys let you move the cursor in four directions

[CLEAR] erases (clears) the entry line or deletes an entry and answer on the home screen

[ENTER] evaluates an expression, executes an instruction, or selects a menu item

Special Features of the TI-84 Plus Silver Edition, TI-84 Plus, and TI-83 Plus

Flash™ — Electronic Upgradability

The TI-84 Plus Silver Edition, TI-84 Plus, and TI-83 Plus use Flash technology, which lets you update your operating system and add **Handheld Software Apps**, such as Topics in Algebra 1, Inequality Graphing, NoteFolio™, TImeSpan™, CellSheet™, and many more!

Comparing the TI-84 Plus Silver Edition and the TI-83 Plus

	TI-84 Plus Silver Edition	TI-83 Plus
Flash ROM	1.54 Mb	160 Kb
Holds up to	94 Apps	10 Apps
Preloaded Apps	18	4
Connectivity	USB cable ***included***	TI Connectivity USB cable sold separately
Case Color	***SILVER & Customizable***	Classic dark gray
Z80 Processor Speed	15 MHz	6 MHz
RAM	24 Kb	24 Kb

TI Connectivity Kit

With the TI Connect™ software and TI Connectivity USB cable, you can link your TI-84 Plus to a personal computer. As future software updates become available on the TI website, you can download the software to your computer and use the TI Connect software and TI Connectivity USB cable to update your TI-84 Plus.

Getting Started Using Your TI-84 Plus Silver Edition

TI-84 Plus Silver Edition Edit Keys

Keystroke	Result
▶ or ◀	Moves the cursor within an expression.
▲ or ▼	Moves the cursor from line to line within an expression that occupies more than one line. On the top line of an expression on the home screen, ▲ moves the cursor to the beginning of the expression. On the bottom line, ▼ moves the cursor to the end of the expression.
2nd ◀	Moves the cursor to the beginning of an expression.
2nd ▶	Moves the cursor to the end of an expression.
ENTER	Executes an instruction and/or an expression.
CLEAR	On a line with text on the home screen, clears the current line. On a blank line on the home screen, clears everything on the home screen. In an editor, clears the expression or value where the cursor is located.
DEL	Deletes a character at the cursor.
2nd [INS]	Changes the cursor to an underline (_) and inserts characters in front of the underline cursor; to end insertion, press 2nd [INS], or press ◀ ▲ ▶ or ▼.
2nd	Changes the cursor to ; the next keystroke performs a 2nd operation (in blue above a key); to cancel 2nd, press 2nd again.
ALPHA	Changes the cursor to A; the next keystroke pastes an alpha character (in green above a key); to cancel ALPHA press ALPHA again, or press ◀ ▲ ▶ or ▼.
2nd [A-LOCK]	Changes the cursor to A; sets alpha-lock; subsequent keystrokes paste alpha characters; to cancel alpha-lock, press ALPHA. If you are prompted to enter a name for a group or a program, alpha-lock is set automatically.
X,T,Θ,*n*	Pastes an **X** in **Func** mode, a **T** in **Par** mode, a **θ** in **Pol** mode, or an ***n*** in **Seq** mode with one keystroke.

Display Cursors

In most cases, the appearance of the cursor indicates what will happen when you press the next key.

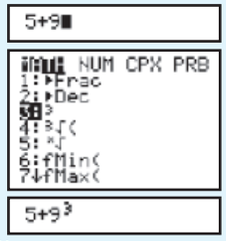
Cursor	Appearance	Effect of next keystroke
Entry	Solid rectangle ■	A character is entered at the cursor; any existing character is overwritten.
Insert	Underline _	A character is inserted in front of the cursor location.
Second	Up arrow ▲	A 2nd character (blue on the keyboard) is entered or a 2nd operation is executed.
Alpha	Reverse A A	An alpha character (green on the keyboard) is entered or SOLVE is executed.
Full	Checkerboard rectangle ▦	No entry; the maximum number of characters has been entered at a prompt or memory is full.

Using a TI-84 Plus Silver Edition Menu

You can access most TI-84 Plus Silver Edition operations using menus. When you press a key or key combination to display a menu, one or more menu names appear on the top line of the screen.

- The menu name on the left side of the top line is highlighted. Up to seven items in that menu are displayed, beginning with item 1, which is also highlighted.
- A number or letter identifies each menu item's place in the menu. The order is **1** through **9**, then **0**, then **A**, **B**, **C**, and so on.
- When the menu continues beyond the displayed items, a down arrow (↓) replaces the colon next to the last displayed item.
- When a menu item ends in an ellipsis (...), selecting the item will display a secondary menu or editor.

Displaying a Menu



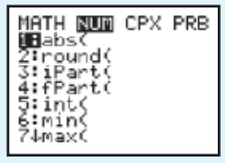
While using your TI-84 Plus Silver Edition, you will often need to access items from its menus. When you press a key that displays a menu, that menu temporarily replaces the screen where you are working.

Example: Calculate $5 + 9^3$

1. 5 + 9 Enter the expression in the home screen
2. Press MATH
3. Press 3 to choose the correct item from the menu
4. Press ENTER to calculate

Keystrokes: 5 + 9 MATH 3 ENTER 734

Moving Between Menus



Some of the keys on your TI-84 Plus Silver Edition access more than one menu. When you press such a key, the names of all accessible menus are displayed on the top line. When you highlight a menu name, the items in that menu are displayed. Press ▶ and ◀ to highlight each menu name.

Setting Modes

Mode settings control how your TI-84 Plus Silver Edition displays and interprets numbers and graphs. Mode settings are retained by the Constant Memory™ feature when you turn off your TI-84 Plus Silver Edition. All numbers, including elements of matrices and lists, are displayed according to the current mode settings.

To display the mode settings on your TI-84 Plus Silver Edition, press MODE. The current settings will be highlighted. Default settings are highlighted below.

Normal Sci Eng	Numeric notation
Float 0123456789	Number of decimal places
Radian Degree	Unit of angle measure
Func Par Pol Seq	Type of graphing
Connected Dot	Whether to connect graph points
Sequential Simul	Whether to plot simultaneously
Real a+b*i* *re* θ*i*	Real, rectangular complex, or polar complex
Full Horiz G-T	Full screen, two split-screen modes

Changing Mode Settings

To change mode settings:

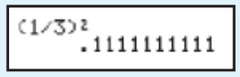
1. Press ▼ or ▲ to move the cursor to the line of the setting you want.
2. Press ▶ or ◀ to move the cursor to the setting you want.
3. Press ENTER.

