Introduction to the TI-83 Plus
for Beginners

International Teachers Teaching with Technology

Friday, March 17, 2000
11:30-1:00 AM
Dallas Ballroom D3
Dallas, TX

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GRAPHICS CALCULATOR (TI-83Plus) Introduction
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DISPLAY CONTRAST
To increase the contrast, press and release the yellow 2nd key (row 2, column A), press and hold ∆ (row 2, between column D and E).
To decrease the contrast, press and release the yellow 2nd key, press and hold ▽ (row 3, between columns D and E).

SETTINGS
Set the Defaults.
For this worksheet, change the MODE (row 2, column B) settings of your calculator to look like the screen below by pressing the arrow keys (rows 2 and 3, columns D and E) to highlight the selection. Press ENTER (row 10, column E) to select what you have highlighted. Press QUIT (2nd, MODE (row 2, column B)) to return to the home screen.

OPERATIONS
2+3*4, ENTER (row 10, column E) 14.000
Many keys on the calculator have three functions:
a) what is written on the key in white lettering (just press the key)
b) what is written above and to the left of the key in yellow lettering (press 2nd (row 2, column A) and the desired “yellow” function)
c) what is written above and to the right of the key in green lettering (press ALPHA (row 3, column A) and the desired “green” letter or symbol).
3², (square function x² is 6A), ENTER 9.000
√9, (square root 2nd, x²), ENTER 3.000
2^5 (2^5, use ^ (5E) to raise a number to a power) 32.000
3√(32^5) (32^1/5) 2.000
EDITING

(2+3)*4, ENTER  20.000
To recall the last expression, press ENTRY (2nd, ENTER(10E)). The last expression will
reappear. To edit the last expression, place the cursor over the 3 and replace it with 6.

(2+6)*4, ENTER  32.000
Try it again! Recall the last expression. To delete +6, use the arrow keys to move the
cursor so that the + sign is highlighted. Press the DEL key (2C) to delete the + sign and the
6. Press the INS key (2nd, DEL, 2C), then insert .1+5, the decimal point (10C), the
addition symbol (9E), and the numeral 5 (7C).

(2.1+5)*4, ENTER  28.4000

Subtraction vs Opposite of (additive inverse)

-3^2 (Grey (-) key, (10D), Square (6A))  -9.000
2*-6 (Blue - key, (8E))  ERR:SYNTAX
Go to error and type gray (-), ENTER  -12.000
2 (-) 6 (Grey key)  ERR:SYNTAX

Note: The “subtract” operation is 5 pixels wide, “opposite of” is 3 pixels wide and 1 pixel
higher than the subtract symbol.

FRACTIONS

1/2 + 1/3 (Use MATH (4A), 1:►FRAC), ENTER  5/6
1/2+1/3, ENTER  .833
MATH, 1:►FRAC, ENTER

<table>
<thead>
<tr>
<th>MATH</th>
<th>NUM</th>
<th>CPX</th>
<th>PRB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:►Frac</td>
<td>1/2+1/3►Frac</td>
<td>5/6</td>
<td></td>
</tr>
<tr>
<td>2:►Dec</td>
<td>1/2+1/3</td>
<td>.833</td>
<td></td>
</tr>
<tr>
<td>3:►Fr</td>
<td>Ans►Frac</td>
<td>5/6</td>
<td></td>
</tr>
<tr>
<td>4:►�(</td>
<td>5:►ṣ</td>
<td>6:►fMin(</td>
<td></td>
</tr>
<tr>
<td>7:►fMax(</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

--------------------------------------------------------------------------------------------------------
ASSIGNMENT STATEMENTS & EVALUATING AN EXPRESSION

To make \( x = 5 \)

5. \( \text{STO (9A), } X (X,T,\theta,n \text{ key (3B)}), \text{ ENTER} \)

\( 2X^2-2X+5, \text{ ENTER} \)

To evaluate the same expression with \( x = -3 \),

input-3, \( \text{STO, } X, \text{ ENTER} \)

recall the expression by pressing \( \text{ENTRY} \) twice (2nd, ENTER), then

\[
\begin{array}{c|c}
2X^2-2X+5 & 45.000 \\
-3\rightarrow X & -3.000 \\
2X^2-2X+5 & 29.000 \\
\end{array}
\]

CONCATENATION AND DEEP RECALL

The colon “:” (2nd, . , (10C)) allows two or more commands to be put together.

