TI-30X Plus MathPrint™
Scientific Calculator Guidebook

This guidebook applies to software version 1.0. To view the latest version of the documentation, go to *education.ti.com/eguide*.

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Contents

Getting Started

This section contains information about basic calculator functionality.

Switching the Calculator On and Off

[on] turns on the calculator. [2nd] [off] turns it off. The display is cleared, but the history, settings, and memory are retained.

The APD™ (Automatic Power Down™) feature turns off the calculator automatically if no key is pressed for about 3 minutes. Press [on] after APD™. The display, pending operations, settings, and memory are retained.

Display Contrast

The brightness and contrast of the display can depend on room lighting, battery freshness, and viewing angle.

To adjust the contrast:

1. Press and release the [2nd] key.
2. Press [▸] (to darken the screen) or [◂] (to lighten the screen).

   Note: This will adjust the contrast one level at a time. Repeat steps 1 and 2 as needed.

Home Screen

On the Home screen, you can enter mathematical expressions and functions, along with other instructions. The answers are displayed on the Home screen.

The TI-30X Plus MathPrint™ screen can display a maximum of four lines with a maximum of 16 characters per line. For entries and expressions longer than the visible screen area, you can scroll left and right (◀ and ▶) to view the entire entry or expression.

In the MathPrint™ mode, you can enter up to four levels of consecutive nested functions and expressions, which include fractions, square roots, exponents with ^, $\sqrt[x]{y}$, e^x, and 10^x.

When you calculate an entry on the Home screen, depending upon space, the answer is displayed either directly to the right of the entry or on the right side of the next line.

Special indicators and cursors may display on the screen to provide additional information concerning functions or results.

Indicator	Definition
2ND	2nd function.
FIX	Fixed-decimal setting. (See Mode section.)
SCI, ENG	Scientific or engineering notation. (See Mode section.)

Indicator	Definition
DEG, RAD, GRAD	Angle mode (degrees, radians, or gradians). (See Mode section.)
L1, L2, L3	Displays above the lists in data editor.
H, B, O	Indicates HEX, BIN, or OCT number-base mode. No indicator displayed for default DEC mode.
	The calculator is performing an operation. Use on to break the calculation.
▲ ▼	An entry is stored in memory before and/or after the visible screen area. Press ⊙ and ⊙ to scroll.
▸	Indicates that the multi-tap key is active.
	Normal cursor. Shows where the next item you type will appear. Replaces any current character.
	Entry-limit cursor. No additional characters can be entered.
	Insert cursor. A character is inserted in front of the cursor location.
	Placeholder box for empty MathPrint™ template. Use arrow keys to move into the box.
	MathPrint™ cursor. Continue entering in the current MathPrint™ template, or press ⊙ to exit the template.

2nd Functions

2nd

Most keys can perform more than one function. The primary function is indicated on the key and the secondary function is displayed above it. Press 2nd to activate the secondary function of a given key. Notice that **2ND** appears as an indicator on the screen. To cancel before pressing the next key, press 2nd again. For example, 2nd [√] **25** enter calculates the square root of 25 and returns the result, 5.

Modes

mode

Use mode to choose modes. Press ⊙ ⊙ ⊙ ⊙ to choose a mode, and enter to select it. Press clear or 2nd [quit] to return to the Home screen and perform your work using the chosen mode settings.

Default settings are highlighted in these sample screens.

DEGREE RADIAN GRADIAN - Sets the angle mode to degrees, radians, or gradians.

NORMAL SCI ENG - Sets the numeric notation mode. Numeric notation modes affect only the display of results, and not the accuracy of the values stored in the unit, which remain maximal.

NORMAL displays results with digits to the left and right of the decimal, as in 123456.78.

SCI expresses numbers with one digit to the left of the decimal and the appropriate power of 10, as in 1.2345678E5, which is the same as the value (1.2345678×10^5) including the parentheses for correct order of operation.

ENG displays results as a number from 1 to 999 times 10 to an integer power. The integer power is always a multiple of 3.

Note: [EE] is a shortcut key to enter a number in scientific notation format. The result displays in the numeric notation format selected in the mode menu.

FLOAT 0 1 2 3 4 5 6 7 8 9 - Sets the decimal notation mode.

FLOAT (floating decimal point) displays up to 10 digits, plus the sign and decimal.

0 1 2 3 4 5 6 7 8 9 (fixed decimal point) specifies the number of digits (0 through 9) to display to the right of the decimal.

REAL a+bi r∠θ - Sets the format of complex number results.

REAL real results

a+bi rectangular results

r∠θ polar results

DEC HEX BIN OCT - Sets the number base used for calculations.

DEC decimal

HEX hexadecimal (To enter hex digits A through F, use [2nd] [A], [2nd] [B], and so on.)

BIN binary

OCT octal

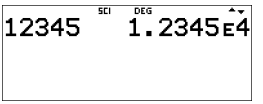
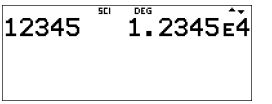
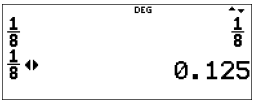
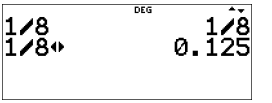
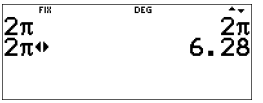
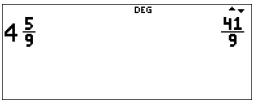
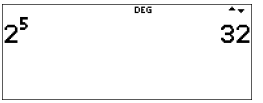
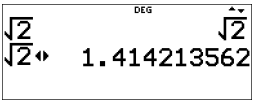
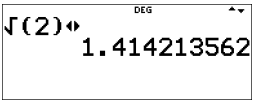
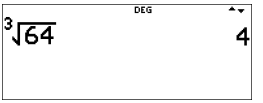
MATHPRINT CLASSIC

MATHPRINT mode displays most inputs and outputs in textbook format.

CLASSIC mode displays inputs and outputs in a single line.

Examples of MathPrint™ and Classic Modes

MathPrint™ Mode	Classic Mode
Sci	Sci

MathPrint™ Mode	Classic Mode
	
Float mode and answer toggle key	Float mode and answer toggle key.
	
Fix 2 and answer toggle key	Fix 2
	
Un/d	Un/d entry
	
Exponent example	Exponent example
	
Square root example	Square root example
	
Cube root example	Cube root example
	

Multi-Tap Keys

A multi-tap key is one that cycles through multiple functions when you press it. Press ⊙ to stop multi-tap.

For example, the [sin sin⁻¹] key contains the trigonometry functions **sin** and **sin**$^{-1}$ as well as the hyperbolic functions **sinh** and **sinh**$^{-1}$. Press the key repeatedly to display the function that you want to enter.

Multi-tap keys include x^{y} z t / $abcd$, $\sin$ / $\sin^{-1}$, $\cos$ / $\cos^{-1}$, $\tan$ / $\tan^{-1}$, $e^{\square}$ $10^{\square}$, ln log, $!$ $_{n}C_{r}$ $_{n}P_{r}$, and π e i. Applicable sections of this guidebook describe how to use the keys.

Menus

Menus give you access to a large number of calculator functions. Some menu keys, such as 2nd [recall], display a single menu. Others, such as math, display multiple menus.

Press ▶ and ▼ to scroll and select a menu item, or press the corresponding number next to the item. To return to the previous screen without selecting the item, press clear. To exit a menu and return to the Home screen, press 2nd [quit].

2nd [recall] (key with a single menu):

RECALL VAR
1:x = 0
2:y = 0
3:z = 0
4:t = 0
5:a = 0
6:b = 0
7:c = 0
8:d = 0

math (key with multiple menus):

MATH	NUM	DMS	R▶P
1:▶n/d◀▶Un/d	1:abs(	1:°	1:P▶Rx(
2:lcm(	2:round(	2:′	2:P▶Ry(
3:gcd(	3:iPart(	3:″	3:R▶Pr(
4:▶Pfactor	4:fPart(	4:r	4:R▶Pθ(
5:sum(	5:int(	5:g	
6:prod(	6:min(	6:▶DMS	
	7:max(		
	8:mod(		

Examples

Some sections are followed by instructions for keystroke examples that demonstrate the TI-30X Plus MathPrint™ functions.

Notes:

- Examples assume all default settings, as shown in the Modes section unless noted in the example.
- Use clear to clear the home screen as needed.

- Some screen elements may differ from those shown in this document.
- Since wizards retain their memory, some keystrokes may be different.

Scrolling Expressions and History

◀ ▶ ▲ ▼

Press ◀ or ▶ to move the cursor within an expression that you are entering or editing. Press 2nd ◀ or 2nd ▶ to move the cursor directly to the beginning or end of the expression.

From an expression or edit, ▲ moves the cursor to the history. Pressing enter from an input or output in history will paste that expression back to the cursor position on the edit line.

Press 2nd ▲ from the denominator of a fraction in the expressions edit to move the cursor to the history. Pressing enter from an input or output in the history will paste that expression to the denominator.

Example

7 x^2 **−** **4** (**3**) (**1**) enter	DEG $7^2-4(3)(1)$ 37
2nd $\sqrt{}$ ▲ ▲ enter enter	DEG $7^2-4(3)(1)$ 37 $\sqrt{7^2-4(3)(1)}$ $\sqrt{37}$
◀▶≈	DEG $7^2-4(3)(1)$ 37 $\sqrt{7^2-4(3)(1)}$ $\sqrt{37}$ $\sqrt{37}$ 6.08276253

Answer Toggle

◀▶≈

Press the ◀▶≈ key to toggle the display result (when possible) between fraction and decimal answers, exact square root and decimal, and exact pi and decimal.

Example

Answer toggle	2nd $\sqrt{}$ **8** enter	DEG $\sqrt{8}$ $2\sqrt{2}$
	◀▶≈	DEG $\sqrt{8}$ $2\sqrt{2}$ $2\sqrt{2}$ 2.828427125

Note: [◆▶≈] is also available to toggle number formats for values in cells in the Function Table and in the Data Editor.

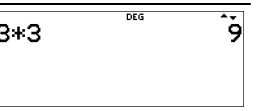
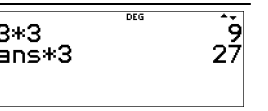
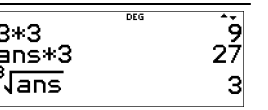
Last Answer

[2nd] [answer]

The last entry performed on the home screen is stored to the variable **ans**. This variable is retained in memory, even after the calculator is turned off. To recall the value of **ans**:

- Press [2nd] [answer] (**ans** displays on the screen), or
- Press any operations key ([+], [−], and so forth) in most edit lines as the first part of an entry. **ans** and the operator are both displayed.

Examples

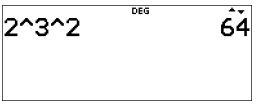
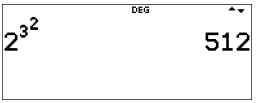
ans	**3** [×] **3** [enter]	
	[×] **3** [enter]	
	3 [2nd] [$\sqrt{\square}$] [2nd] [answer] [enter]	

Note: The variable **ans** is stored and pastes in full precision which is 13 digits.

Order of Operations

The TI-30X Plus MathPrint™ calculator uses Equation Operating System (EOS™) to evaluate expressions. Within a priority level, EOS™ evaluates functions from left to right and in the following order.

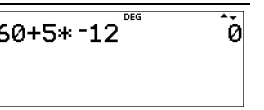
1st	Expressions inside parentheses.
2nd	Functions that need a **)** and precede the argument, such as **sin**, **log**, and all **R◆▶P** menu items.
3rd	Functions that are entered after the argument, such as $\mathbf{x}^2$ and angle unit modifiers.
4th	Exponentiation (^) and roots ($\sqrt[x]{}$). **Note:** In Classic mode, exponentiation using the [$x^{\square}$] key is evaluated from left to right. The expression 2^3^2 is evaluated as (2^3)^2, with a result of 64.