TI-84 Plus Silver Edition Expressions, Menus, and Graphing

Entering Expressions and Instructions

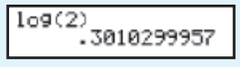
What is an Expression?

An expression is a group of numbers, variables, or functions and their arguments, or a combination of these elements. An expression evaluates to a single answer. For example, $(\frac{1}{3})^2$ is an expression. On the TI-84 Plus Silver Edition, you enter an expression in the same order as you would write it on paper. You can enter an expression on the home screen to calculate an answer.

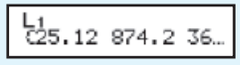


Entering an Expression

To create an expression, you enter numbers, variables, and functions from the keyboard and menus on your TI-84 Plus Silver Edition. An expression is completed when you press [ENTER], regardless of the cursor location. The entire expression is evaluated according to Equation Operating System (EOS™) rules (see General Math page), and the answer is displayed. When an entry is executed on the home screen, the answer is displayed on the right side of the next line.



The mode settings control the way the TI-84 Plus Silver Edition interprets expressions and displays answers. If an answer, such as a list or matrix, is too long to display entirely on one line, an ellipsis (...) is displayed to the right or left. Press ▶ or ◀ to display the rest of the answer.



To display the MATH menu, press [MATH]

MATH NUM CPX PRB

1: ▶Frac	Displays answer as a fraction
2: ▶Dec	Displays answer as a decimal
3: ^{3}	Calculates cube
4: $\sqrt[3]{}$(	Calculates cube root
5: $\sqrt[x]{}$	Calculates xth root
6: fMin(	Finds minimum of a function
7: fMax(	Finds maximum of a function
8: nDeriv(	Computes numeric derivative
9: fnInt(	Computes integral of a function
0: Solver...	Displays equation solver

To display the MATH NUM menu, press [MATH] ▶

MATH NUM CPX PRB

1: abs(	Computes absolute value
2: round(	Rounds value to specified decimal place
3: iPart(	Calculates integer part
4: fPart(	Calculates fractional part
5: int(	Finds greatest integer less than or equal to number
6: min(	Finds minimum value
7: max(	Finds maximum value
8: lcm(	Calculates least common multiple
9: gcd(	Calculates greatest common divisor

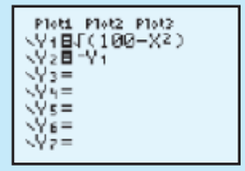
To display the MATH PRB menu, press [MATH] ◀

MATH NUM CPX PRB

1: rand	Generates random number between 0 and 1
2: nPr	Computes number of permutations
3: nCr	Computes number of combinations
4: !	Calculates factorial
5: randInt(	Generates random integer in specified range
6: randNorm(	Generates random # from Normal distribution
7: randBin(	Generates random # from Binomial distribution

Defining or Editing a Function for Graphing

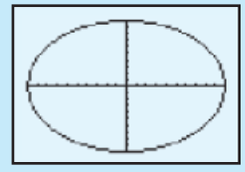
To Define or Edit a Function



1. Press [Y=] to display the Y= editor.
2. Press ▼ to move the cursor to the function you want to define or edit. To erase a function, press [CLEAR].
3. Enter or edit an expression to define the function.

Displaying a New Graph

To display a graph of the selected function, press [GRAPH]. TRACE, ZOOM, and CALC operations display the graph automatically. As the graph is plotted, the busy indicator is on, and the X and Y values are updated.



Free-Moving Cursor

When you first display the graph, no cursor is visible. You must press ◀ ▶ ▲ or ▼ for the cursor to move from the center of the viewing window. Continue pressing ◀ ▶ ▲ or ▼ to move the cursor around.

Tracing a Function

Use the TRACE operation to move the cursor from one plotted point to the next along a function. To begin, press [TRACE]. The TRACE cursor is on the first selected function in the Y= editor, centered horizontally on the screen. The cursor coordinates are displayed at the bottom of the screen if ***CoordOn*** format is selected. The Y= expression is displayed in the top left corner of the screen if ***ExprOn*** format is selected.

Moving the TRACE Cursor

To move the TRACE cursor	Do this:
To the previous or next plotted point	Press ◀ or ▶
Five plotted points on a function (***Xres*** affects this)	Press [2nd] ◀ or [2nd] ▶
To any valid X value on a function	Enter a value & press [ENTER]
From one function to another	Press ▲ or ▼

To alter the viewing area of the graph, press [ZOOM]

ZOOM MEMORY

1: ZBox	Draws a box to define the viewing window
2: Zoom In	Magnifies the graph around the cursor
3: Zoom Out	Views more of a graph around the cursor
4: ZDecimal	Sets ΔX and ΔY to 0.1
5: ZSquare	Sets equal-size pixels on the X and Y axes
6: ZStandard	Sets the standard window variables
7: ZTrig	Sets the built-in trig window variables
8: ZInteger	Sets integer values on the X and Y axes
9: ZoomStat	Sets the values for current stat plots
0: ZoomFit	Fits ***Ymin*** and ***Ymax*** between ***Xmin*** and ***Xmax***

To display the CALCULATE menu, press [2nd] [CALC]

CALCULATE

1: value	Calculates a function Y value for a given X
2: zero	Finds a zero (x-intercept) of a function
3: minimum	Finds a minimum of a function
4: maximum	Finds a maximum of a function
5: intersect	Finds an intersection of two functions
6: dy/dx	Finds a numeric derivative of a function
7: ∫f(x)dx	Finds a numeric integral of a function

To return to the Home Screen from any other screen, press [2nd] [QUIT].

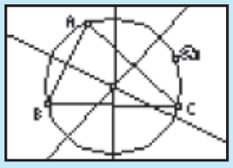
All About Apps for the TI-84 Plus Silver Edition

If you've ever wondered...

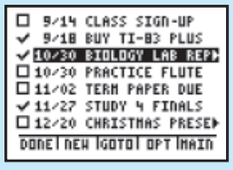
So what is that little APPS key on your TI-84 Plus Silver Edition for, anyway?

Handheld Software Applications, or Apps, are pieces of software you can add on to your TI-84 Plus Silver Edition or TI-84 Plus, in the same way you would add software to your computer. This allows you to customize your TI handheld to meet your class needs and update it from one year to the next. Pretty cool, huh?

