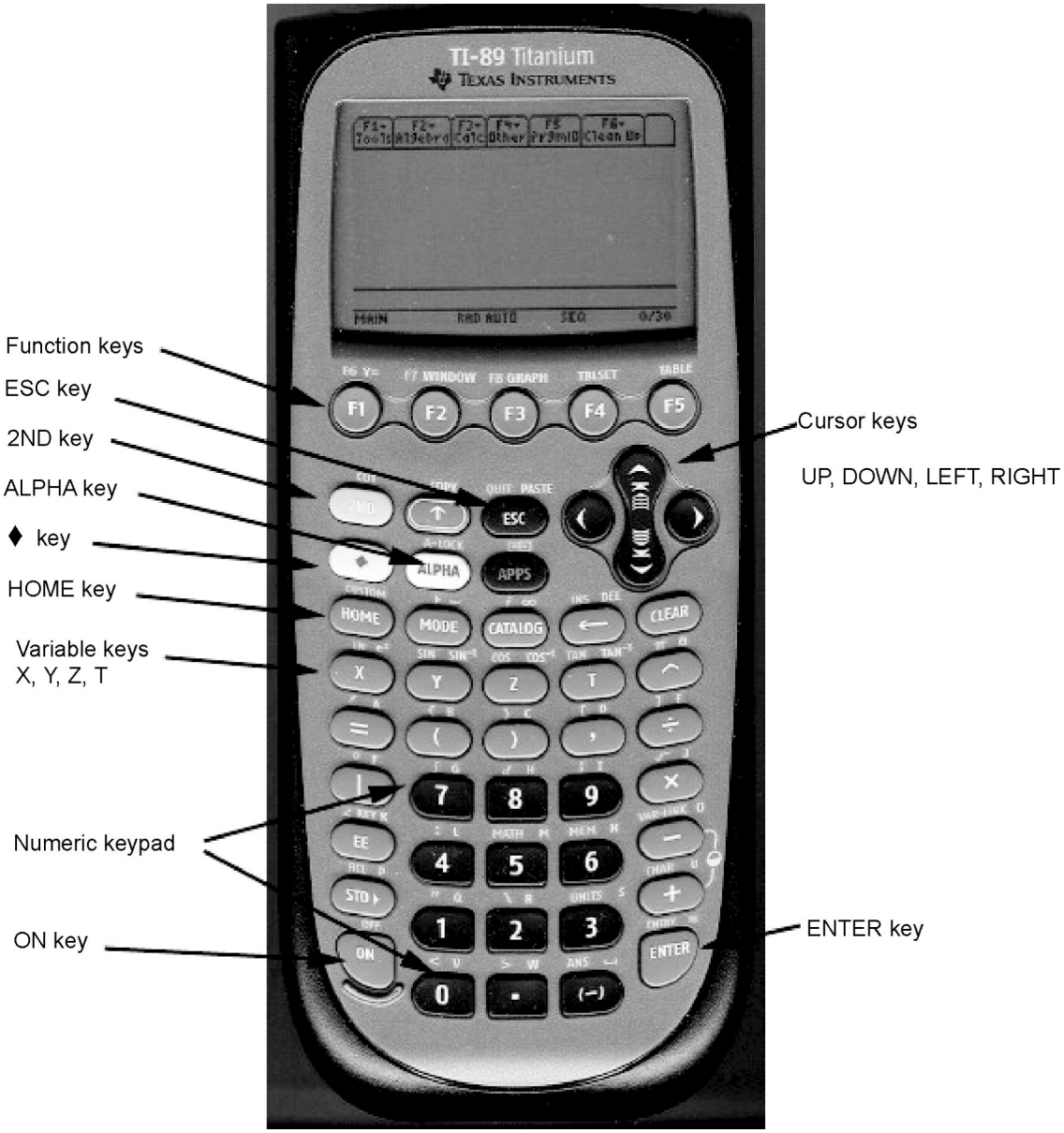
Name: _____ Date: _____

The Computer Algebra System (CAS) on the TI-89 Calculator

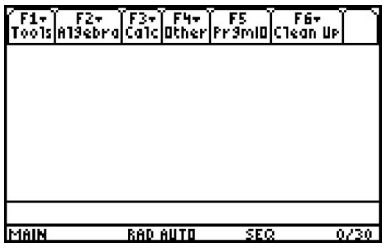
The TI-89 calculator features a Computer Algebra System (CAS) engine that allows you to perform algebraic operations, such as manipulating and solving algebraic equations.



Name: _____ Date: _____

The Computer Algebra System (CAS) on the TI-89 Calculator

Starting the CAS



Turn on your TI-89 calculator by pressing [ON]. If you don't see the Home screen shown, press [HOME].