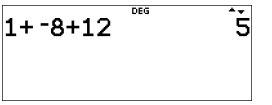
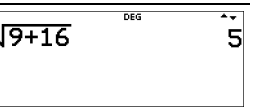
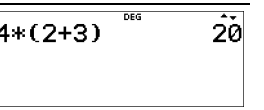
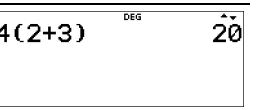
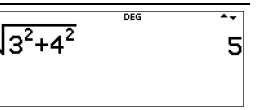
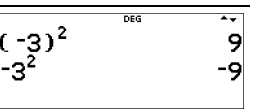
	 In MathPrint™ mode, exponentiation using the $x^{\square}$ key is evaluated from right to left. The expression 2^3^2 is evaluated as 2^(3^2), with a result of 512.  The calculator evaluates expressions entered with x^2 and $\frac{1}{\square}$ from left to right in both Classic and MathPrint™ modes. Pressing **3** x^2 x^2 is calculated as $(3^2)^2 = 81$.
5th	Negation (-).
6th	Fractions.
7th	Permutations (**nPr**) and combinations (**nCr**).
8th	Multiplication, implied multiplication, division, and angle indicator ∠.
9th	Addition and subtraction.
10th	Logic operators **and**, **nand**.
11th	Logic operators **or**, **xor**, **xnor**.
12th	Conversions such as ▶**n/d**◀▶**Un/d**, **F**◀▶**D**, ▶**DMS**.
13th	sto→
14th	enter evaluates the input expression.

Note: End of expression operators and Base n conversions such as ▶**Bin**, angle conversion ▶**DMS**, ▶**Pfactor**, and complex number conversions ▶**Polar** and ▶**Rectangle**, are only valid in the Home Screen. They are ignored in wizards, function table display and data editor features where the expression result, if valid, will display without a conversion.

Note: Use parentheses to clearly indicate the operation order you expect for your expression entry. If necessary, the parentheses can be used to override the order of operations followed by the algorithms in the calculator. If the result is not as expected, check how the expression was entered and add parentheses as needed.

Examples

+ × ÷ -	**60** + **5** × (−) **12** enter	

(-)	**1** + (−) **8** + **12** enter	
√ and +	2nd [√] **9** + **16** enter	
( )	**4** × (**2** + **3**) enter	
( ) and +	**4** (**2** + **3**) enter	
^ and √	2nd [√] **3** $x^{\square}$ **2** ▶ + **4** $x^{\square}$ **2** enter	
( ) and -	((−) **3**) x^2 enter (−) **3** x^2 enter	

Clearing and Correcting

2nd [quit]	Returns the cursor to the home screen. Quickly dismisses these applications: Expression Evaluation, Set Operation, Function Table, Data Editor, Statistics and Distributions.
clear	Clears an error message. Clears characters on entry line.
delete	Deletes the character at the cursor. When the cursor is at the end of an expression, it will backspace and delete.
2nd [insert]	Inserts a character at the cursor.
2nd [clear var] **1**	Clears variables **x**, **y**, **z**, **t**, **a**, **b**, **c**, and **d** to their default value of 0. Any computed Stat Vars will no longer be available in the Stat Vars menu. Recompute statistic features as needed.
2nd [reset] **2**	Resets the calculator. Returns the calculator to default settings; clears memory variables, pending operations, all entries

	in history, and statistical data; clears any stored operation, and **ans**.

Memory and Stored Variables

x^{yzt}_{abcd} sto→ 2nd [recall] 2nd [clear var]

The TI-30X Plus MathPrint™ calculator has 8 memory variables—**x**, **y**, **z**, **t**, **a**, **b**, **c**, and **d**. You can store the following to a memory variable:

- real or complex numbers
- expression results
- calculations from various applications such as Distributions
- data editor cell values (stored from the edit line)

Features of the calculator that use variables will use the values that you store.

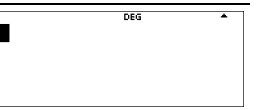
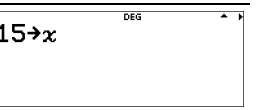
sto→ lets you store values to variables. Press sto→ to store a variable, and press x^{yzt}_{abcd} to select the variable to store. Press enter to store the value in the selected variable. If this variable already has a value, that value is replaced by the new one.

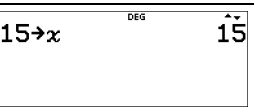
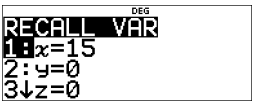
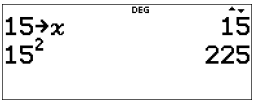
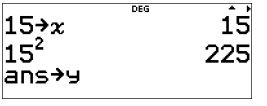
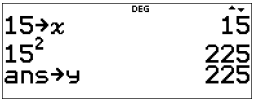
x^{yzt}_{abcd} is a multi-tap key that cycles through the variable names **x**, **y**, **z**, **t**, **a**, **b**, **c**, and **d**. You can also use x^{yzt}_{abcd} to recall the stored values for these variables. The name of the variable is inserted into the current entry, but the value assigned to the variable is used to evaluate the expression. To enter two or more variables in succession, press ▶ after each.

2nd [recall] recalls the values of variables. Press 2nd [recall] to display a menu of variables and their stored values. Select the variable you want to recall and press enter. The value assigned to the variable is inserted into the current entry and used to evaluate the expression.

2nd [clear var] clears variable values. Press 2nd [clear var] and select **1:Yes** to clear all variable values. Any computed Stat Vars will no longer be available in the Stat Vars menu. Recompute statisitc features as needed.

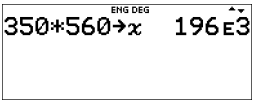
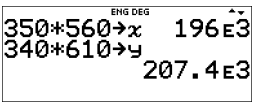
Examples

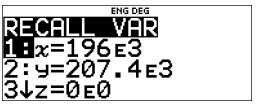
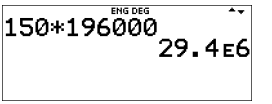
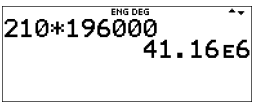
Start with clear screen	2nd [quit] clear	
Clear Var	2nd [clear var] **1** (Selects **Yes**)	
Store	**15** sto→ x^{yzt}_{abcd}	

	enter	
Recall	2nd [recall]	
	enter x^2 enter	
	sto→ x^{yzt}_{abcd} x^{yzt}_{abcd}	
	enter	
	x^{yzt}_{abcd} x^{yzt}_{abcd}	
	enter ÷ 4 enter	

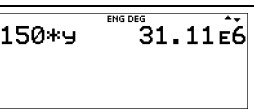
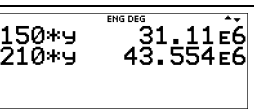
Problem

In a gravel quarry, two new excavations have been opened. The first one measures 350 meters by 560 meters, the second one measures 340 meters by 610 meters. What volume of gravel does the company need to extract from each excavation to reach a depth of 150 meters? To reach 210 meters? Display the results in engineering notation.

mode ⊖ ⊕ ⊕ enter clear **350** × **560** sto→ x^{yzt}_{abcd} enter	
340 × **610** sto→ x^{yzt}_{abcd} x^{yzt}_{abcd} enter	

clear **150** × 2nd [recall]	
enter enter	
clear **210** × 2nd [recall] enter enter	

For the first excavation, the company needs to extract 29.4 million cubic meters to reach a depth of 150 meters, and extract 41.16 million cubic meters to reach a depth of 150 meters.

clear **150** × $x^{y\,z\,t}_{abcd}$ $x^{y\,z\,t}_{abcd}$ enter	
210 × $x^{y\,z\,t}_{abcd}$ $x^{y\,z\,t}_{abcd}$ enter	

For the second excavation, the company needs to extract 31.11 million cubic meters to reach a depth of 150 meters, and extract 43.554 million cubic meters to reach a depth of 210 meters.

Math Functions

This section contains information about using the calculator math functions such as trigonometry, statistics, and probability.

Fractions

[▫/▫] [2nd] [□▫/▫] [math] **1** [2nd] [f◂▸d]

Fractions with [▫/▫] can include real and complex numbers, operation keys ([+], [×], etc.), and most function keys ([x^2], [2nd] [%], etc.).

In Classic mode or classic entries in MathPrint™ mode, the fraction bar [▫/▫] displays in-line as a thick bar, for example 8/9. Use parentheses to clearly indicate the arithmetic you expect. While the Order of Operations rules will apply, you are in control of the way an expression evaluates by placing the correct parentheses in your inputs.

Fraction Results

- Fraction results are automatically simplified and output is in improper fraction format.
- When mixed number output is desired, use the ▸n/d◂▸Un/d mixed number conversion at the end of the input expression. This feature is located in [math] **1: ▸n/d◂▸Un/d**.
- Fraction results are obtained when the calculated value can display within the limits of the fraction format supported by the calculator and no decimal value was entered in the input expression.
- If decimal numbers are used or calculated in a fraction numerator or denominator, the result will display as a decimal. Entering a decimal forces the result to display in decimal format.
- Use [2nd] [f◂▸d] (above [◂▸≈]) on results to attempt fraction to decimal conversions within the fraction display limits offered by this numeric calculator.

Mixed Numbers and Conversions

- [2nd] [□▫/▫] enters a mixed number. Press the arrow keys to cycle through the unit, numerator, and denominator.
- [math] **1** converts between simple fractions and mixed-number form (▸n/d◂▸Un/d).
- [2nd] [f◂▸d] converts results between fractions and decimals.

MathPrint™ Entry

- To enter numbers or expressions in the numerator and denominator in MathPrint™ mode, press [▫/▫].
- Press ⌄ or ⌃ to move the cursor between the numerator and denominator.
- Pressing [▫/▫] before or after numbers or functions may pre-populate the numerator with parts of your expression. Watch the screen as you press keys to ensure you enter the expression exactly as needed.

On the Home Screen

- To paste a previous entry from history in the numerator or mixed number unit, place the cursor in the numerator or unit, press ▲ to scroll to the desired entry, and then press enter to paste the entry to the numerator or unit.
- To paste a previous entry from history in the denominator, place the cursor in the denominator, press 2nd ▲ to jump into history. Press ▲ to scroll to the desired entry, and then press enter to paste the entry to the denominator.

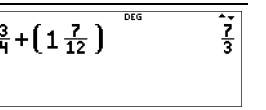
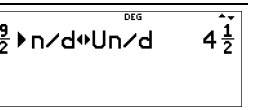
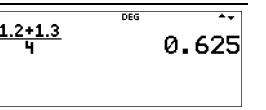
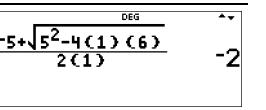
Evaluation of Your Expression

- When enter is pressed to evaluate your input expression, parentheses may be displayed to clearly indicate how it was interpreted and calculated by the calculator. If it is not what you expected, copy the input expression and edit as needed.

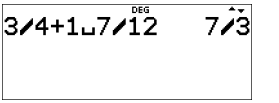
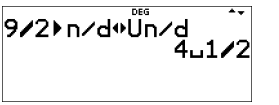
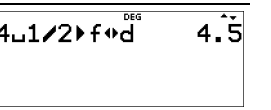
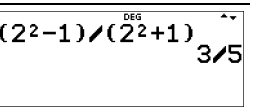
Classic Mode or Classic Entry

- If the cursor is in a classic entry location, enter the numerator expression enclosed by parentheses, then press ▫/▫ to display the thick fraction bar, and then enter the denominator expression also enclosed with parentheses for the result to be calculated as you expect for your problem.

Examples in MathPrint™ Mode

n/d, Un/d	▫/▫ **3** ▼ **4** ▶ + **1** 2nd [▫ ▫] **7** ▼ **12** enter **Note:** Parentheses are added automatically.	
▸n/d◂▸Un/d	**9** ▫/▫ **2** ▶ math **1** enter	
f◂▸d	**4** 2nd [▫ ▫] **1** ▼ **2** ▶ 2nd [f◂▸d] enter	
Example	▫/▫ **1.2** + **1.3** ▼ **4** enter **Note:** Result is decimal since decimal numbers were used in the fraction.	
Example	▫/▫ (−) **5** + 2nd [√] **5** [x²] − **4** (**1**) (**6**) ▼ **2** (**1**) enter	

Examples in Classic Mode

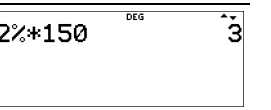
n/d, Un/d	**3** [▯/▯] **4** [+] **1** [2nd] [▯ ▯] **7** [▯/▯] **12** [enter]	
▸n/d◂▸Un/d	**9** [▯/▯] **2** [math] **1** [enter]	
f◂▸d	**4** [2nd] [▯ ▯] **1** [▯/▯] **2** [2nd] [f◂▸d] [enter]	
Parentheses	[(] **2** [x^2] [−] **1** [)] [▯/▯] [(] **2** [x^2] [+] **1** [)] [enter]	

Percentages

[2nd] [%]

To perform a calculation involving a percentage, press [2nd] [%] after entering the value of the percentage.