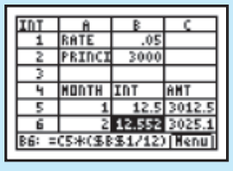
The TI-84 Plus Silver Edition comes preloaded with lots of Apps — StudyCards™, Probability Simulation, CBL™/CBR™, Conic Graphing, Cabri™ Jr., Organizer, CellSheet™, Puzzle Pack, Science Tools, Catalog Help, Vernier EasyData™, to name a few! The TI-84 Plus comes preloaded with StudyCards, Probability Simulation, CBL/CBR, Catalog Help, and other Apps. Some of the coolest Apps for the TI-84 Plus Silver Edition and TI-84 Plus are:



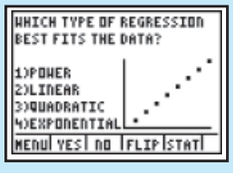
Cabri™ Jr.
Add a new dimension to your learning experience with Cabri Jr., our interactive Geometry App. Construct, analyze and transform mathematical models and geometric diagrams. Then alter geometric objects on the fly to see patterns, make conjectures and draw conclusions.



Organizer
Keep track of where you're going and where you've been. Put your future and your friends at your fingertips when you input contacts and tasks.

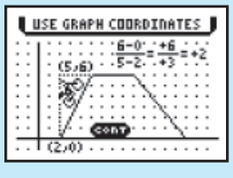


CellSheet™
You have a spreadsheet to your TI-84 Plus Silver Edition! Create graphs, including pie charts, and fill a range of cells with formulas. You can even import and export files to and from Excel®.



StudyCards™
Create electronic flash cards to use as a study tool for quiz or test review. Download ready made StudyCard stacks for the SAT* and ACT from our collection at **education.ti.com/studycards**. Create and share stacks with other students from all over the world.

NoteFolio™
Easily type notes for all your classes with the **TI Keyboard**. Select, cut, copy, paste, delete and insert text in your notes. Best of all, use the NoteFolio Creator PC utility to transfer notes to and from Word® files.



Topics in Algebra 1
Walk, run or ride a bicycle through basic concepts in algebra. You can be the envy of all your friends by grasping this mystical subject with this fun and easy tutorial.

To access the Apps on your TI-84 Plus Silver Edition

All you have to do is press the APPS key, scroll down the list to the App you'd like to explore, and press ENTER. If you get stuck using an App, visit **education.ti.com/guides** to download the FREE instruction guide.

But that's not all...

We also have dozens of other Apps you can download, and all of them are FREE! Visit the TI website at **education.ti.com/apps** to find out more information on all of the Apps you can download.

So how do you get these free Apps?

First, you'll need a **TI Connectivity USB cable** – one is included with the TI-84 Plus Silver Edition and is available as an accessory with the TI-83 Plus model. You can purchase a TI Connectivity USB cable at a retail store or the **TI Online Store**. USB and serial cables are available for both Windows® PCs and Macintosh® computers.

Inside the TI Connectivity kit (and TI-84 Plus Silver Edition) package, you will find a CD with **TI Connect™** link software, which allows your computer to communicate with your TI-84 Plus Silver Edition handheld. Follow the directions to install the software from the CD into your computer.

Next, visit **education.ti.com/apps** to browse through the FREE Apps that are available for the TI-84 Plus and TI-83 Plus families of graphing calculators. All Apps are FREE to download – simply follow the steps online. Just be sure to save the file in a location you'll remember.

Now it's time to transfer the App from your computer to your TI-84 Plus Silver Edition. This is the easy part! Just plug your USB cable into your computer and your TI-84 Plus Silver Edition, launch the TI Connect software, and click on **Device Explorer**. TI Connect will automatically detect your device. All you have to do is find the App file you saved, drag it to the Device Explorer window, drop it, and wait for it to transfer. Voilà! Press the APPS key to see your newly transferred App! Good luck and happy downloading! We know you'll have an Appsolute blast!

General Math with the TI-84 Plus Silver Edition

Arithmetic Operations and Properties

Arithmetic Operations with the TI-84 Plus Silver Edition

Addition: valueA + valueB	Returns valueA plus valueB	+
Subtraction: valueA - valueB	Subtracts valueB from valueA	−
Multiplication: valueA × valueB	Returns valueA times valueB	×
Division: valueA ÷ valueB	Returns valueA divided by valueB	÷

Properties of Addition & Multiplication

Commutative property of addition	$a+b = b+a$
Commutative property of multiplication	$ab = ba$
Associative property of addition	$a+(b+c) = (a+b)+c$
Associative property of multiplication	$a(bc) = (ab)c$
Distributive property of multiplication over addition	$a(b+c) = ab+ac$
Distributive property of multiplication over subtraction	$a(b–c) = ab–ac$

Numbers

Prime Numbers

A whole number with only two factors: itself and 1
EXAMPLES: 2, 3, 5, 7, 11, 13, 17

Common Factors

A number that divides exactly into two or more given numbers
EXAMPLES: 1, 2, 3, 4, 6, and 12 are factors of 12

Greatest Common Factor

The greatest number that is a factor of two or more numbers
EXAMPLE: 4 is the greatest common factor of 12 and 16.
To calculate the greatest common factor on your TI-84 Plus Silver Edition, press MATH ▸ ***9:gcd(.*** This will compute the greatest common factor of valueA and valueB, which can be real numbers or lists.

Least Common Multiple

The smallest number that is a multiple of two or more numbers
EXAMPLE: 12 is the least common multiple of 2, 3, 4 and 6.
To calculate the least common multiple on your TI-84 Plus Silver Edition, press MATH ▸ ***8:lcm(.*** This will compute the least common multiple of valueA and valueB, which can be real numbers or lists.

Order of Operations

General Rules

1. Do all operations within parentheses
2. Do all powers and roots
3. Do multiplication and division in order from left to right
4. Do addition and subtraction in order from left to right

Equation Operating System (EOS™) for the TI-84 Plus Silver Edition

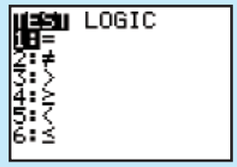
EOS defines the order in which functions and expressions are entered and evaluated. EOS evaluates the functions in an expression in this order:

1. Functions that precede the argument, such as $\sqrt{}$ (, *sin(*, or *log(*
2. Functions that are entered after the argument, such as ^{2}, $^{-1}$, *!*, *°*, or *ʳ*, and conversions
3. Powers and roots, such as 2^5 or $\sqrt[5]{32}$
4. Permutations (***nPr***) and combinations (***nCr***)
5. Multiplication, implied multiplication, and division
6. Addition and subtraction
7. Relational functions, such as > or ≤
8. Logic operator ***and***
9. Logic operators ***or*** and ***xor***

Within a priority level, EOS evaluates functions from left to right. Calculations within parentheses are evaluated first.