2. \( \text{STO, } X : X^2-3X+7, \text{ ENTER} \)

\( 5.000 \)

\( \text{ENTRY (2nd, ENTER)} \) allows you to recall many of your previous expressions in the stack.
The TI-83 retains entries up to 128 bytes.

To bring back the last entry, press \( \text{ENTRY} \), edit the line to input -2.75 for \( x \)

-2.75, \( \text{STO, } X : X^2-3X+7, \text{ ENTER} \)

\( 22.813 \)

What could it be?

Place parentheses in different places in the expressions below to see how many different values you can make for each expression. Find at least three different values for each exercise.

\[
\begin{array}{c}
7-5\times8+6/2 & -13.5 \\
(7-5)\times8+6/2 & -30 \\
7-5\times(8+6)/2 & 19 \\
(7-5)\times(8+6)/2 & 19 \\
7-5\times8+6/2 & -28 \\
(7-5)\times8+6/2 & -28 \\
\end{array}
\]

\[
\begin{array}{c}
1. \quad 7-5\times8+6/2 & -13.5 \\
& -30 \\
& 19 \\
& -28 \\
& -13.5 \\
\end{array}
\]
Solve Command

Problem: what is the height of a can with a radius of 3 inches, if the volume must be 100 cubic inches?
Input the equation \( V = \pi R^2 H \) into the Solver and the appropriate values in \( V \) and \( R \), then solve for \( H \).

**Raise Problem**

Annual salaries paid to Department Chairs at LS University are $74,250; $69,000; $57,500; $78,000; and $55,000. The dean wants to give them a 10% raise. What are the new salaries? How much are the individual raises?

**Solving a Linear Equation Using Three Different Methods**

Solve \( 3 + x = 10 - (x + 2) \). The equation \( 3 + x = 10 - (x + 2) \) may be solved using different methods on the calculator. Let us look at Tables, Graphing, and the Solve Command.

**TABLES**

The solution to the equation \( 3 + x = 10 - (x + 2) \) may be found using tables. To input functions, press \( Y= \) key (1A), key in:

\( Y_1 = 3 + X \)
\( Y_2 = 10 - (X + 2) \)

Press \( TBLSET \) (2nd, WINDOW (1B), set TblStart = 2 and \( \Delta \) Tbl=.1. Press \( TABLE \) (2nd, GRAPH (1E)), use the arrow keys to look for where \( Y_1 \) values and \( Y_2 \) values are the same.
Let $y_1$ be the left-hand side of the equation, namely, $y_1 = 3 + x$ and let $y_2 = 10 - (x + 2)$, the right hand side of the equation. Look for the point where the two lines intersect.

To input functions, press $\mathit{Y=}$ key (1A), key in:

\[
\begin{align*}
Y_1 &= 3 + X \\
Y_2 &= 10 - (X + 2)
\end{align*}
\]

By pressing the arrow keys, move the cursor to the left of $Y_1$. Use the \texttt{ENTER} key to cycle through the "style" choices for the graph. Choose the "thick" for $Y_1$ and the "animated with a path" for $Y_2$.

If you were graphing using a pencil and paper, you would need to set up a graphing grid or viewing window. To use a viewing window of $[-10, 10]$ by $[-10, 10]$, press the \texttt{ZOOM} key (1C), choose 6:ZStandard from the menu. Press the \texttt{TRACE} key (1D) to see the $(x, f(x))$ values of the function along the bottom of the screen. Notice the spider-like cursor! The left (<) and right (>) arrow keys move the cursor along the function. The up (Δ) and down (∇) arrow keys switch between the functions. Notice the equation of the function being traced is printed in the upper left side of the screen when you press the Trace option! Press the \texttt{FORMAT} key (1C) to select ExprOn or ExprOff. When you press the TRACE key, you can either use the arrow keys or you can enter a specific value for $x$, press \texttt{ENTER}; the cursor will move to the specified location and the $x$ and $y$ coordinates will be displayed.