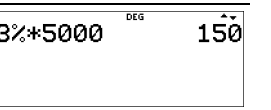
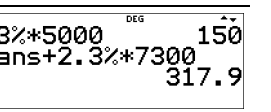
Example

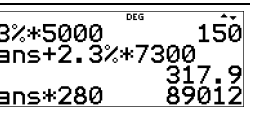
2 [2nd] [%] [×] **150** [enter]	

Problem

A mining company extracts 5000 tons of ore with a concentration of metal of 3% and 7300 tons with a concentration of 2.3%. On the basis of these two extraction figures, what is the total quantity of metal obtained?

If one ton of metal is worth 280 units of currency, what is the total value of the metal extracted?

3 [2nd] [%] [×] **5000** [enter]	
[+] **2.3** [2nd] [%] [×] **7300** [enter]	

× **280** enter	

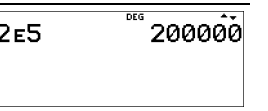
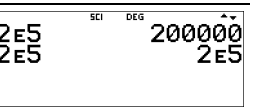
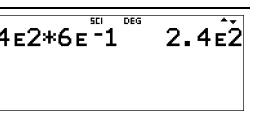
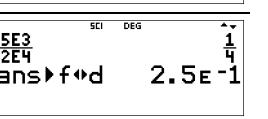
The two extractions represent a total of 317.9 tons of metal for a total value of 89012 units of currency.

Scientific Notation [EE]

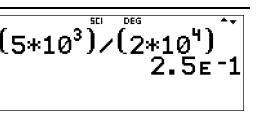
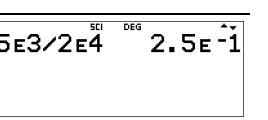
EE

EE is a shortcut key to enter a number in scientific notation format. A number such as (1.2×10^{-4}) is entered in the calculator as the number 1.2E-4.

Example

2 EE **5** enter **Note:** Enters (2×10^5) using the calculator E notation.	
mode ▼ ▶ enter **Note:** The **SCI** mode setting displays results in scientific notation.	
clear enter	
clear **4** EE **2** × **6** EE (−) **1** enter	
▫/▫ **5** EE **3** ▼ **2** EE **4** enter 2nd [answer] 2nd [f◂▸d]	

Example

Textbook Problem clear (**5** × **10** $x^{\square}$ **3** ▶) ÷ (**2** × **10** $x^{\square}$ **4** ▶) enter	
Using EE clear **5** EE **3** ÷ **2** EE **4** enter	

Powers, Roots and Inverses

[x^2]	Calculates the square of a value.
[$x^{\square}$]	Raises a value to the power indicated. Use ▶ to move the cursor out of the power in MathPrint™ mode.
[2nd] [$\sqrt{}$]	Calculates the square root of a non-negative value. In complex number modes, a+bi and r∠θ, calculates the square root of a negative real value.
[2nd] [$\sqrt[\square]{}$]	Calculates the xth root of any non-negative value and any odd integer root of a negative value.
[$\frac{1}{\square}$]	Inverts the entered value as 1/x.

Examples

5 [x^2] [+] **4** [$x^{\square}$] **2** [+] **1** ▶ [enter]	5^2+4^{2+1} → 89
10 [$x^{\square}$] [(−)] **2** [enter]	10^{-2} → $\frac{1}{100}$
[2nd] [$\sqrt{}$] **49** [enter]	$\sqrt{49}$ → 7
[2nd] [$\sqrt{}$] **3** [x^2] [+] **2** [$x^{\square}$] **4** [enter]	$\sqrt{3^2+2^4}$ → 5
6 [2nd] [$\sqrt[\square]{}$] **64** [enter]	$\sqrt[6]{64}$ → 2
3 [enter] [2nd] [$\frac{1}{\square}$] [enter]	3 → 3; $\frac{1}{ans}$ → $\frac{1}{3}$

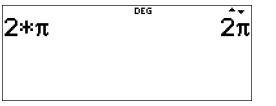
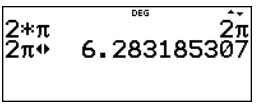
Pi (symbol Pi)

[π] (multi-tap key)

π ≈ 3.14159265359 for calculations.

π ≈ 3.141592654 for display in Float mode.

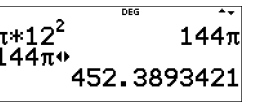
Example

π	**2** × π^e_i enter	
	◂▸≈	

Problem

What is the area of a circle if the radius is 12 cm?

Reminder: $A = \pi \times r^2$

π^e_i × **12** x^2 enter ◂▸≈	

The area of the circle is 144 π square cm. The area of the circle is approximately 452.4 square cm when rounded to one decimal place.

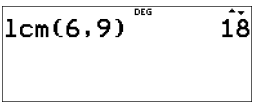
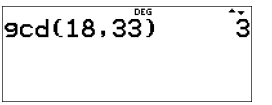
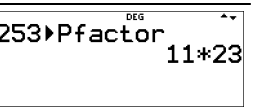
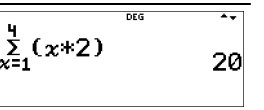
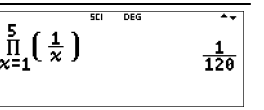
Math

math **MATH**

math displays the **MATH** menu:

1:▸n/d◂▸Un/d	Converts between simple fractions and mixed-number form.
2:lcm(	Least common multiple Syntax: **lcm(***valueA*,*valueB***)**
3:gcd(	Greatest common divisor Syntax: **gcd(***valueA*,*valueB***)**
4:▸Pfactor	Prime factors
5:sum(	Summation Syntax: **sum(***expression*,*variable*,*lower*,*upper***)** (Classic mode syntax)
6:prod(	Product Syntax: **prod(***expression*,*variable*,*lower*,*upper***)** (Classic mode syntax)

Examples

▸n/d◂▸Un/d	**9** [□/□] **2** ⊙ [math] **1** [enter]	
lcm(	[math] **2** **6** [2nd] [,] **9** [)] [enter]	
gcd(	[math] **3** **18** [2nd] [,] **33** [)] [enter]	
▸Pfactor	**253** [math] **4** [enter]	
sum(	[math] **5** **1** ⊙ **4** ⊙ [x^{yzt}_{abcd}] [×] **2** [enter]	
prod(	[math] **6** **1** ⊙ **5** ⊙ **1** [□/□] [x^{yzt}_{abcd}] ⊙ ⊙ [enter]	

Number Functions

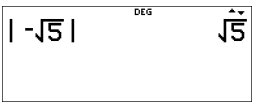
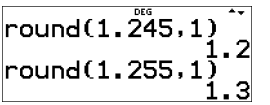
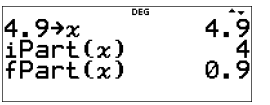
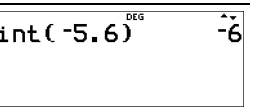
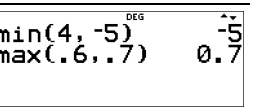
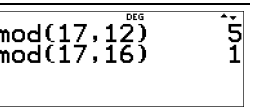
[math] **NUM**

[math] ⊙ displays the **NUM** menu:

1:abs(	Absolute value Syntax: **abs(***value***)**
2:round(	Rounded value Syntax: **round(***value,#decimals***)**
3:iPart(	Integer part of a number Syntax: **iPart(***value***)**
4:fPart(	Fractional part of a number Syntax: **fPart(***value***)**
5:int(	Greatest integer that is ≤ the number Syntax: **int(***value***)**
6:min(	Minimum of two numbers Syntax: **min(***valueA,valueB***)**

7:max(	Maximum of two numbers Syntax: **max(***valueA*,*valueB***)**
8:mod(	Modulo (remainder of first number ÷ second number) Syntax: **mod(***dividend*,*divisor***)**

Examples

abs(	[math] ▶ **1** [(−)] [2nd] [√] **5** [enter]	
round(	[math] ▶ **2** **1.245** [2nd] [,] **1** [)] [enter] ▲ ▲ [enter] ◀ ◀ ◀ ◀ ◀ **5** [enter]	
iPart(fPart(	**4.9** [sto→] [$x^{y=t}_{abcd}$] [enter] [math] ▶ **3** [$x^{y=t}_{abcd}$] [)] [enter] [math] ▶ **4** [$x^{y=t}_{abcd}$] [)] [enter]	
int(	[math] ▶ **5** [(−)] **5.6** [)] [enter]	
min(max(	[math] ▶ **6** **4** [2nd] [,] [(−)] **5** [)] [enter] [math] ▶ **7** **.6** [2nd] [,] **.7** [)] [enter]	
mod(	[math] ▶ **8** **17** [2nd] [,] **12** [)] [enter] ▲ ▲ [enter] ◀ ◀ **6** [enter]	

Angles

[math] **DMS**

[math] ▶ ▶ displays the **DMS** menu:

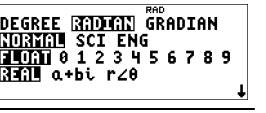
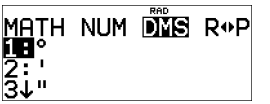
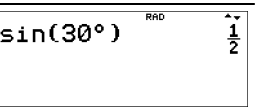
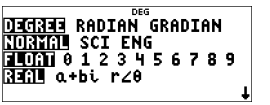
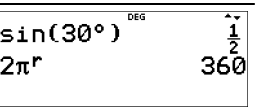
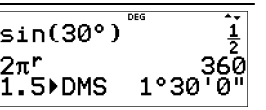
1:°	Specifies the angle unit modifier as degrees (°).
2:′	Specifies the angle unit modifier as minutes (′).
3:″	Specifies the angle unit modifier as seconds (″).
4:r	Specifies a radian angle.

5:g	Specifies a gradian angle.
6:▸DMS	Converts angle from decimal degrees to degrees, minutes, and seconds.

Choose an angle mode from the mode screen. You can choose from DEGREE (default), RADIAN, or GRADIAN. Entries are interpreted and results displayed according to the angle mode setting without needing to enter an angle unit modifier.

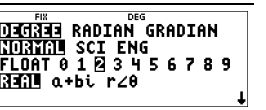
Note: You can also convert between rectangular coordinate form (R) and polar coordinate form (P). (See Rectangular to Polar for more information.)

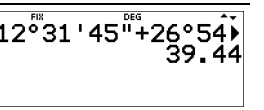
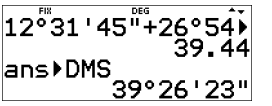
Examples

RADIAN	mode ▶ enter	
	clear sin/sin⁻¹ **30** math ▶ ▶	
	1) enter	
DEGREE	mode enter	
	clear **2** π e^i math ▶ ▶ **4** enter	
▸DMS	**1.5** math ▶ ▶ **6** enter	

Problem

Two adjacent angles measure 12° 31′ 45″ and 26° 54′ 38″ respectively. Add the two angles and display the result in DMS format. Round the results to two decimal places.

clear mode ▼ ▼ ▶ ▶ ▶ enter	

clear **12** math ▶ ▶	
1 **31** math ▶ ▶ **2** **45** math ▶ ▶ **3** + **26** math ▶ ▶ **1** **54** math ▶ ▶ **2** **38** math ▶ ▶ **3** enter	
math ▶ ▶ **6** enter	

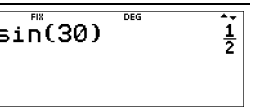
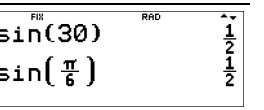
The result is 39 degrees, 26 minutes and 23 seconds.

Problem

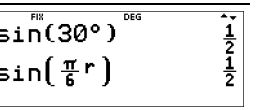
It is known that 30° = π / 6 radians. In the default mode, degrees, find the sine of 30°. Then set the calculator to radian mode and calculate the sine of π / 6 radians.

Notes

- Press clear to clear the screen between problems.
- The indicator row displays DEG or RAD mode setting for the current calculation only.

clear sin sin⁻¹ **30**) enter	
mode ▶ enter clear sin sin⁻¹ π e^i □/□ **6** ▶) enter	

Retain radian mode on the calculator and calculate the sine of 30°. Change the calculator to degree mode and find the sine of π / 6 radians.

clear sin sin⁻¹ **30** math ▶ ▶ enter) enter mode enter clear sin sin⁻¹ π e^i □/□ **6** ▶ math ▶ ▶ **4**) enter	

Rectangular to Polar

math **R▸P**

[math] ◀ displays the **R▸P** menu, which has functions for converting coordinates between rectangular (x,y) and polar (r,θ) format. Set Angle mode, as necessary, before starting calculations.