Math Symbols

To access many math symbols, go to the TEST Menu on your TI-84 Plus Silver Edition, by pressing 2nd [TEST] .



Powers and Roots

Square: value^2	The x^2 key returns a value multiplied by itself. The value can be a real or complex number, expression, or list.
Square root: $\sqrt{(value)}$	2nd [$\sqrt{}$] returns the square root of a real or complex number, expression, or list.

Common Squares and Roots

n	n^2	$\sqrt{n}$	n	n^2	$\sqrt{n}$
1	1	1.0	9	81	3.0
2	4	1.414	10	100	3.162
3	9	1.732	15	225	3.873
4	16	2.0	20	400	4.472
5	25	2.236	25	625	5.0
6	36	2.449	100	10,000	10.0
7	49	2.646	$^1/_2$	$^1/_4$	0.707
8	64	2.828	$^1/_4$	$^1/_{16}$	$^1/_2$

Cube: value^3	Press MATH. ***3:³*** Returns the cube of a real or complex number, expression, list, or square matrix.
Cube root: $\sqrt[3]{(value)}$	Press MATH. ***4:³√(*** Returns the cube root of a real or complex number, expression, or list.
xth root: $\sqrt[x]{value}$	Press MATH. ***5:ˣ√(*** Returns xth root of a value.
Power: value^power	The ^ key returns a value raised to a power. Value can be a real or complex number or expression.
Power of 10: 10^(value)	Press 2nd [10^x]. Returns 10 raised to the value power. Value can be a real or complex number or expression.

Fractions, Decimals and Percents

1	=	1.0	=	100%
$^1/_2$	=	0.5	=	50%
$^1/_3$	=	$0.33\overline{3}$	=	33.3%
$^1/_4$	=	0.25	=	25%
$^1/_5$	=	0.2	=	20%
$^1/_6$	=	$0.16\overline{6}$	=	16.7%
$^1/_8$	=	0.125	=	12.5%
$^1/_9$	=	$0.1\overline{1}$	=	11.1%
$^1/_{10}$	=	0.1	=	10%
$^1/_{12}$	=	$0.08\overline{3}$	=	8.3%
$^2/_3$	=	$0.66\overline{6}$	=	66.7%
$^3/_4$	=	0.75	=	75%

value ▸***Dec***	Press MATH. ***2:▸Dec*** Displays a real or complex number, expression, list or matrix in decimal format.
value ▸***Frac***	Press MATH. ***1:▸Frac*** Displays a real or complex number, expression, list or matrix as a fraction simplified to its simplest terms.

Algebra with the TI-84 Plus Silver Edition

Law of Exponents & Radicals

Formulas	Examples (where a=3, b=2, P=5, Q=6, r=4, s=2)	Keystrokes
$a^r \times a^s = a^{r+s}$	$3^4 \times 3^2 = 3^{4+2}$	3 ^ (4 + 2) ENTER 729
$\frac{a^r}{a^s} = a^{r-s}$	$\frac{3^4}{3^2} = 3^{4-2}$	3 ^ (4 − 2) ENTER 9
$\frac{a^p a^q}{a^r} = a^{p+q-r}$	$\frac{3^5 \times 3^6}{3^4} = 3^{5+6-4}$	3 ^ (5 + 6 − 4) ENTER 2187
$(ab)^r = a^r b^r$	$(3 \times 2)^4 = 3^4 \times 2^4$	3 ^ 4 × 2 ^ 4 ENTER 1296
$\left(\frac{a}{b}\right)^r = \frac{a^r}{b^r}\ (b \neq 0)$	$\left(\frac{3}{2}\right)^4 = \frac{3^4}{2^4}$	3 ^ 4 ÷ 2 ^ 4 ENTER 5.0625
$a^{\frac{r}{s}} = \sqrt[s]{a^r}$	$9^{\frac{2}{4}} = \sqrt[4]{9^2}$	4 MATH 5 (9 ^ 2) ENTER 3
$a^0 = 1\ (a \neq 0)$	$3^0 = 1$	3 ^ 0 ENTER 1
$a^{-r} = \frac{1}{a^r}\ (a \neq 0)$	$3^{-4} = \frac{1}{3^4}$	1 ÷ 3 ^ 4 ENTER .0123

Binomial Expansion

$a\,(b + c) = ab + ac$

$(a + b)\,(c + d) = ac + ad + bc + bd$

$(a + b)^2 = a^2 + 2ab + b^2$

$(a - b)^2 = a^2 - 2ab + b^2$

$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$

$(a + b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$

$(a + b)^5 = a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$

Factoring

$a^2 - b^2 = (a + b)\,(a - b)$

$a^2 + 2ab + b^2 = (a + b)^2$

$a^2 - 2ab + b^2 = (a - b)^2$

$a^3 + b^3 = (a + b)\,(a^2 - ab + b^2)$

$a^3b - ab = ab\,(a + 1)\,(a - 1)$

$a^3 - b^3 = (a - b)\,(a^2 + ab + b^2)$

Factorial

$n! = n\,(n-1)\,(n-2)\,\ldots\,(2)\,(1)$

Example: $5! = 5\,(4)\,(3)\,(2)\,(1)$

Keystrokes: 5! = 5 MATH ◂ *4* ENTER 120

Logarithms LOG LN [e^x]

$y = \log_a x$ means $a^y = x$

$\log_a xy = \log_a x + \log_a y$

$\log_a \frac{x}{y} = \log_a x - \log_a y$

$\ln x = \log_e x$

$\log_a x^r = r \log_a x$

$\log_a 1 = 0$

$\log_a a = 1$

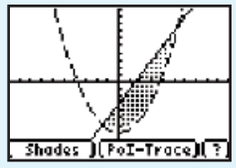
$\ln e = 1$

$\log x = \log_{10} x$

$\log_a x = \frac{\log_{10} x}{\log_{10} a}$

Graphing Inequalities

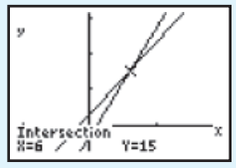
The **Inequality Graphing** App for the TI-84 Plus Silver Edition is used here to enter the equations $y \leq 2x-3$ and $y > .5x^2-7$.



The intersection of $y \leq 2x-3$ and $y > .5x^2-7$ is shaded.

Solving Linear Systems by Graphing

The intersection of two functions is the solution to the system. Graphing provides a quick and powerful way to solve linear systems.



1. Enter equations in the Y= editor.
2. Press GRAPH to graph both equations. (You may need to adjust the viewing window.)
3. Press 2nd [CALC] ***5: intersect*** to find the point of intersection.
4. Press ENTER to select the 1st curve and again to select the 2nd curve.
5. Enter your best guess and press ENTER.