Press \texttt{WINDOW} (1B), notice that the viewing window is $[-10, 10]$ by $[-10, 10]$. To change to a more "friendly" window, press \texttt{WINDOW} and change Xmin to -18.8, Xmax to 18.8, Xscl to 4, Ymin to -12.4, Ymax to 12.4, Yscl to 4. Press the \texttt{TRACE} key and look at the "nice" $x$ values
The intersection point seems “close” to x = 2.4 and y = 5.4, but what is the exact intersection point? While you are on the graph screen, press \textbf{CALC} (2nd, \textbf{TRACE} (1D)). Choose \textit{5:intersect} from the menu. In response to “First curve?”, move cursor to curve Y1, press \textbf{ENTER}, in response to “Second curve?”, move to curve Y2, press \textbf{ENTER}, “Guess?” move close to point of intersection, press \textbf{ENTER}. Notice the intersection point printed along the bottom of the screen.

Press the \textbf{MODE} key (2B) to select \textit{G-T} to display the graph and the table simultaneously. Press the \textbf{TABLE} key and then the arrow keys to move the cursor in the table, press the \textbf{GRAPH} key or the \textbf{TRACE} key to move the cursor along the graph.

The SOLVE command could be used with eqn:0 = y1-y2. Another method to find the solution of the equation 3+x=10-(x+2) is to use the \texttt{solve} command. From the home screen, press the \textbf{MATH} key (4A), select \textit{0:Solver...} from the menu. The expression is assumed equal to zero, so rewriting the equation as y1-y2 will set the equation equal to 0. If the equation editor is empty, use Y1-Y2 for the equation. If the equation editor is not empty, press the up arrow, this will allow you to change the equation. To input Y1-Y2, press the \textbf{VARS} key (4D), from the Y-VARS menu choose \textit{1:Function...}, then 1:Y1, repeat using 2:Y2. Press \textbf{ENTER}. The equation will appear at the top of the screen and the unknowns will be listed under it. Place the cursor on X, then press \textbf{SOLVE (ALPHA, ENTER, (10E))}. Notice a solid square appears next to the solved variable and indicates the equation is balanced.
Find all real solutions for \(2^x = x^2\), using graphs, tables and the solve command.

Use the Solve command, note the changes in the bound.
STATISTICS

Students were asked how many people came to their Thanksgiving Day Dinner. The following data represents the number of guests the students reported: 3, 5, 4, 8, 9, 15, 4, 7, 12, 11, 3, and 6.

On the home screen, input the data into a List, L1. Use the braces { (2nd, ((6C)), ), (comma key (6B)), the data, close the list, the STO key (9A), the L1 key (9B), then press ENTER. To calculate the mean, the standard deviation, etc., press STAT (3C), select CALC, then 1:1-Var Stats, press L1, then ENTER.

<table>
<thead>
<tr>
<th>Data</th>
<th>1-Var Stats L1</th>
</tr>
</thead>
</table>
| (3,5,4,8,9,15,4,7,12,11,3,6) | x̄=7.25  
|       | s=87  
|       | sx=795  
|       | sx=3,864171086  
|       | n=12  

To sort the data, press STAT (3C), choose EDIT, 2:SortA(, then press L1, ), ENTER. Press the right arrow key to scroll to the right.