1:P▸Rx(	Converts polar to rectangular and displays x. Syntax: **P▸Rx(**r,θ**)**
2:P▸Ry(	Converts polar to rectangular and displays y. Syntax: **P▸Ry(**r,θ**)**
3:R▸Pr(	Converts rectangular to polar and displays r. Syntax: **R▸Pr(**x,y**)**
4:R▸Pθ(	Converts rectangular to polar and displays θ. Syntax: **R▸Pθ(**x,y**)**

Example

Convert polar coordinates (r,θ) = (5,30) into rectangular coordinates. Then convert rectangular coordinates (x,y) = (3,4) into polar coordinates. Round decimal results to one decimal place.

R◀▶P	[clear] [mode] ▼ ▼ ▶ ▶ [enter]	FIX DEG DEGREE RADIAN GRADIAN NORMAL SCI ENG FLOAT 0 1 2 3 4 5 6 7 8 9 REAL a+bi r∠θ ↓
	[clear] [math] ◀ **1** **5** [2nd] [,] **30** [)] [enter] [math] ◀ **2** **5** [2nd] [,] **30** [)] [enter]	FIX DEG P▸Rx(5,30) $5\sqrt{3}/2$ P▸Ry(5,30) $5/2$
	[math] ◀ **3** **3** [2nd] [,] **4** [)] [enter] [math] ◀ **4** **3** [2nd] [,] **4** [)] [enter]	FIX DEG R▸Pr(3,4) 5.0 R▸Pθ(3,4) 53.1

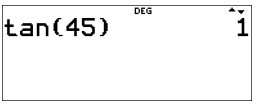
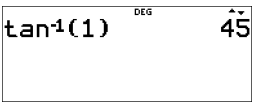
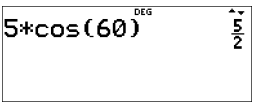
Converting (r,θ) = (5,30) gives (x,y) = ($\frac{5\sqrt{3}}{2}$, $\frac{5}{2}$) and (x,y) = (3,4) gives (r,θ) = (5.0,53.1).

Trigonometry

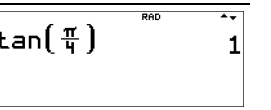
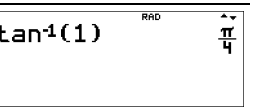
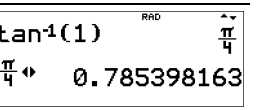
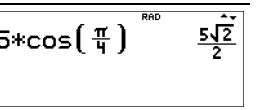
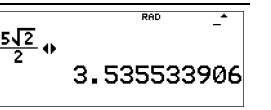
[sin sin⁻¹] [cos cos⁻¹] [tan tan⁻¹] (multi-tap keys)

Pressing one of these multi-tap keys repeatedly lets you access the corresponding trigonometric or inverse trigonometric function. Set the Angle mode - Degree or Radian - before your calculation.

Example in Degree Mode

tan	clear mode enter clear tan/tan⁻¹ **45**) enter	
$\tan^{-1}$	clear tan/tan⁻¹ tan/tan⁻¹ **1**) enter	
cos	clear **5** × cos/cos⁻¹ **60**) enter	

Example in Radian Mode

tan	clear mode ▶ enter clear tan/tan⁻¹ π e^i ▫/▫ **4** ▶) enter	
$\tan^{-1}$	clear tan/tan⁻¹ tan/tan⁻¹ **1**) enter	
	◂▸≈	
cos	clear **5** × cos/cos⁻¹ π e^i ▫/▫ **4** ▶) enter	
	clear ◂▸≈	

Problem

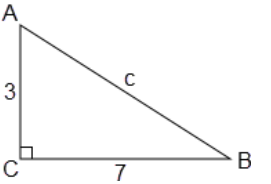
Find angle A of the right triangle below. Then calculate angle B and the length of the hypotenuse c. Lengths are in meters. Round results to one decimal place.

Reminder:

$\tan A = \frac{7}{3}$ therefore $m\angle A = \tan^{-1}\left(\frac{7}{3}\right)$

$m\angle A + m\angle B + 90° = 180°$
therefore $m\angle B = 90° - m\angle A$

$c = \sqrt{3^2+7^2}$



Note: Set mode to **DEGREE** and fix 1 decimal place for the calculations.

mode enter ▼ ▼ ▶ ▶ enter	FIX 1 DEG DEGREE RADIAN GRADIAN NORMAL SCI ENG FLOAT 0 1 2 3 4 5 6 7 8 9 REAL a+bi r∠θ
clear tan tan⁻¹ tan tan⁻¹ **7** ÷ **3** ▶) enter	FIX 1 DEG $\tan^{-1}(\frac{7}{3})$ 66.8
90 − 2nd [answer] enter	FIX 1 DEG $\tan^{-1}(\frac{7}{3})$ 66.8 90−ans 23.2
2nd [√] **3** x^2 + **7** x^2 enter	FIX 1 DEG $\tan^{-1}(\frac{7}{3})$ 66.8 90−ans 23.2 $\sqrt{3^2+7^2}$ $\sqrt{58}$
◀▶≈	FIX 1 DEG 90−ans 23.2 $\sqrt{3^2+7^2}$ $\sqrt{58}$ $\sqrt{58}$ 7.6
mode enter ▼ ▼ ▶ ▶ enter	FIX 1 DEG DEGREE RADIAN GRADIAN NORMAL SCI ENG FLOAT 0 1 2 3 4 5 6 7 8 9 REAL a+bi r∠θ

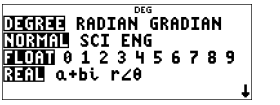
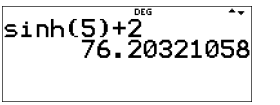
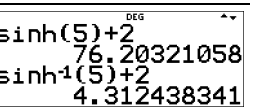
To one decimal place, the measure of angle A is 66.8°, the measure of angle B is 23.2°, and the length of the hypotenuse is 7.6 meters.

Hyperbolics

sin sin⁻¹ cos cos⁻¹ tan tan⁻¹ (multi-tap keys)

Pressing one of these multi-tap keys repeatedly lets you access the corresponding hyperbolic or inverse hyperbolic function. Angle modes do not affect hyperbolic calculations.

Example

Set floating decimal	mode ▼ ▼ enter	
	clear sin sin⁻¹ sin sin⁻¹ sin sin⁻¹ 5) + 2 enter	
	▲ ▲ enter 2nd ◀ sin sin⁻¹ sin sin⁻¹ sin sin⁻¹ enter	

Logarithm and Exponential Functions

ln log e□ 10□ (multi-tap keys)

ln log pastes the natural logarithm, ln, of a number to the base e. The argument of the function is **ln(***value***)**.

e ≈ 2.718281828459 for calculations.

e ≈ 2.718281828 for display in Float mode.

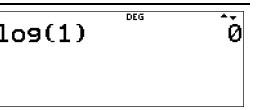
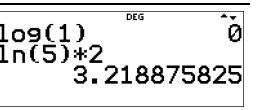
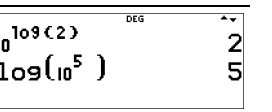
ln log ln log pastes the common logarithm, $\log_{10}$, of a number. The argument of the function is **log(***value***)**.

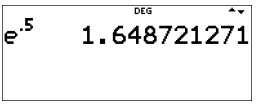
ln log ln log ln log pastes the logBASE function as a MathPrint™ template. When needed, the arguments in classic entry are **logBASE(***value*,*base***)**.

e□ 10□ pastes *e* to the power function.

e□ 10□ e□ 10□ pastes 10 to the power function.

Examples

log	ln log ln log 1) enter	
ln	ln log 5) × 2 enter	
10□	clear e□ 10□ e□ 10□ ln log ln log 2) enter ln log ln log e□ 10□ e□ 10□ 5 ▶) enter	

$e^{\square}$	clear $e^{\square}$ 10$^{\square}$ .5 enter	

Statistics, Regressions, and Distributions

data 2nd [stat-reg/distr]

data lets you enter and edit the data lists. (See Data Editor section.)

2nd [stat-reg/distr] displays the **STAT-REG** menu, which has the following options.

Notes:

- Regressions store the regression information, along with the 2-Var statistics for the data, in StatVars (menu item 1).
- A regression can be stored to either f(x) or g(x). The regression coefficients display in full precision.

Important note about results: Many of the regression equations share the same variables **a**, **b**, **c**, and **d**. If you perform any regression calculation, the regression calculation and the 2-Var statistics for that data are stored in the **StatVars** menu until the next statistics or regression calculation. The results must be interpreted based on which type of statistics or regression calculation was last performed. To help you interpret correctly, the title bar reminds you of which calculation was last performed.

1:StatVars	Displays a secondary menu of the last computed statistical result variables. Use ⊙ and ⊙ to locate the desired variable, and press enter to select it. If you select this option before calculating 1-Var stats, 2-Var stats, or any of the regressions, a reminder appears.
2:1-VAR STATS	Analyzes statistical data from 1 data set with 1 measured variable, x. Frequency data may be included.
3:2-VAR STATS	Analyzes paired data from 2 data sets with 2 measured variables—x, the independent variable, and y, the dependent variable. Frequency data may be included. **Note:** 2-Var Stats also computes a linear regression and populates the linear regression results. It displays values for **a** (slope) and **b** (y-intercept); it also displays values for $\mathbf{r}^2$ and **r**.
4:LinReg ax+b	Fits the model equation y=ax+b to the data using a least-squares fit for at least two data points. It displays values for **a** (slope) and **b** (y-intercept); it also displays values for $\mathbf{r}^2$ and **r**.
5:PropReg ax	Fits the model equation y=ax to the data using

	using least squares fit for at least one data point. It displays the value for **a**. Supports data forming a vertical line with the exception of all 0 data.
6:RecipReg a/x+b	Fits the model equation y=a/x+b to the data using least squares fit on linearized data for at least two data points. It displays values for **a** and **b**; it also displays values for $\mathbf{r}^2$ and **r**.
7:QuadraticReg	Fits the second-degree polynomial $y=ax^2+bx+c$ to the data. It displays values for **a**, **b**, and **c**; it also displays a value for $\mathbf{R}^2$. For three data points, the equation is a polynomial fit; for four or more, it is a polynomial regression. At least three data points are required.
8:CubicReg	Fits the third-degree polynomial $y=ax^3+bx^2+cx+d$ to the data. It displays values for **a**, **b**, **c**, and **d**; it also displays a value for $\mathbf{R}^2$. For four points, the equation is a polynomial fit; for five or more, it is a polynomial regression. At least four points are required.
9:LnReg a+bln$x$	Fits the model equation y=a+b ln(x) to the data using a least squares fit and transformed values ln (x) and y. It displays values for **a** and **b**; it also displays values for $\mathbf{r}^2$ and **r**.
:PwrReg ax^b	Fits the model equation $y=ax^b$ to the data using a least-squares fit and transformed values ln(x) and ln(y). It displays values for **a** and **b**; it also displays values for $\mathbf{r}^2$ and **r**.
:ExpReg ab^x	Fits the model equation $y=ab^x$ to the data using a least-squares fit and transformed values x and ln (y). It displays values for **a** and **b**; it also displays values for $\mathbf{r}^2$ and **r**.
:expReg ae^(bx)	Fits the model equation y=a e^(bx) to the data using least squares fit on linearized data for at least two data points. It displays values for **a** and **b**; it also displays values for $\mathbf{r}^2$ and **r**.