Quadratic Formula

If $a \neq 0$, the roots of $ax^2 + bx + c = 0$ are $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

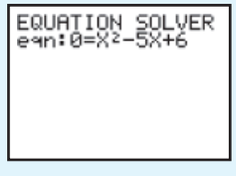
Example: $3x^2 + 2x - 4$ (where a=3, b=2, c=-4)

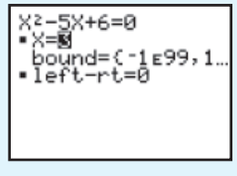
$$x = \frac{-2 \pm \sqrt{2^2 - 4(3)(-4)}}{2(3)}$$

		Keystrokes
Step 1	$2^2 - 4(3)(-4)$	2 x^2 − 4 × 3 × (−) 4 ENTER 52
Step 2	$-2 + \sqrt{52}$	(−) 2 + 2nd [$\sqrt{\ }$] 5 2) ENTER 5.211
	$-2 - \sqrt{52}$	(−) 2 − 2nd [$\sqrt{\ }$] 5 2) ENTER -9.211
Step 3	$\frac{5.211}{2(3)}$	5 • 2 1 1 ÷ (2 × 3) ENTER 0.869
	$\frac{-9.211}{2(3)}$	(−) 9 • 2 1 1 ÷ (2 × 3) ENTER -1.535

Using the Equation Solver

Use the Equation Solver on your TI-84 Plus Silver Edition to solve for any variable in an equation. In this example, the Solver is being used to find one of the roots of the polynomial $x^2 - 5x + 6$.





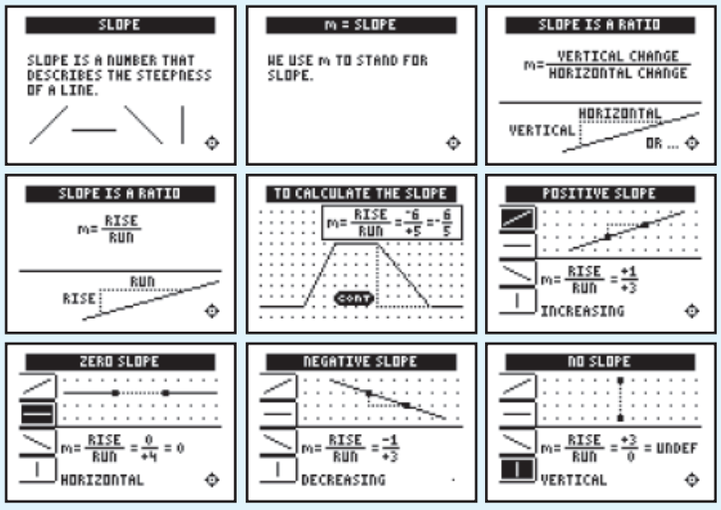
1. Press MATH ***0: Solver...***
2. Enter equation (must be in form where equation is set equal to 0) and press ENTER.
3. Place cursor next to variable for which you would like to solve.
4. Enter a guess for the value.
5. Press ALPHA [SOLVE] to see a solution.

More Algebra with the TI-84 Plus Silver Edition

Definition of Slope

This section uses the **Topics in Algebra 1** App for the TI-84 Plus Silver Edition to help define slope.

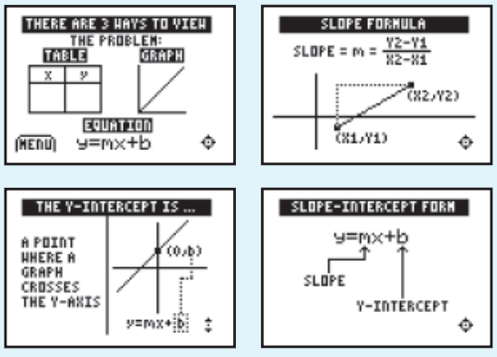
$$m = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$



Equations of Lines

This section features the **Topics in Algebra 1** App for the TI-84 Plus Silver Edition.

$Ax + By = C$	Standard form — graph using **intercepts**
$y = mx + b$	Slope-intercept form — graph using **m** and **(0,b)**
$y - y_1 = m(x - x_1)$	Point-slope form — graph using **m** and **(x_1, y_1)**



Standard form example

Given $3x + 2y = 6$, find intercepts:

$3(0) + 2y = 6$	$3x + 2(0) = 6$	x | y
$2y = 6$	$3x = 6$	0 | 3
$y = 3$	$x = 2$	2 | 0

Point-slope form example

Given m=3 and (2,-3)

Equation

$y - (-3) = 3(x-2)$
$y + 3 = 3x - 6$
$y = 3x - 9$

Keystrokes

Y= CLEAR 3 X,T,Θ,n − 9 ZOOM 0

The Distance Formula

The Distance Formula is used to calculate the distance between two points.

$$d(P_1, P_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Example: Find the distances between the points P_1 (2, 5) and P_2 (-3, 1).

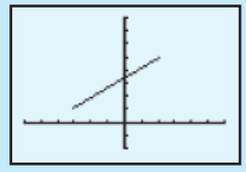
$$d(P_1, P_2) = \sqrt{(-3 - 2)^2 + (1 - 5)^2} = \sqrt{(-5)^2 + (-4)^2}$$
$$= \sqrt{25 + 16} = \sqrt{41} \approx 6.403$$

Keystrokes

2nd [√] ((−) 3 − 2) x^2 + (1 − 5) x^2) ENTER ≈ 6.403

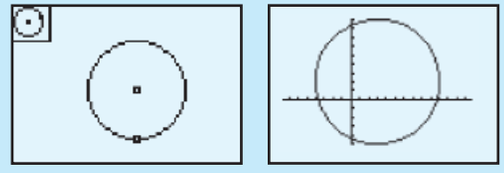
To draw the line segment between (-3, 1) and (2, 5) on your TI-84 Plus Silver Edition:

2nd [DRAW] ***2:Line*** (−) 3 , 1 , 2 , ☐) ENTER

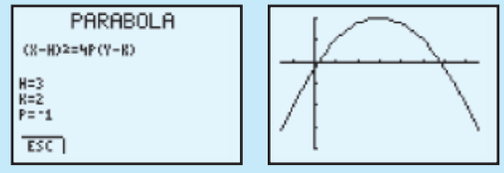


Quadratic Functions

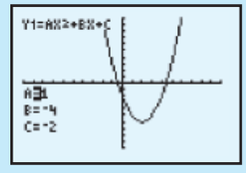
This section features the **Conic Graphing** App for the TI-84 Plus Silver Edition.