The TI-89 Keyboard

Refer to the picture of the TI-89 calculator. Most keys have a primary function, as well as one or more secondary functions. For example, the 1 key is usually pressed to enter the number 1. However, if the blue [2nd] key is pressed, and then 1, you will enter opening quotes ". If the white key is pressed, and then 1, you will enter the letter q. Some keys have additional functions labelled in green. If the green [♦] key is pressed, and then [ESC], you will access the [PASTE] function.

The Function Keys

The CAS uses the functions F1 through F6 to display menus.
F1 through F5 are accessed by pressing the appropriate key.
F6 is accessed by pressing [2nd] [F6].
Press F1. Notice the menu. To close the menu without making a selection, press [ESC]. This is useful for cancelling a keystroke that was made in error.

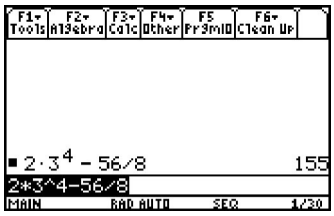
Starting a New Problem

Before starting a new problem, clear any data that may be stored in memory. Press [2nd] [F6]. Select **2: NewProb** then, press [ENTER]. This will clear the memory and reset all algebraic variables. If you do not do this, you may see unexpected results as you work through CAS solutions.
Note that NewProb also clears the Home screen.

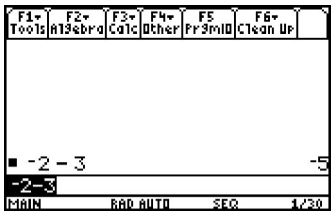
Name: _____ Date: _____

The Computer Algebra System (CAS) on the TI-89 Calculator

Entering Calculations

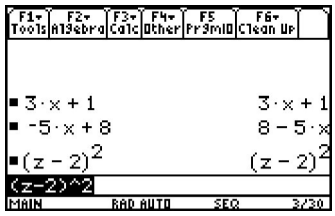


The numeric keypad on your TI-89 works just like the keypad on other graphing calculators, such as the TI-83 Plus or TI-84. For example, consider the expression $2 \times 3^4 - 56 \div 8$. Enter the keystrokes 2 [×] 3 [^] 4 [−] 56 [÷] 8 [ENTER].
The answer is 155.



Like the TI-83 Plus and TI-84, the TI-89 has two keys with a minus sign, the negative key [(-)] and the subtract key [−]. Use the [−] key for the operation of subtraction. Use the [(-)] key when you are making an expression negative. For example, to enter –2 – 3, press [(-)] 2 [−] 3.

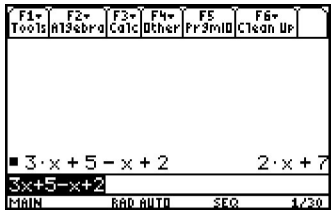
Entering and Simplifying Algebraic Expressions



The real power of a CAS lies in an ability to enter and manipulate algebraic expressions. Four of the variable names have their own keys: [X], [Y], [Z], and [T]. Others are accessed by pressing [ALPHA] and other keys.

Clear the Home screen if necessary, using NewProb.
Then, enter the expression $3x + 1$. Press [ENTER].
Notice that the TI-89 enters the expression on the Home screen, and also retains it in the command line. Enter some more expressions, such as $-5y + 8$, and $(z - 2)^2$. Notice that the CAS sometimes changes the format of the expression.

The CAS will simplify expressions by collecting like terms. As an example, enter the expression $3x + 5 - x + 2$, and press [ENTER]. Notice that like terms have been collected.

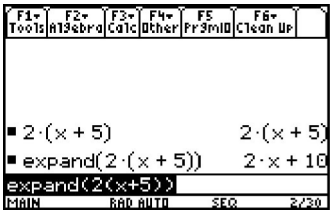


Name: _____ Date: _____

The Computer Algebra System (CAS) on the TI-89 Calculator

Expanding Expressions

The CAS can use the distributive property to expand algebraic expressions. Enter the expression $2(x + 5)$, and press ENTER.
Notice that the expression remains unexpanded.



Now, press F2, and select **3:expand(**.
Press 2 (X + 5) ENTER.
Notice that the CAS has expanded the expression.

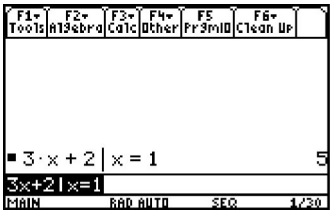
Factoring Expressions

The CAS can common factor expressions.
Press F2, and select **2:factor(**.
Press 2 X ^ 2 + 8 X) ENTER.
Notice that the CAS has factored the expression.