2nd [stat-reg/distr] ▶ displays the **DISTR** menu, which has the following distribution functions:

1:Normalpdf	Computes the probability density function (**pdf**) for the normal distribution at a specified x value. The defaults are mean *mu*=0 and standard deviation *sigma*=1. The probability density function (pdf) is: $f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{\frac{-(x-\mu)^2}{2\sigma^2}}, \sigma > 0$

2:Normalcdf	Computes the normal distribution probability between *LOWERbnd* and *UPPERbnd* for the specified mean *mu* and standard deviation *sigma*. The defaults are *mu*=0; *sigma*=1; with *LOWERbnd* = -1E99 and *UPPERbnd* = 1E99. **Note:** -1E99 to 1E99 represents -infinity to infinity.
3:invNormal	Computes the inverse cumulative normal distribution function for a given area under the normal distribution curve specified by mean *mu* and standard deviation *sigma*. It calculates the *x* value associated with an area to the left of the *x* value. $0 \le area \le 1$ must be true. The defaults are *area*=1, *mu*=0 and *sigma*=1.
4:Binomialpdf	Computes a probability at *x* for the discrete binomial distribution with the specified *numtrials* and probability of success (*p*) on each trial. *x* is a non-negative integer and can be entered with options of SINGLE entry, LIST of entries or ALL (list of probabilities from 0 to *numtrials* is returned). $0 \le p \le 1$ must be true. The probability density function (**pdf**) is: $f(x) = \binom{n}{x} p^x (1-p)^{n-x}, x = 0,1,...,n$
5:Binomialcdf	Computes a cumulative probability at *x* for the discrete binomial distribution with the specified *numtrials* and probability of success (*p*) on each trial. *x* can be non-negative integer and can be entered with options of SINGLE, LIST or ALL (a list of cumulative probabilities is returned.) $0 \le p \le 1$ must be true.
6:Poissonpdf	Computes a probability at *x* for the discrete Poisson distribution with the specified mean *mu* (μ), which must be a real number > 0. *x* can be an non-negative integer (SINGLE) or a list of integers (LIST). The default is *mu*=1. The probability density function (**pdf**) is: $f(x) = e^{-\mu} \mu^x / x!, x = 0,1,2,...$
7:Poissoncdf	Computes a cumulative probability at *x* for the discrete Poisson distribution with the specified mean *mu*, which must be a real number > 0. *x* can be an non-negative integer (SINGLE) or a list of integers (LIST). The default is *mu*=1.

Stats Results

Variables	1-Var or 2-Var	Definition
n	1-Var	Number of *x* or (*x*,*y*) data points.

Variables	1-Var or 2-Var	Definition
$\bar{x}$	Both	Mean of all x values.
$\bar{y}$	2-Var	Mean of all y values.
Sx	Both	Sample standard deviation of x.
Sy	2-Var	Sample standard deviation of y.
σ**x**	Both	Population standard deviation of x.
σ**y**	2-Var	Population standard deviation of y.
Σ**x** or Σ**x**^{2}	Both	Sum of all x or x^2 values.
Σ**y** or Σ**y**^{2}	2-Var	Sum of all y or y^2 values.
Σ**xy**	2-Var	Sum of (x×y) for all xy pairs.
a	2-Var	Linear regression slope.
b	2-Var	Linear regression y-intercept.
r^2 or **r**	2-Var	Correlation coefficient.
x′	2-Var	Uses a and b to calculate predicted x value when you input a y value.
y′	2-Var	Uses a and b to calculate predicted y value when you input an x value.
minX or **maxX**	Both	Minimum or maximum of x values.
Q1	1-Var	Median of the elements between minX and Med (1st quartile).
Med	1-Var	Median of all data points.
Q3	1-Var	Median of the elements between Med and maxX (3rd quartile).
minY or **maxY**	2-Var	Minimum or maximum of y values.

To define statistical data points:

1. Enter data in L1, L2, or L3. (See Data Editor section.)

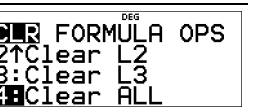
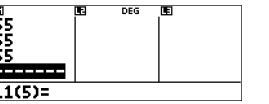
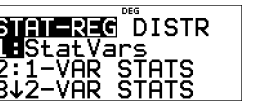
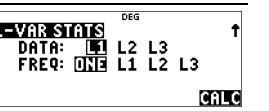
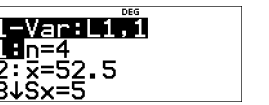
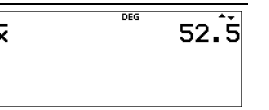
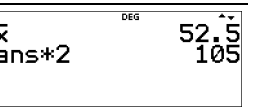
   Note: Non-integer frequency elements are valid. This is useful when entering frequencies expressed as percentages or parts that add up to 1. However, the sample standard deviation, Sx, is undefined for non-integer frequencies, and Sx=Error is displayed for that value. All other statistics are displayed.

2. Press 2nd [stat-reg/distr]. Select **1-Var** or **2-Var** and press enter.
3. Select L1, L2, or L3, and the frequency.

4. Press enter to display the menu of variables.
5. To clear data, press data data, select a list to clear, and press enter.

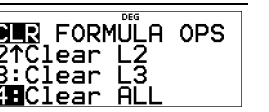
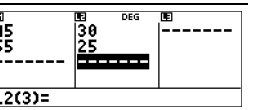
1-Var Example

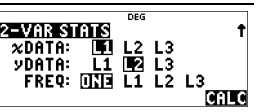
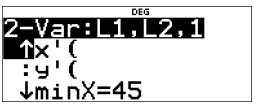
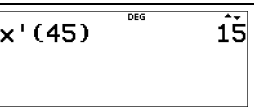
Find the mean of {45,55,55,55}.

Clear all data	data data ⊙ ⊙ ⊙	
Data	enter **45** ⊙ **55** ⊙ **55** ⊙ **55** enter	
Stat	2nd [quit] 2nd [stat-reg/distr]	
	2 (Selects **1-VAR STATS**) ⊙ ⊙	
	enter	
Stat Var	**2** enter	
	× **2** enter	

2-Var Example

Data: (45,30); (55,25). Find: x′(45).

Clear all data	data data ⊙ ⊙ ⊙	
Data	enter **45** ⊙ **55** ⊙ ⊙ **30** ⊙ **25** ⊙	

Stat	2nd [stat-reg/distr]	
	3 (Selects **2-VAR STATS**) ⊙ ⊙ ⊙	
StatVars	enter 2nd [quit] 2nd [stat-reg/distr] **1** ⊙ ⊙ ⊙ ⊙ ⊙ ⊙	
	enter **45**) enter	

Problem

For his last four tests, Anthony obtained the following scores. Tests 2 and 4 were given a weight of 0.5, and tests 1 and 3 were given a weight of 1.

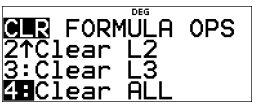
Test No.	1	2	3	4
Score	12	13	10	11
Weight	1	0.5	1	0.5

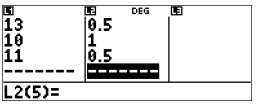
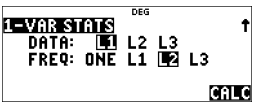
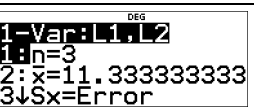
1. Find Anthony's average grade (weighted average).
2. What does the value of n given by the calculator represent? What does the value of Σx given by the calculator represent?

   Reminder: The weighted average is

   $$\frac{\Sigma x}{n} = \frac{(12)(1)+(13)(0.5)+(10)(1)+(11)(0.5)}{1+0.5+1+0.5}$$

3. The teacher gave Anthony 4 more points on test 4 due to a grading error. Find Anthony's new average grade.

data data ⊙ ⊙ ⊙	
enter data ⊙ ⊙ ⊙ ⊙ ⊙	

enter **12** ▼ **13** ▼ **10** ▼ **11** ▼ ▶ **1** ▼ **.5** ▼ **1** ▼ **.5** enter	
2nd [stat-reg/distr]	
2 ▼ ▶ ▶ enter	
enter	

Anthony has an average ($\bar{x}$) of 11.33 (to the nearest hundredth).

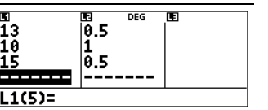
On the calculator, n represents the total sum of the weights.

$n = 1 + 0.5 + 1 + 0.5$.

Σx represents the weighted sum of his scores.

$(12)(1) + (13)(0.5) + (10)(1) + (11)(0.5) = 34$.

Change Anthony's last score from 11 to 15.

data ▼ ▼ ▼ **15** enter	
2nd [stat-reg/distr] **2** ▼ ▶ ▶ enter enter	

If the teacher adds 4 points to Test 4, Anthony's average grade is 12.

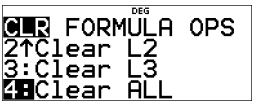
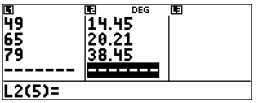
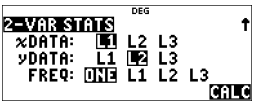
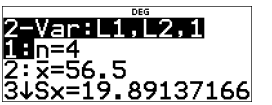
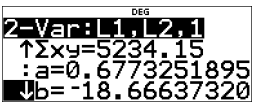
Problem

The table below gives the results of a braking test.

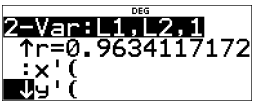
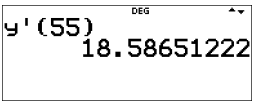
Test No.	1	2	3	4
Speed (kph)	33	49	65	79
Braking distance (m)	5.30	14.45	20.21	38.45

Use the relationship between speed and braking distance to estimate the braking distance required for a vehicle traveling at 55 kph.

A hand-drawn scatter plot of these data points suggest a linear relationship. The calculator uses the least squares method to find the line of best fit, $y'=ax'+b$, for data entered in lists.

data data ⊙ ⊙ ⊙	
enter **33** ⊙ **49** ⊙ **65** ⊙ **79** ⊙ ⊙ **5.3** ⊙ **14.45** ⊙ **20.21** ⊙ **38.45** enter	
2nd [quit] 2nd [stat-reg/distr]	
3 (Selects **2-VAR STATS**) ⊙ ⊙ ⊙	
enter	
Press ⊙ as necessary to view a and b.	

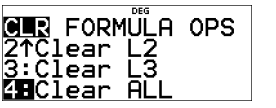
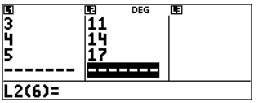
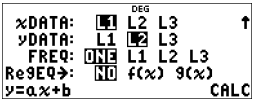
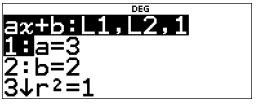
This line of best fit, $y'=0.67732519x'-18.66637321$ models the linear trend of the data.

Press ⊙ until y' is highlighted.	
enter **55**) enter	

The linear model gives an estimated braking distance of 18.59 meters for a vehicle traveling at 55 kph.

Regression Example 1

Calculate an ax+b linear regression for the following data: {1,2,3,4,5}; {5,8,11,14,17}.

Clear all data	data data ▼ ▼ ▼	
Data	enter **1** ▼ **2** ▼ **3** ▼ **4** ▼ **5** ▼ ▶ **5** ▼ **8** ▼ **11** ▼ **14** ▼ **17** enter	
Regression	2nd [quit] 2nd [stat-reg/distr] ▼ ▼ ▼	
	enter	
	▼ ▼ ▼ ▼ enter Press ▼ to examine all the result variables.	

Regression Example 2

Calculate the exponential regression for the following data:

- L1 = {0,1,2,3,4}; L2 = {10,14,23,35,48}
- Find the average value of the data in L2.
- Compare the exponential regression values to L2.

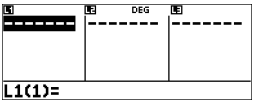
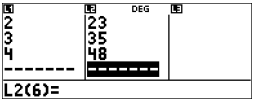
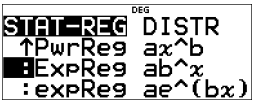
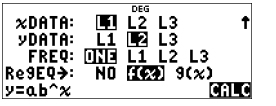
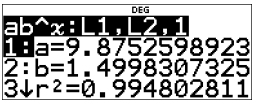
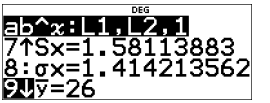
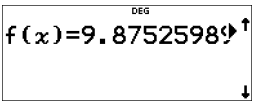
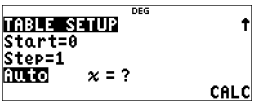
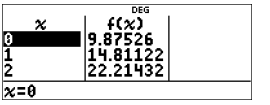
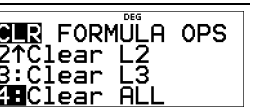
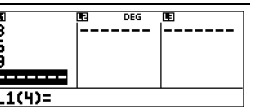
Clear all data	data data **4**	
Data	**0** ▼ **1** ▼ **2** ▼ **3** ▼ **4** ▼ ▶ **10** ▼ **14** ▼ **23** ▼ **35** ▼ **48** enter	
Regression	2nd [stat-reg/distr] ▲ ▲	
Save the regression equation to f(x) in the	enter ▼ ▼ ▼ ▶ enter	

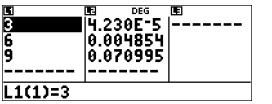
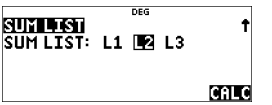
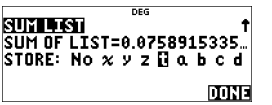
table menu.		
Regression Equation	enter	
Find the average value ($\bar{y}$) of the data in L2 using StatVars.	2nd [stat-reg/distr] **1** (Selects **StatVars**) ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙	 Notice that the title bar reminds you of your last statistical or regression calculation.
Examine the table of values of the regression equation.	table **1**	
	enter ⊙ **0** enter **1** enter	
	enter enter	

Warning: If you now calculate 2-Var Stats on your data, the variables **a** and **b** (along with **r** and $\mathbf{r}^2$) will be calculated as a linear regression. Do not recalculate 2-Var Stats after any other regression calculation if you want to preserve your regression coefficients (a, b, c, d) and r values for your particular problem in the **StatVars** menu.