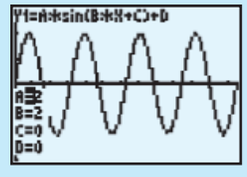
Equation of a circle: $(x - H)^2 + (y - k)^2 = R^2$
Values are entered for the center and the radius. The **Conic Graphing** App produces a circle you can now trace.



Equation of a parabola: $(x - H)^2 = 4P(y - k)$
Values are entered for the vertex (H, K) and the distance (P) between the directrix and the vertex. The **Conic Graphing** App produces a parabola you can now trace.

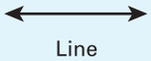


The **Transformation Graphing** App allows you to see what happens to a graph as you change its coefficient(s).



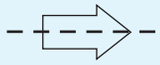
Geometry with the TI-84 Plus Silver Edition

Lines


Line


Ray


Line Segment


Line of Symmetry

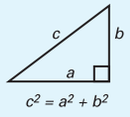

Parallel Lines

Creation of primitive geometric objects as Points, Lines, Line Segments and many others is fun and easy using the **Cabri Jr.**™ App for the TI-84 Plus Silver Edition.

Triangles

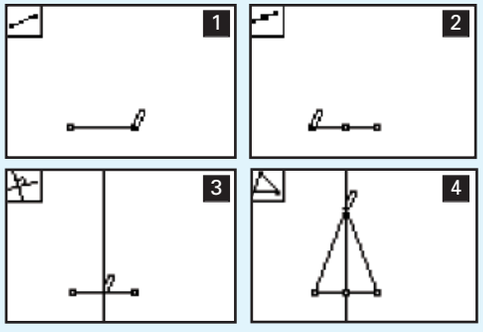
This section features the **Cabri Jr.** App for the TI-84 Plus Silver Edition.

Equilateral: all sides and angles equal
Isosceles: two sides and angles equal
Right: one 90 degree angle



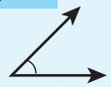
$c^2 = a^2 + b^2$
Pythagorean Theorem

Example: Draw an Isosceles Triangle

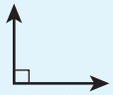


1. Create a segment
2. Find the middle of the segment
3. Trace a perpendicular line crossing the middle point
4. Trace a triangle using the two existing points of the segment and a point on the perpendicular line

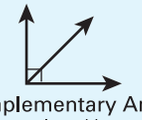
Angles

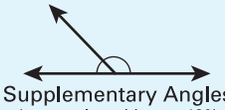

Acute Angle
(less than 90)

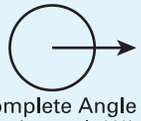

Obtuse Angle
(greater than 90)


Right Angle
(equals 90)


Straight Angle
(equals 180)

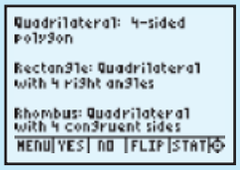

Complementary Angles
(two angles add up to 90)

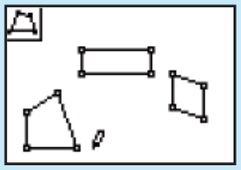

Supplementary Angles
(two angles add up to 180)

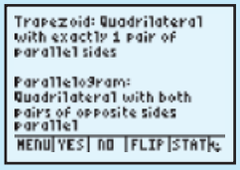

Complete Angle
(rotation equals 360)

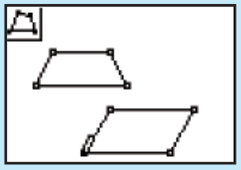
Polygons

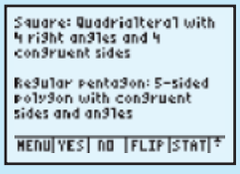
The information in this section is presented using screen shots from the **StudyCards**™ and **Cabri Jr.** Apps for the TI-84 Plus Silver Edition.

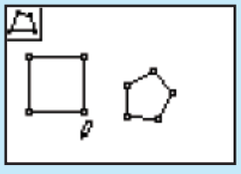






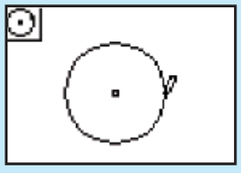




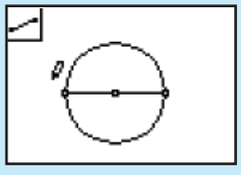


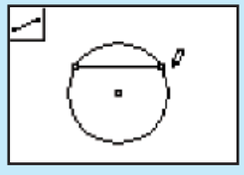
Circles

This section features the **Cabri Jr.** App for the TI-84 Plus Silver Edition.

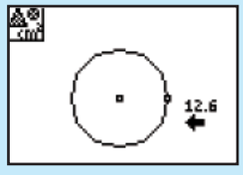

Circle

Diameter = 2(radius)*
Circumference = π(diameter)*
Area = π(radius)²*

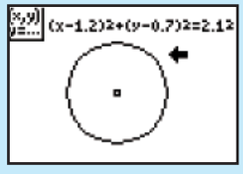

Diameter


Chord

Area



Circle's Equation



Geometric Formulas

All Perimeters
P = a+b+c+ ...

Square
Perimeter $P = 4s$
Area $A = s^2$

Rectangle
Perimeter $P = 2l+2w$
Area $A = lw$

Circle
Circumference $C = 2\pi r$
Area $A = \pi r^2$

Triangle
Perimeter $P = a+b+c$
Area $A = \frac{1}{2} bh$

Parallelogram
Perimeter $P = a+b+c+d$
Area $A = bh$

Trapezoid
Perimeter $P = a+b+c+d$
Area $A = \frac{(a+b)h}{2}$

Rectangular Prism
Surface $S = 2(hl+lw+hw)$
Volume $V = lwh$

Sphere
Surface $S = 4\pi r^2$
Volume $V = \frac{4\pi r^3}{3}$

Right Circular Cylinder
Lateral Surface $S = 2\pi rh$
Total Surface $S = 2\pi rh + 2\pi r^2$
Volume $V = \pi r^2 h$

Right Circular Cone
Lateral Surface $S = \pi r \sqrt{r^2+h^2}$
Total Surface $S = \pi r \sqrt{r^2+h^2}+\pi r^2$
Volume $V = \frac{1}{3} \pi r^2 h$