The CAS can factor trinomials.
Press F2, and select **2:factor(**.
Press 2 X ^ 2 + 12 X − 32) ENTER.
Notice that the CAS has factored the expression.

Evaluating Expressions

The CAS can evaluate an expression for a particular value of the variable. Press 3 X + 2 | X = 1 ENTER.
Notice that the CAS substituted the value 1 for the variable x, and then evaluated the expression for an answer of 5.

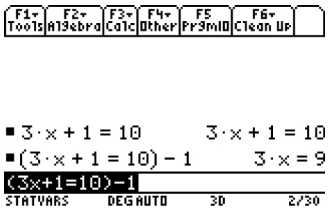
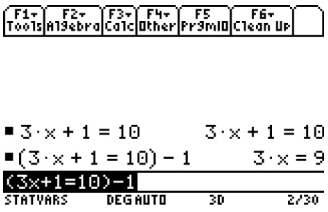


Name: _____ Date: _____

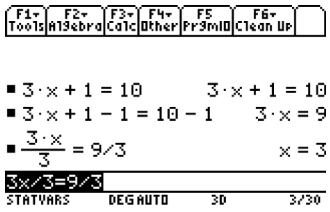
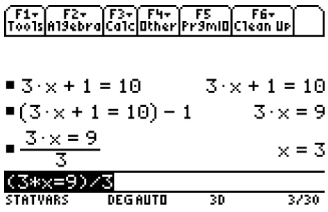
Entering and Manipulating Equations

The CAS will let you enter an equation, and apply operators to both sides. For example, enter the equation $3x + 1 = 10$. Press ENTER.

The first step in solving this equation is to subtract 1 from both sides. This can be done in two ways.

Enter the equation with –1 on both sides.	Enter $(3x + 1 = 10) - 1$ and press ENTER.
	

The next step is to divide both sides by 3. This can be done in two ways.

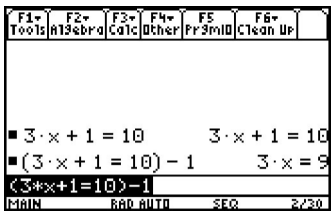
Enter the equation with /3 on both sides.	Enter $(3x = 9)/3$ and press ENTER.
	

Notice that the CAS displays the value of x that satisfies the equation.

Copying and Pasting Expressions

Press ◆ to copy and paste the equation that you have already entered. This is a useful feature, especially for long or complicated expressions.

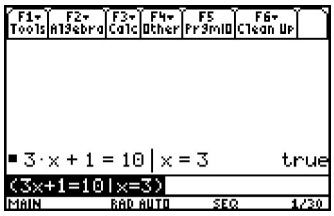
Press ▲ then press CLEAR to delete the previous line. Press then press CLEAR to clear out the last command prompt. Press (then press ▲. Press ◆ [COPY]. Press . Press ◆ [PASTE]. Notice that the equation has been pasted after the opening bracket.



Name: _____ Date: _____

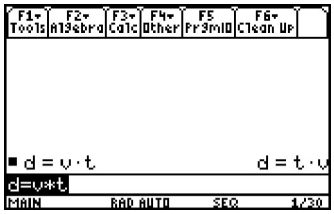
The Computer Algebra System (CAS) on the TI-89 Calculator

Checking a Solution



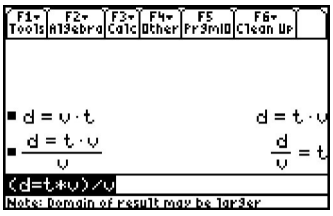
You can use the CAS to check a solution to an equation.
Suppose that you solved the equation $3x + 1 = 10$,
and found that $x = 3$.
Press (3 X + 1 = 10 | X = 3) ENTER.
Notice that the CAS returns a value of "**true**" if the solution is correct.

Entering Other Variables



You may find a problem in which it is convenient to use variables other than **X**, **Y**, **Z**, or **T**. You can access these by pressing .
For example, suppose that you want to enter the equation $d = vt$.
Press [D] = [V] × T ENTER
Note: when you want to multiply two variables, such as v and t, you must put a multiplication operator between them.

Solving Variable Equations

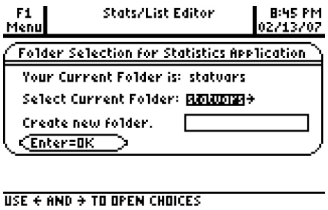


You can use the CAS to solve equations for a particular variable.
For example, suppose that you want to solve $d = vt$ for v.
You must divide both sides by t.