Distribution Example

Compute the binomial pdf distribution at x values {3,6,9} with 20 trials and a success probability of 0.6. Enter the x values in list L1, store the results in L2, and then find the sum of the probabilities and store in the variable *t*.

Clear all data	data data ⊙ ⊙ ⊙	
Data	enter **3** ⊙ **6** ⊙ **9** enter	

DISTR	2nd [stat-reg/distr] ▶ ▼ ▼ ▼	
	enter ▶	
	enter **20** ▼ **0.6**	
	enter ▼ ▼	
	enter	
	data ◀ **4** ▶ enter	
	enter ▶ ▶ ▶ ▶ enter enter	

Probability

! nCr nPr 2nd [random]

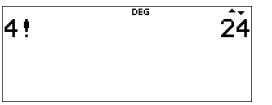
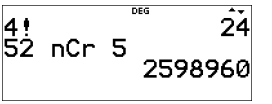
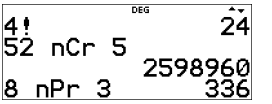
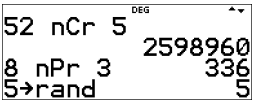
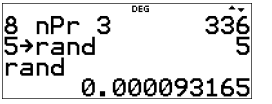
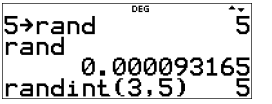
! nCr nPr is a multi-tap key that cycles through the following options:

!	A **factorial**, n!, is the product of the positive integers from 1 to n. The value of n must be a positive whole number ≤ 69. When n = 0, n! = 1
nCr	Calculates the number of possible **combinations** given n and r, non-negative integers. The order of objects is not important, as in a hand of cards.
nPr	Calculates the number of possible **permutations** of n items taken r at a time, given n and r, non-negative integers. The order of objects is important, as in a race.

2nd [random] displays a menu with the following options:

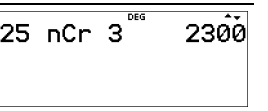
rand	Generates a random real number between 0 and 1. To control a sequence of random numbers, store an integer (seed value) ≥ 0 to **rand**. The seed value changes randomly every time a random number is generated.
randint(	Generates a random integer between two integers, A and B, where $A \le$ randint $\le B$. The arguments of the function are: **randint(***integer*A,*integer*B**)**

Examples

!	**4** [! nCr nPr] [enter]	
nCr	**52** [! nCr nPr] [nCr nPr] **5** [enter]	
nPr	**8** [! nCr nPr] [! nCr nPr] [! nCr nPr] **3** [enter]	
Store value to rand	**5** [sto→] [2nd] [random]	
	1 (Selects **rand**) [enter]	
rand	[2nd] [random] **1** [enter]	
randint(	[2nd] [random] **2** **3** [2nd] [,] **5** [)] [enter]	

Problem

An ice cream store advertises that it makes 25 flavors of home made ice cream. You like to order three different flavors in a dish. How many combinations of ice cream can you test over a very hot summer?

clear **25** ! nCr nPr ! nCr nPr **3** enter	

You can choose from 2300 dishes with different combinations of flavors!

Math Tools

This section contains information about using the calculator tools such as data lists, functions, and conversions.

Stored Operations

2nd [op] 2nd [set op]

2nd [set op] lets you store an operation.

2nd [op] pastes operation to the home screen.

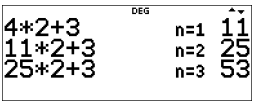
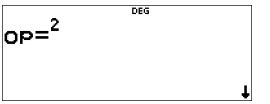
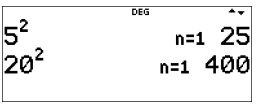
To set an operation and then recall it:

1. Press 2nd [set op].
2. Enter any combination of numbers, operations, and/or values.
3. Press enter to store the operation.
4. Press 2nd [op] to recall the stored operation and apply it to the last answer or the current entry.

   If you apply 2nd [op] directly to a 2nd [op] result, the **n=1** iteration counter is incremented.

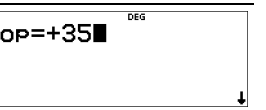
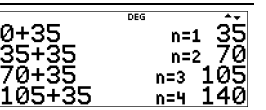
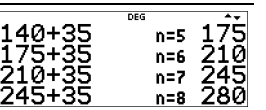
Examples

Clear op	2nd [set op] If a stored op is present, press clear to clear it.	DEG op= Enter operation. Set op:[enter] ↓
Set op	× **2** + **3**	DEG op=*2+3 ↓
	enter	DEG Operation set! [2nd][op] pastes to Home Screen.
Recall op	**4** 2nd [op]	DEG 4*2+3 n=1 11
	2nd [op]	DEG 4*2+3 n=1 11 11*2+3 n=2 25

	2nd [op]	
Redefine op	clear 2nd [set op] clear x^2 enter	
Recall op	**5** 2nd [op] **20** 2nd [op]	

Problem

A local store allows you to earn loyalty points that you can redeem for various gifts. The store adds 35 points to your mobile app for every visit. You would like to get a music download which costs 275 points. How many visits will it take? Currently, you have 0 points.

2nd [set op] clear + **35** enter	
0 2nd [op] 2nd [op] 2nd [op] 2nd [op]	
2nd [op] 2nd [op] 2nd [op] 2nd [op]	

After 8 visits to the store you will have 280 points which is enough for your download!

Data Editor and List Formulas

data

Pressing data displays the Data Editor where you can enter data in up to 3 lists (L1, L2, L3). Each list can contain up to 50 items.

Note: This feature is available in DEC mode only.

When editing a list, press data to access the following menus:

CLR	FORMULA	OPS
1:Clear L1	1:Add/Edit Frmla	1:Sort Sm-Lg...

2:Clear L2	2:Clear L1 Frmla	2:Sort Lg-Sm...
3:Clear L3	3:Clear L2 Frmla	3:Sequence...
4:Clear ALL	4:Clear L3 Frmla	4:Sum List...
	5:Clear ALL	

Entering and Editing Data

- Use ◀ ▶ ▲ ▼ to highlight a cell in the data editor and then enter a value.
- Mode settings such as number format, Float/Fix decimal and angle modes affect the display of a cell value.
- Fractions, radicals and π values will display.
- Press:
  - sto→ in a cell edit to store the value of the cell to a variable.
  - ◆▶≈ to toggle the number format when a cell is highlighted.
  - delete to delete a cell.
  - enter clear to clear the edit line of a cell.
  - 2nd [quit] to return to the Home Screen.
  - 2nd ▲ to go to the top of a list.
  - 2nd ▼ to go to the bottom of a list.
- Use the **CLR** menu to clear the data from a list.

List Formulas (FORMULA menu)

- In the data editor, press data ▶ to display the **FORMULA** menu. Select the appropriate menu item to add or edit a list formula in the highlighted column, or clear formulas from a particular list.
- When a data cell is highlighted, pressing sto→ is a shortcut to open the formula edit state.
- In the formula edit state, pressing data displays a menu to paste L1, L2 or L3 in the formula.
- Formulas cannot contain a circular reference such as L1=L1.
- When a list contains a formula, the edit line will display the reversed cell name. Cells will update if referenced lists are updated.
- To clear a formula list, clear the formula first, and then clear the list.
- If sto→ is used in a list formula, the last element of the computed list is stored to the variable. Lists cannot be stored.
- List formulas accept all calculator functions and real numbers.

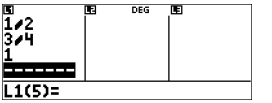
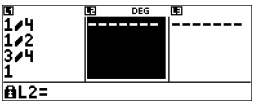
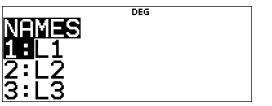
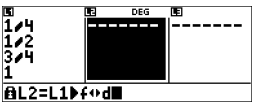
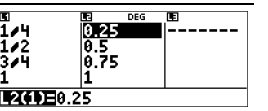
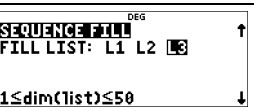
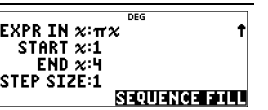
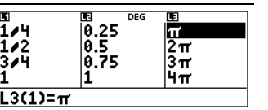
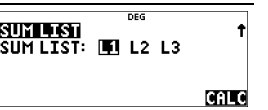
Options (OPS menu)

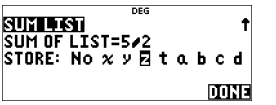
In the data editor, press data ◀ to display the **OPS** menu. Select the appropriate menu item to:

- Sort values from smallest to largest or largest to smallest.
- Create a Sequence of values to fill a list.

- Sum the elements in a list and store to a variable for further investigation.

Example

L1	data data 4 data 1 ▫/▫ 4 ▼ 2 ▫/▫ 4 ▼ 3 ▫/▫ 4 ▼ 4 ▫/▫ 4 enter	
Formula	▶ data ▶	
	enter	
	data	
	enter 2nd [f◂▸d]	
	enter	
Fill a list with a sequence	▶ data ◀ 3 ▶ ▶ enter	
	π e i x^{yzt}_{abcd} enter 1 enter 4 enter 1 enter	
	enter	
Store the Sum of L1 to the variable z	data ◀ 4 enter	

	enter ▷ ▷ ▷ enter enter	

Problem

On a November day, a weather report on the Internet listed the following temperatures.

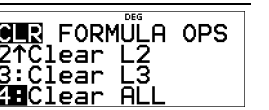
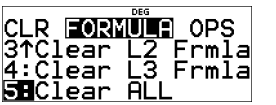
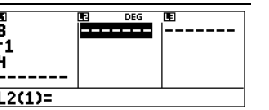
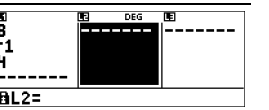
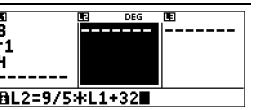
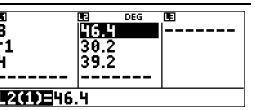
Paris, France 8°C

Moscow, Russia -1°C

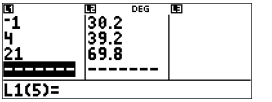
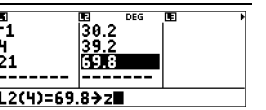
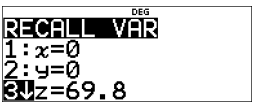
Montreal, Canada 4°C

Convert these temperatures from degrees Celsius to degrees Fahrenheit. (See also the section on Conversions.)

Reminder: $F = \frac{9}{5} C + 32$

data data **4** data ▷ **5**	 
8 ▽ (−) **1** ▽ **4** ▽ ▷	
data ▷ **1**	
9 ÷ **5** × data **1** + **32**	
enter	

If Sydney, Australia is 21°C, find the temperature in degrees Fahrenheit and store the temperature in the variable *z*.

⊖ ⊖ ⊖ ⊖ **21** enter	
⊕ ⊕ enter 2nd ⊕ sto→ x^{yzt}_{abcd} x^{yzt}_{abcd} x^{yzt}_{abcd}	
enter 2nd [recall] ⊖ ⊖	

Function Table

table displays a menu with the following options:

1:Add/Edit Func	Lets you define the function **f(**x**)** or **g(**x**)** or both and generates a table of values. ◆▸≈ on a value in the table will toggle the number format.
2:f(	Pastes **f(** to an input area such as the Home screen to evaluate the function at a point (for example, **f(2)**).
3:g(	Pastes **g(** to an input area such as the Home screen to evaluate the function at a point (for example, **g(3)**).