Frustum of a Cone
Volume $V = \frac{1}{3} \pi h(r^2+rR+R^2)$

Circular Sector
Area $A = \frac{1}{2} r^2 \theta$

Circular Ring
Area $A = \pi(R^2-r^2)$

education.ti.com/CabriJr

Trigonometry with the TI-84 Plus Silver Edition

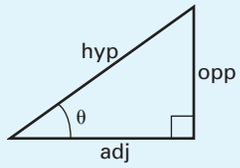
Trigonometric Functions

Acute Angles

SIN $\sin\theta = \frac{opp}{hyp}$ $\quad \csc\theta = \frac{hyp}{opp}$

COS $\cos\theta = \frac{adj}{hyp}$ $\quad \sec\theta = \frac{hyp}{adj}$

TAN $\tan\theta = \frac{opp}{adj}$ $\quad \cot\theta = \frac{adj}{opp}$

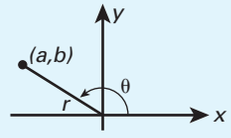


Arbitrary Angles

$\sin\theta = \frac{b}{r}$ $\quad \csc\theta = \frac{r}{b}$

$\cos\theta = \frac{a}{r}$ $\quad \sec\theta = \frac{r}{a}$

$\tan\theta = \frac{b}{a}$ $\quad \cot\theta = \frac{a}{b}$

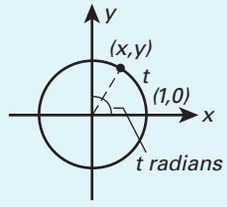


Real Numbers

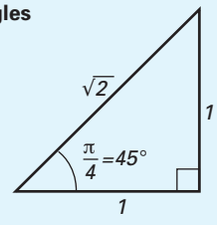
$\sin t = y$ $\quad \csc t = \frac{1}{y}$

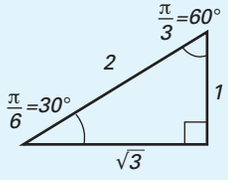
$\cos t = x$ $\quad \sec t = \frac{1}{x}$

$\tan t = \frac{y}{x}$ $\quad \cot t = \frac{x}{y}$



Special Triangles





Trigonometric Identities

$\csc t = 1/\sin t$ $\quad \tan t = \sin t/\cos t$

$\sec t = 1/\cos t$ $\quad \cot t = \cos t/\sin t$

$\cot t = 1/\tan t$

$\sin^2 t + \cos^2 t = 1$ $\quad \sin(-t) = -\sin t$

$1 + \tan^2 t = \sec^2 t$ $\quad \cos(-t) = \cos t$

$1 + \cot^2 t = \csc^2 t$ $\quad \tan(-t) = -\tan t$

$\sin(u + v) = \sin u \cos v + \cos u \sin v$

$\cos(u + v) = \cos u \cos v - \sin u \sin v$

$$\tan(u + v) = \frac{\tan u + \tan v}{1 - \tan u \tan v}$$

$\sin(u - v) = \sin u \cos v - \cos u \sin v$

$\cos(u - v) = \cos u \cos v + \sin u \sin v$

$$\tan(u - v) = \frac{\tan u - \tan v}{1 + \tan u \tan v}$$

$\sin 2u = 2 \sin u \cos u$

$\cos 2u = \cos^2 u - \sin^2 u = 1 - 2\sin^2 u = 2\cos^2 u - 1$

$$\tan 2u = \frac{2\tan u}{1 - \tan^2 u}$$

$$\left|\sin\frac{u}{2}\right| = \sqrt{\frac{1 - \cos u}{2}} \qquad \left|\cos\frac{u}{2}\right| = \sqrt{\frac{1 + \cos u}{2}}$$

$$\tan\frac{u}{2} = \frac{1 - \cos u}{\sin u} = \frac{\sin u}{1 + \cos u} \qquad \tan^2 u = \frac{1 - \cos 2u}{1 + \cos 2u}$$

$$\sin^2 u = \frac{1 - \cos 2u}{2} \qquad \cos^2 u = \frac{1 + \cos 2u}{2}$$

$\sin u \cos v = \frac{1}{2}[\sin(u + v) + \sin(u - v)]$

$\cos u \sin v = \frac{1}{2}[\sin(u + v) - \sin(u - v)]$

$\cos u \cos v = \frac{1}{2}[\cos(u + v) + \cos(u - v)]$

$\sin u \sin v = \frac{1}{2}[\cos(u - v) - \cos(u + v)]$

Special Values of Trigonometric Functions

θ (degrees)	θ (radians)	sin θ	cos θ	tan θ	cot θ	sec θ	csc θ
0°	0	0	1	0	–	1	–
30°	$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$	$\sqrt{3}$	$\frac{2\sqrt{3}}{3}$	2
45°	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1	1	$\sqrt{2}$	$\sqrt{2}$
60°	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\frac{\sqrt{3}}{3}$	2	$\frac{2\sqrt{3}}{3}$
90°	$\frac{\pi}{2}$	1	0	–	0	–	1

Inverse Trigonometric Functions

Function	Domain	Range
2nd [SIN⁻¹] $y = \sin^{-1} x$	$-1 \le x \le 1$	$-\frac{\pi}{2} \le y \le \frac{\pi}{2}$
2nd [COS⁻¹] $y = \cos^{-1} x$	$-1 \le x \le 1$	$0 \le y \le \pi$
2nd [TAN⁻¹] $y = \tan^{-1} x$	All real numbers	$-\frac{\pi}{2} < y < \frac{\pi}{2}$
$y = \cot^{-1} x$	All real numbers	$0 < y < \pi$
$y = \sec^{-1} x$	$\lvert x\rvert \ge 1$	$\left[0, \frac{\pi}{2}\right) \cup \left(\frac{\pi}{2}, \pi\right]$
$y = \csc^{-1} x$	$\lvert x\rvert \ge 1$	$\left[-\frac{\pi}{2}, 0\right) \cup \left(0, \frac{\pi}{2}\right]$