Enter the equation $d = vt$ as shown in the section **Entering Other Variables**. Press ENTER (◆ [COPY] ◆ [PASTE])
÷ [V] ENTER.

Graphing Features

Entering Data into Lists

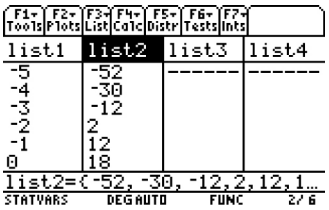


Press APPS and scroll to **Stats/List Editor** and press ENTER.
Press ENTER to select the default **Folder**
Selection for Statistics Application

- Enter these data into **list1**
  –5, –4, –3, –2, –1, 0, 1, 2, 3, 4, 5.
- Enter these data into **list2**
  –52, –30, –12, 2, 12, 18, 20, 18, 12, 2.

Name: _____ Date: _____

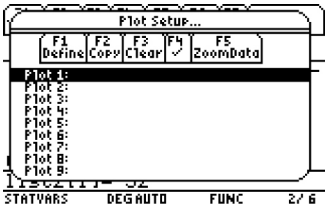
To use the List Editor as a Spreadsheet for the data in **list2**, scroll up to the top of the list so that the listname **list2** is highlighted.



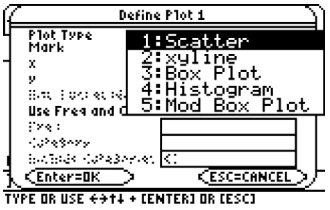
Press CLEAR then to clear the list.
Press ▲ to highlight the listname **list2**.

To generate data in **list2** press (-) 2 (F3 ENTER
Scroll down to listname titled **list1** so that it is highlighted and press ENTER − 1) ^ 2 + 20 ENTER.
In this way the List Editor is being used as a spreadsheet.

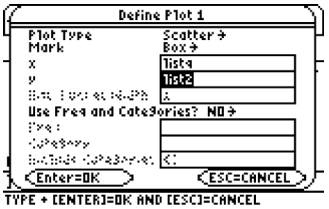
Setting up the Plot
To construct a scatter plot of the data in list1 and list2, press F2 from within the **Stats/List Editor** and select 1 for **Plot Setup**.



Press F1 to set up the plot.
A scatter plot is the default graph type.
Press ▶ to see the other types of plots available. Press ENTER to select **Scatter**.

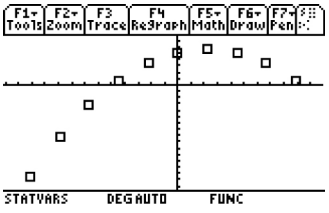


Press the twice. Input the listname for x.
Press 2nd [ALPHA] then type the word **L**, **I**, **S**, **T**.
Press to turn off the Alpha-Lock then press 1.
Press once. Input the listname for y as **list2**.



Press ENTER to complete the plot set-up.

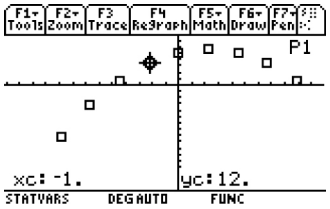
To construct the scatter plot, press F5 for **ZoomData**.



Name: _____ Date: _____

Tracing Data Points

To trace the data, press [F3] and press [◄] [►].

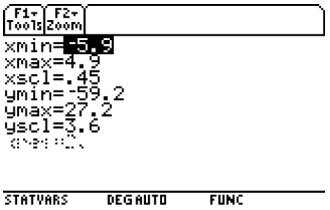


Re-Graphing a Set of Data Points

To Re-graph the equation, press [F4] or [◆] [F3].

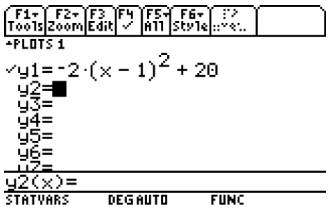
Setting the WINDOW

Press [◆] [F2].
The current window settings will be seen.
These values can be changed if desired.

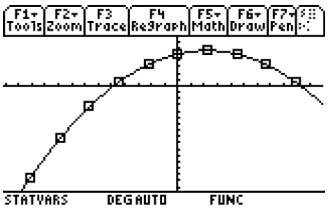


Inputting an Equation

To input an equation, press [◆] [F1].
Press [(-)] 2 [(] [X] [−] 1 [)] [^] 2 [+] 20 [ENTER]
to paste the information from the command prompt line to y1.



Press [◆] [F3] to graph the equation.



For More Information

You can obtain more information on the operation of your TI-89 calculator in the calculator manual. You can also download an electronic version of the manual in PDF format at *www.education.ti.com*.