The function table allows you to display a defined function in a tabular form. To set up a function table:

1. Press table and select **Add/Edit Func**.
2. Enter one or two functions and press enter.
3. Select the table start, table step, auto, or ask-x options and press enter.

The table is displayed using the specified values. Table results will display as Real numbers in DEC mode only. Complex functions evaluate on the home screen only.

Start	Specifies the starting value for the independent variable, x.
Step	Specifies the incremental value for the independent variable, x. The step can be positive or negative.
Auto	The calculator automatically generates a series of values based on table start and table step.
Ask-x	Lets you build a table manually by entering specific values for the independent variable, x. The table has a maximum of three rows, but you can

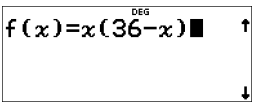
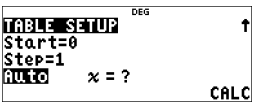
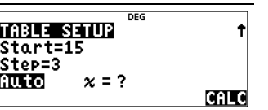
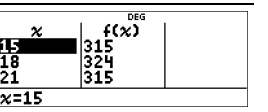
	overwrite the x values as needed to see more results.

Note: In the Function Table view, press clear to display and edit the Table Setup wizard as needed.

Problem

Find the vertex of the parabola, $y = x(36 - x)$ using a table of values.

Reminder: The vertex of the parabola is the point on the parabola that is also on the line of symmetry.

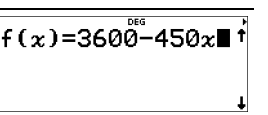
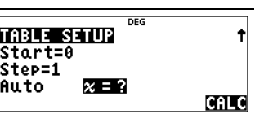
table **1** clear $x^{y=t}_{abcd}$ (**36** − $x^{y=t}_{abcd}$)	
enter clear enter	
15 ▼ **3** ▼ ▼	
enter	

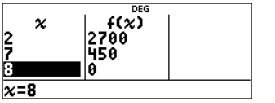
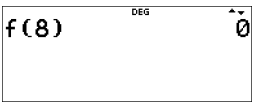
After searching close to x = 18, the point (18,324) appears to be the vertex of the parabola since it appears to be the turning point of the set of points of this function. To search closer to x = 18, change the Step value to smaller and smaller values to see points closer to (18,324).

Problem

A charity collected $3,600 to help support a local food kitchen. $450 will be given to the food kitchen every month until the funds run out. How many months will the charity support the kitchen?

Reminder: If x = months and y = money left, then $y = 3600 - 450x$.

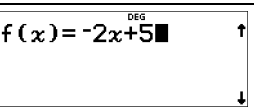
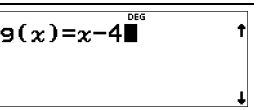
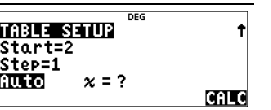
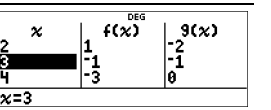
table **1** clear **3600** − **450** $x^{y=t}_{abcd}$	
enter clear enter **0** ▼ **1** ▼ ▶ enter enter	

Input each guess and press enter.	
Calculate the value of **f(8)** on the Home screen. 2nd [quit] table	
2 Selects **f(** **8**) enter	

The support of $450 per month will last for 8 months since $y(8) = 3600 - 450(8) = 0$ as shown in the table of values.

Problem

Find the intersection of the lines f(x)=⁻2x+5 and g(x)=x-4.

table **1** clear (−) **2** x^{yzt}_{abcd} + **5**	
enter clear x^{yzt}_{abcd} − **4**	
enter **2** enter **1** Select **Auto** enter enter	
enter ⊙	

The two lines intersect at (x,y) = (3,⁻1).

Number Bases

2nd [base n]

Base Conversion

2nd [base n] displays the **CONVR** menu, which converts a real number to the equivalent in a specified base.

1:▶ Hex	Converts to hexadecimal (base 16).
2:▶ Bin	Converts to binary (base 2).

3:▶ Dec	Converts to decimal (base 10).
4:▶ Oct	Converts to octal (base 8).

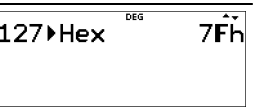
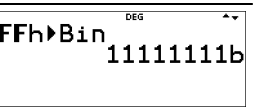
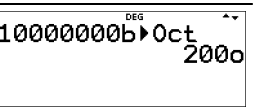
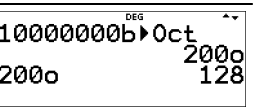
Base Type

2nd [base n] ⊙ displays the **TYPE** menu, which lets you designate the base of a number regardless of the calculator's current number-base mode.

1:h	Designates a hexadecimal integer.
2:b	Designates a binary integer.
3:d	Designates a decimal number.
4:o	Designates an octal integer.

Examples in DEC Mode

Note: Mode can be set to DEC, BIN, OCT, or HEX. See the Mode section.

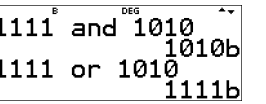
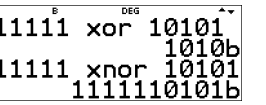
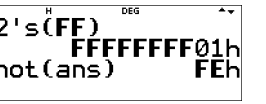
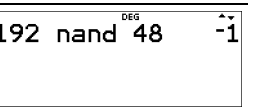
d ▶ Hex	clear **127** 2nd [base n] **1** enter	
h ▶ Bin	clear 2nd [F] 2nd [F] 2nd [base n] ⊙ **1** 2nd [base n] **2** enter	
b ▶ Oct	clear **10000000** 2nd [base n] ⊙ **2** 2nd [base n] **4** enter	
o ▶ Dec	⊛ enter enter	

Boolean Logic

2nd [base n] ⊖ displays the **LOGIC** menu, which lets you perform boolean logic.

1:and	Bitwise AND of two integers
2:or	Bitwise OR of two integers
3:xor	Bitwise XOR of two integers
4:xnor	Bitwise XNOR of two integers
5:not(	Logical NOT of a number
6:2's(	2's complement of a number
7:nand	Bitwise NAND of two integers

Examples

BIN mode: **and**, **or**	clear mode ▼ ▼ ▼ ▼ ▶ ▶ enter **1111** 2nd [base n] ◀ **1** **1010** enter **1111** 2nd [base n] ◀ **2** **1010** enter	
BIN mode: **xor**, **xnor**	clear **11111** 2nd [base n] ◀ **3** **10101** enter **11111** 2nd [base n] ◀ **4** **10101** enter	
HEX mode: **not**, **2's**	clear mode ▼ ▼ ▼ ▼ ▶ enter 2nd [base n] ◀ **6** 2nd [F] 2nd [F]) enter 2nd [base n] ◀ **5** 2nd [answer]) enter	
DEC mode: **nand**	clear mode ▼ ▼ ▼ ▼ enter **192** 2nd [base n] ◀ **7** **48** enter	

Expression Evaluation

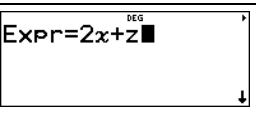
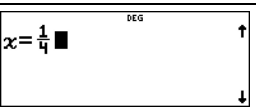
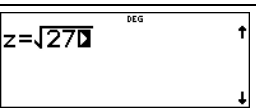
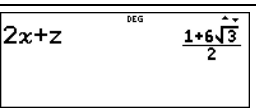
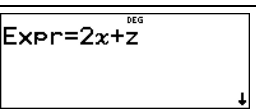
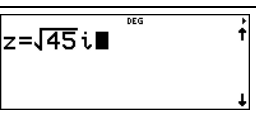
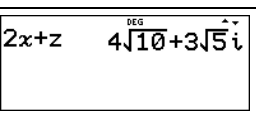
2nd [expr-eval]

Press 2nd [expr-eval]to input and calculate an expression using numbers, functions, and variables/parameters. Pressing 2nd [expr-eval]from a populated home screen expression pastes the content to **Expr=**. If the cursor focus is in history, the selected expression will paste to **Expr=** when 2nd [expr-eval]is pressed.

If variables, x, y, z, t, a, b, c or d are used in the expression, you will be prompted for values or use the stored values displayed for each prompt. The number stored in the variables will update in the calculator.

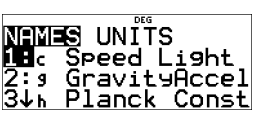
Example

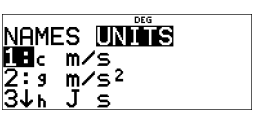
2nd [expr-eval] clear	

2 $x^{y\,z\,t}_{a\,b\,c\,d}$ + $x^{y\,z\,t}_{a\,b\,c\,d}$ $x^{y\,z\,t}_{a\,b\,c\,d}$ $x^{y\,z\,t}_{a\,b\,c\,d}$	
enter clear **1** $\frac{\square}{\square}$ **4**	
enter clear 2nd [√] **27**	
enter	
2nd [expr-eval]	
enter clear 2nd [√] **40**	
enter clear 2nd [√] **45** ▶ π^{e}_{i} π^{e}_{i} π^{e}_{i}	
enter	

Constants

Constants lets you access scientific constants to paste in various areas of the TI-30X Plus MathPrint™ calculator. Press 2nd [constants] to access, and ◀ or ▶ to select either the **NAMES** or **UNITS** menus of the same 20 physical constants. Use ▲ and ▼ to scroll through the list of constants in the two menus. The **NAMES** menu displays an abbreviated name next to the character of the constant. The **UNITS** menu has the same constants as **NAMES** but the units of the constant show in the menu.





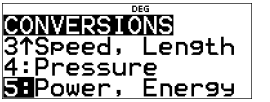
Note: Displayed constant values are rounded. The values used for calculations are given in the following table.

Constant		Value used for calculations
c	speed of light	299792458 meters per second
g	gravitational acceleration	9.80665 meters per second^2
h	Planck's constant	$6.626070040\times10^{-34}$ Joule seconds
NA	Avogadro's number	6.022140857×10^{23} molecules per mole
R	ideal gas constant	8.3144598 Joules per mole per Kelvin
$\mathbf{m}_e$	electron mass	9.10938356×10^{-31} kilograms
$\mathbf{m}_p$	proton mass	$1.672621898\times10^{-27}$ kilograms
$\mathbf{m}_n$	neutron mass	$1.674927471\times10^{-27}$ kilograms
$\mathbf{m}_\mu$	muon mass	$1.883531594\times10^{-28}$ kilograms
G	universal gravitation	6.67408×10^{-11} meters^3 per kilogram per seconds^2
F	Faraday constant	96485.33289 Coulombs per mole
$\mathbf{a}_0$	Bohr radius	$5.2917721067\times10^{-11}$ meters
$\mathbf{r}_e$	classical electron radius	$2.8179403227\times10^{-15}$ meters
k	Boltzmann constant	1.38064852×10^{-23} Joules per Kelvin
e	electron charge	$1.6021766208\times10^{-19}$ Coulombs
u	atomic mass unit	1.66053904×10^{-27} kilograms
atm	standard atmosphere	101325 Pascals
$\varepsilon\mathbf{0}$	permittivity of vacuum	$8.85418781762\times10^{-12}$ Farads per meter
$\mu\mathbf{0}$	permeability of vacuum	$1.256637061436\times10^{-6}$ Newtons per ampere^2
Cc	Coulomb's constant	$8.987551787368\times10^{9}$ meters per Farad

Conversions

The **CONVERSIONS** menu allows a total of 20 conversions (or 40 if converting both ways). The conversion must be at the end of an expression. The value of the full expression will be converted. A conversion can be stored to a variable.

To access the **CONVERSIONS** menu, press 2nd [convert]. Press one of the numbers (1-5) to select, or press ▲ and ▼ to scroll through and select one of the **CONVERSIONS** submenus. The submenus include the categories English-Metric, Temperature, Speed and Length, Pressure, and Power and Energy.