Laws of Sines and Cosines

Sine

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

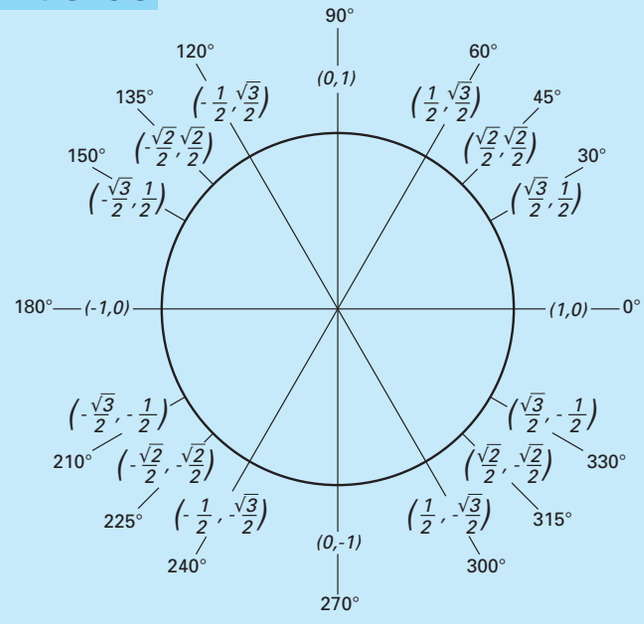
Cosine

$a^2 = b^2 + c^2 - 2bc\cos A$

$c^2 = a^2 + b^2 - 2ab\cos C$

$b^2 = c^2 + a^2 - 2ac\cos B$

Unit Circle



Math References

Metric Prefixes

Prefix	Symbol	Magnitude
Exa-	E	10^{18}
Peta-	P	10^{15}
Tera-	T	10^{12}
Giga-	G	10^{9}
Mega-	M	10^{6}
kilo-	k	10^{3}
hecto-	h	10^{2}
deka-	da	10^{1}

Prefix	Symbol	Magnitude
deci-	d	10^{-1}
centi-	c	10^{-2}
milli-	m	10^{-3}
micro-	∝	10^{-6}
nano-	n	10^{-9}
pico-	p	10^{-12}
femto-	f	10^{-15}
atto-	a	10^{-18}

Greek Alphabet

Upper	Lower	Name
A	α	alpha
B	β	beta
Γ	γ	gamma
∅	δ	delta
E	ε	epsilon
Z	ζ	zeta
H	η	eta
Θ	θ	theta

Upper	Lower	Name
I	ι	iota
K	κ	kappa
Λ	λ	lambda
M	∝	mu
N	ν	nu
Ξ	ξ	xi
O	ο	omicron
Π	π	pi

Upper	Lower	Name
P	ρ	rho
Σ	σ	sigma
T	τ	tau
Y	υ	upsilon
Φ	ϕ	phi
X	χ	chi
Ψ	ψ	psi
Ω	ω	omega

Weights and Measures

Annular and Circular Measure
- 60 seconds = 1 minute
- 90 minutes = 1 degree
- 90 degrees = 1 right angle
- 180 degrees = 1 straight angle
- 360 degrees = complete angle

Apothecaries' Fluid Measure
- 60 minims = 1 fluid dram
- 8 fluid drams = 1 fluid ounce
- 16 fluid ounces = 1 pint
- 2 pints = 1 quart
- 4 quarts = 1 gallon

Apothecaries' Weight
- 20 grains = 1 scruple
- 3 scruples = 1 dram
- 8 drams = 1 ounce
- 12 ounces = 1 pound

Avoirdupois Weight
- 27 $^{11}/_{32}$ grains = 1 dram
- 16 drams = 1 ounce
- 16 ounces = 1 pound
- 100 pounds = 1 short cwt.
- 1 short ton = 2,000 pounds

Cubic Measure
- 1728 cubic inches = 1 cubic foot
- 27 cubic feet = 1 cubic yard
- 1000 cu. millimeters = 1 cu. cm.
- 1000 cu. centimeters = 1 cu. dcm.
- 1000 cu. decimeters = 1 cu. meter

Linear Measure
- 12 inches = 1 foot
- 3 feet = 1 yard
- 5 $^{1}/_{2}$ yards = 1 rod
- 40 rods = 1 furlong
- 5,280 feet = 1 mile
- 10 millimeters = 1 centimeter
- 10 centimeters = 1 decimeter
- 10 decimeters = 1 meter
- 10 meters = 1 dekameter
- 10 dekameters = 1 hectometer
- 10 hectometers = 1 kilometer

Liquid Measure
- 4 gills = 1 pint
- 2 pints = 1 quart
- 4 quarts = 1 gallon
- 31 $^{1}/_{2}$ gallons = 1 barrel
- 2 barrels = 1 hogshead
- 10 milliliters = 1 centiliter
- 10 centiliters = 1 deciliter
- 10 deciliters = 1 liter
- 10 liters = 1 dekaliter
- 10 dekaliters = 1 hectoliter
- 10 hectoliters = 1 kiloliter

Mass Measure
- 10 milligrams = 1 centigram
- 10 centigrams = 1 decigram
- 10 decigrams = 1 gram
- 10 grams = 1 dekagrams
- 10 dekagrams = 1 hectogram
- 10 hectograms = 1 kilogram
- 100 kilograms = 1 quintal
- 10 quintals = 1 ton

Square Measure
- 144 square inches = 1 square foot
- 9 square feet = 1 square yard
- 30 $^{1}/_{4}$ square yards = 1 sq. rod
- 160 square rods = 1 acre
- 640 acres = 1 square mile
- 100 sq. millimeters = 1 sq. cm.
- 100 sq. centimeters = 1 sq. dcm.
- 100 sq. decimeters = 1 sq. meter
- 100 sq. meters = 1 sq. dekameter
- 100 sq. dekameters = 1 sq. hm.
- 100 sq. hectometers = 1 sq. km.

Troy Weight
- 24 grains = 1 pennyweight
- 20 pennyweights = 1 ounce
- 12 ounces = 1 pound

Liquid or Volume Measures

(approximate)

$^{1}/_{4}$ teaspoon	=	0.042 fluid ounce
$^{1}/_{2}$ teaspoon	=	0.083 fluid ounce
1 teaspoon	=	0.167 fluid ounce
1 tablespoon	=	0.5 fluid ounce
2 tablespoons	=	1 fluid ounce
$^{1}/_{4}$ cup	=	2 fluid ounces
$^{1}/_{3}$ cup	=	2.67 fluid ounces
$^{1}/_{2}$ cup	=	4 fluid ounces
$^{2}/_{3}$ cup	=	5.33 fluid ounces
$^{3}/_{4}$ cup	=	6 fluid ounces
$^{7}/_{8}$ cup	=	7 fluid ounces
1 cup	=	8 fluid ounces
1 pint	=	16 fluid ounces
1 quart	=	32 fluid ounces
1 gallon	=	128 fluid ounces
1 liter	=	33.82 fluid ounces

This section uses the **Science Tools App** for the TI-84 Plus Silver Edition to help convert any unit.

Example: Convert 250km to fathoms

1. Select LENGTH from the unit converter Menu.
2. Enter 250, the numerical value to convert.
3. Use the arrow keys to select km, the conversion unit to convert from, and then press [ENTER].
4. Use the arrow key to select fath, the conversion unit to convert to, and then press [ENTER].