English-Metric Conversion

in ▶ cm	inches to centimeters
cm ▶ in	centimeters to inches
ft ▶ m	feet to meters
m ▶ ft	meters to feet
yd ▶ m	yards to meters
m ▶ yd	meters to yards
mile ▶ km	miles to kilometers
km ▶ mile	kilometers to miles
acre ▶ m^2	acres to square meters
m^2 ▶ acre	square meters to acres
gal US ▶ L	US gallons to liters
L ▶ gal US	liters to US gallons
gal UK ▶ L	UK gallons to liters
L ▶ gal UK	liters to UK gallons
oz ▶ gm	ounces to grams
gm ▶ oz	grams to ounces
lb ▶ kg	pounds to kilograms
kg ▶ lb	kilograms to pounds

Temperature Conversion

°F ▶ °C	Farenheit to Celsius
°C ▶ °F	Celsius to Farenheit
°C ▶ K	Celsius to Kelvin

K ▸ °C	Kelvin to Celsius

Speed and Length Conversion

km/hr ▸ m/s	kilometers/hour to meters/second
m/s ▸ km/hr	meters/second to kilometers/hour
LitYr ▸ m	light years to meter
m ▸ LitYr	meters to light years
pc ▸ m	parsecs to meters
m ▸ pc	meters to parsecs
Ang ▸ m	Angstrom to meters
m ▸ Ang	meters to Angstrom

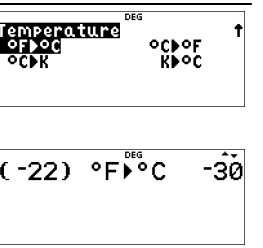
Power and Energy Conversion

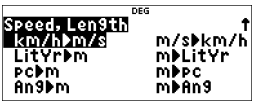
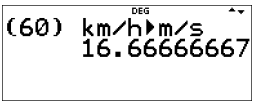
J ▸ kWh	Joules to kilowatt hours
kWh ▸ J	kilowatt hours to Joules
J ▸ cal	Joules to calories
cal ▸ J	calories to Joules
hp ▸ kW	horsepower to kilowatt
kW ▸ hp	kilowatt to horsepower

Pressure Conversion

atm ▸ Pa	atmospheres to Pascals
Pa ▸ atm	Pascals to atmospheres
mmHg ▸ Pa	millimeters of mercury to Pascals
Pa ▸ mmHg	Pascals to millimeters of mercury

Examples

Temperature	[(] [(–)] **22** [)] [2nd] [convert] **2** [enter] [enter] (Enclose negative numbers or expressions in parentheses.)	

Speed, Length	clear (60) 2nd convert ▼ ▼ enter enter enter	 
Power, Energy	clear (200) 2nd convert ▼ ▼ ▼ ▼ enter ▶ enter enter	 

Complex Numbers

2nd [complex]

The calculator performs the following complex number calculations:

- Addition, subtraction, multiplication, and division
- Argument and absolute value calculations
- Reciprocal, square, and cube calculations
- Complex Conjugate number calculations

Setting the Complex Format

Set the calculator to DEC mode when computing with complex numbers.

mode ▼ ▼ ▼ Selects the **REAL** menu. Use ◀ and ▶ to scroll with in the **REAL** menu to highlight the desired complex results format **a+bi**, or **r**$\angle\theta$, and press enter.

REAL, **a+bi**, or **r**$\angle\theta$ set the format of complex number results.

a+bi rectangular complex results

r$\angle\theta$ polar complex results

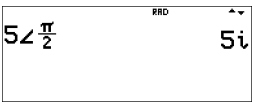
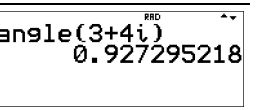
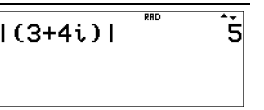
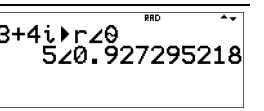
Notes:

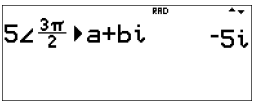
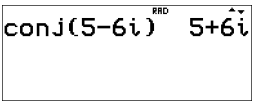
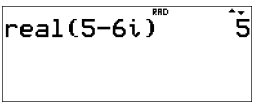
- Complex results are not displayed unless complex numbers are entered.
- To access i on the keypad, use the multi-tap key π.
- Variables x, y, z, t, a, b, c, and d are real or complex.
- Complex numbers can be stored.

- For conj(, real(, and imag(, the argument can be in either rectangular or polar form. The output for conj(is determined by the mode setting.
- The output for real(and imag(are real numbers.
- Set mode to DEGREE or RADIAN depending on the angle measure needed.

Complex Menu	Description
1:∠	∠ (polar angle character) Lets you paste the polar representation of a complex number (such as 5∠π).
2:polar angle	Returns the polar angle of a complex number. Syntax: **angle(***value***)**
3:magnitude	Returns the magnitude (modulus) of a complex number. Syntax: **abs(***value***)** (or |□| in MathPrint™ mode)
4:▸r∠θ	Displays a complex result in polar form. Valid only at the end of an expression.
5:▸a+bi	Displays a complex result in rectangular form. Valid only at the end of an expression.
6:conjugate	Returns the conjugate of a complex number. Syntax: **conj(***value***)**
7:real	Returns the real part of a complex number. Syntax: **real(***value***)**
8:imaginary	Returns the imaginary (nonreal) part of a complex number. Syntax: **imag(***value***)**

Examples (set mode to RADIAN)

Polar angle character: ∠	clear **5** 2nd [complex] enter π^{e}_{i} ▫/▫ **2** enter	
Polar angle: angle(	clear 2nd [complex] ▼ enter **3** + **4** π^{e}_{i} π^{e}_{i} π^{e}_{i}) enter	
Magnitude: abs(	clear 2nd [complex] **3** (**3** + **4** π^{e}_{i} π^{e}_{i} π^{e}_{i}) enter	
▸r∠θ	clear **3** + **4** π^{e}_{i} π^{e}_{i} π^{e}_{i} 2nd [complex] **4** enter	

▶a+bi	clear **5** 2nd [complex] enter **3** π $\frac{\square}{\square}$ **2** ▶ 2nd [complex] **5** enter	
Conjugate: conj(	clear 2nd [complex] **6** **5** − **6** π π π) enter	
Real: real(	clear 2nd [complex] **7** **5** − **6** π π π) enter	

Reference Information

This section contains information about errors, maintaining and replacing the batteries, and troubleshooting problems.

Errors and Messages

When the calculator detects an error, the screen will display the error type or a message.

- To correct an error: Press [clear] to clear the error screen. The cursor will display at or near the error. Correct the expression.
- To close the error screen without correcting the expression: Press [2nd] [quit] to return to the Home Screen.

The following list includes some of the errors and messages that you may encounter.

Error/Message	Description
Argument	This error is returned when: • a function does not have the correct number of arguments • the lower limit is greater than upper limit in summation or product function
Bounds: Enter LOWER ≤ UPPER	This error is returned when input for lower bound > upper bound for Normalcdf distribution.
Break	This error is returned when the [on] key is pressed to stop the evaluation of an expression.
Calculate 1-Var,2-Var Stat or a regression.	This message is returned when no statistics or regression calculation has been stored.
Change mode to DEC.	This error is returned when the mode is set to BIN, HEX or OCT and the following apps are accessed: [expr-eval] [table] [convert] [stat-reg/distr] [data] These apps are available in DEC mode only.
Dimension mismatch	This error is returned if: • the dimensions of lists used in a data formula are not the same length for the operation • a calculation of 2-var stats is attempted when the data lists are not of equal length
Division by 0	This error is returned if the expression evaluation contains division by 0.

Error/Message	Description
Domain	This error is returned when an argument is not in the function domain. For example: • For $x\sqrt{y}$: $x = 0$ – or – $y < 0$ and x is not an odd integer. • For y^x: y and $x = 0$. • For $\sqrt{x}$: $x < 0$. • For **log**, **ln** or **logBASE**: $x \leq 0$. • For **tan**: x = 90°, -90°, 270°, -270°, 450°, etc., and equivalent for radian mode. • For **sin**$^{-1}$ or **cos**$^{-1}$: $\lvert x \rvert > 1$. • For **nCr** or **nPr**: n or r are not integers ≥ 0. • For $x!$: x is not an integer between 0 and 69.
Enter 0≤area≤1	This error is returned when you enter an invalid area value in invNormal for a distribution.
Enter sigma>0	This error is returned when the input for sigma in a distribution is invalid.
Expression is too long	This error is returned when an entry exceeds the digit limits. For example, pasting an expression entry with a constant that exceeds the limit. A checkerboard cursor may display when limits are reached in each MathPrint™ feature.
Formula	This error is returned in data when: • the formula does not contain a list name (L1, L2, or L3) • the formula for a list contains its own list name For example, a formula for L1 contains L1.
Frequency: Enter FREQ≥0	This error is returned when at least one element in a list selected for $FREQ$ is a negative real number in **1-VAR** or **2-VAR STATS**.
Input must be non-negative Integer.	This error is returned when an input is not the expected number type. For example, in distribution arguments $TRIALS$ and x in Binomialpdf.
Input must be Real	This error is returned when an input requires a real number.

Error/Message	Description
Invalid data type	This error is returned when the argument of a command or function is the incorrect data type. For example, the error will be displayed for sin (i) or min(i,7) where the arguments must be Real numbers.
Invalid function	This error is returned when no function is defined and a function evaluation is attempted. Define functions in [table].
List Dimension 1≤dim(list)≤50	This error is returned when, in [data]: • the **SUM LIST** function is executed on an empty list • a sequence is created with a length of 0 or >50.
Mean: Enter mu>0	This error is returned when an invalid value is input for the mean ($mean = mu$) in poissonpdf or poissoncdf.
Memory limit reached	This error is returned when a calculation contains a circular reference such as two functions referencing each other, or a very long calculation.
[2nd] [set op]: Operation is not defined.	This error is returned when an operation has not been defined in [2nd] [set op] and [2nd] [op] is pressed.
Operation set! [2nd] [op] pastes to Home Screen.	This message is returned when an operation is stored (set) from [2nd] [set op] editor. Press any key to continue.
Overflow	This error is returned when a calculation or value is beyond the range of the calculator.
Probability: Enter 0≤p≤1	This error is returned when input for the probability in distributions is invalid.
Statistics	This error is returned when a statistical or regression function is invalid. For example, when a calculation of 1-var or 2-var stats is attempted with no defined data points.
Step size must not be 0.	This error is returned when, in [data], the $STEP\ SIZE$ input is set to 0 in the **SEQUENCE FILL** function.
Syntax	This error is returned when an expression contains misplaced functions, arguments, parentheses, or commas.

Error/Message	Description
TRIALS: Enter 0≤n≤49	This error is returned in Binomialpdf and Binomialcdf, when the number of trials is out of range, 0≤n≤49 in the case of ALL.

Battery Information

Battery Precautions

- Do not leave batteries within the reach of children.
- Do not mix new and used batteries.
- Do not mix brands (or types within brands) of batteries.
- Do not use rechargeable batteries.
- Do not place non-rechargeable batteries in a battery recharger.
- Install batteries according to polarity (+ and -) diagrams.
- Properly dispose of used batteries immediately.
- Do not incinerate or dismantle batteries.
- Seek Medical Advice immediately if a cell or battery has been swallowed. (In the USA, contact the National Capital Poison Center at 1-800-222-1222.)

Battery Disposal

Do not mutilate, puncture, or dispose of batteries in fire. The batteries can burst or explode, releasing hazardous chemicals. Discard used batteries according to local regulations.

How to Remove or Replace the Batteries

The TI-30X Plus MathPrint™ calculator uses two 3-volt CR2032 batteries.

- Remove the protective cover and turn the calculator face downwards.
- With a small screwdriver, remove the screws from the back of the case.
- From the bottom, carefully separate the front from the back. Be careful not to damage any of the internal parts.
- With a small screwdriver, remove the screw on the battery clip and remove the batteries.

- To replace the batteries, check the polarity (+ and -) and slide in the new batteries. Press firmly to snap the new batteries into place and replace the screw in the battery clip.

  Important: When replacing the batteries, avoid any contact with the other components of the calculator.

Dispose of the dead batteries immediately and in accordance with local regulations.

Per CA Regulation 22 CCR 67384.4, the following applies to the button cell batteries in this unit:

Perchlorate Material - Special handling may apply.

See: www.dtsc.ca.gov/hazardouswaste/perchlorate

In Case of Difficulty

Review instructions to be certain calculations were performed properly.

Check the batteries to ensure that they are fresh and properly installed.

Change the batteries when:

- [on] does not turn the unit on, or
- the screen goes blank, or
- you get unexpected results.

General Information

Online Help

education.ti.com/eguide

Select your country for more product information.

Contact TI Support

education.ti.com/ti-cares

Select your country for technical and other support resources.

Service and Warranty Information

For information about the length and terms of the warranty or about product service, refer to the warranty statement enclosed with this product or contact your local Texas Instruments retailer/distributor.