<table>
<thead>
<tr>
<th>Data</th>
<th>Sorted Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3,5,4,8,9,15,4,7,12,11,3,6)</td>
<td>3 4 5 6 7 8 9 11 12 15</td>
</tr>
</tbody>
</table>

To plot this data, first press Y= key (1A) to be sure all functions are turned off. To turn off a function, move the cursor on the equal sign and press ENTER. When you move away from the equal sign the equal sign will no longer be highlighted. Press STAT PLOT (2nd, Y= (1A)), choose 1:Plot1..., under type choose a histogram or a box and whiskers or a modified box and whiskers, because the data is one variable statistics. At Xlist: choose L1, under Freq: choose 1. Press the ZOOM key (1C) and choose 9:ZoomStat. Press the GRAPH key (1E). The viewing window is not the best choice for this data. ZoomStat redefines the viewing window so that all statistical data points are displayed. For one-variable plots, only Xmin and Xmax are adjusted. Go back, press the WINDOW key and make the following changes: Xmin=0, Xmax=18, Xscl=3, Ymin=-1, Ymax=6, Yscl=1, Xres=1.
Two Variable Statistics

A manager of a small textile plant wishes to study the relationship between the time required to complete a certain task and the noise level at the work station. He collects data for a random sample of five employees and finds:

<table>
<thead>
<tr>
<th>Noise Level</th>
<th>.5</th>
<th>1</th>
<th>1.5</th>
<th>2</th>
<th>2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time required to complete task</td>
<td>1</td>
<td>1.8</td>
<td>2.9</td>
<td>3.6</td>
<td>4.8</td>
</tr>
</tbody>
</table>

To enter the data, press STAT, choose EDIT, 1:Edit. If there is data in L1, highlight L1 at the top of the list and press CLEAR (4E). When you move the cursor down the list, you will see that the list is now empty. Another method is to use the ClrList command located on the submenu of the EDIT under the STAT key. Enter the x values in the L1 column, the corresponding values in L2. Press the STAT PLOT key, choose 1:Plot1, On. Under Type, choose the scatterplot, under Xlist, L1, under Ylist, L2, under Mark, . Press WINDOW, input the following values: Xmin=-1, Xmax=4, Xscl=1, Ymin=-1, Ymax=6, Yscl=1, Xres=1.
To find and graph the equation of the line of regression, press **STAT**, then **Calc**, **4:LinReg(ax+b)**, **L1, L2, Y1**. To find Y1, press the **VARS** key (4E), from the Y-VARS submenu, choose **1:Function..**, then choose **1:Y1**. This will paste the equation of the line which was just computed into Y1. Press **GRAPH**. The regression line and the actual data points are on the same graph. Press the up and down arrows to switch from the Stat plot to the Y1 plot. To look at the coefficient of correlation and \( r^2 \), press the **CATALOG** key(2nd, 0 (10B)), press D to move down the catalog list, choose **DiagnosticOn**. Repeat the LinReg command and notice the \( r \) and \( r^2 \) for the line.
Turn all the plots off. Press the **STAT PLOT** key, choose **4:PlotsOff**, press **ENTER**.

**DATA ANALYSIS**

**Heights**
1. Measure each other’s height in both Metric and the English system.
2. Store the data in L1 and L2.
3. Sort the data.
4. Fit a curve to the data.

**Measuring Up**
Measure the length of five items using the metric and English systems. Record the data in a table. Store the values in two lists.

<table>
<thead>
<tr>
<th>Item</th>
<th>Centimeters</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Do you see any relationships between the two measures?

2. Plot the information collected using inches along the horizontal axis and centimeters along the vertical axis.

**Random Numbers**
There are several ways to generate random numbers. To generate the same set of random numbers, use 123 at the seed value for rand. The command **rand** (random number) generates and returns one or more random numbers greater than or equal to zero and less than or equal to 1. By repeatedly pressing the ENTER key, a random-number sequence is generated. To insure integer values, you could change the mode to Float 0. To generate
random numbers beyond the range of 0 to 1, include the integer, for example, rand 8, will generate a random number greater than 0 and less than or equal to 8. To display a random number sequence as a list, specify an integer greater than 1 for the number of trials, for example, rand(5).

To generate random integers with a range specified by lower and upper integer bounds, use the `randInt` command.

Simulate a sample of tossing a die for 10 trials.

The syntax is `randInt(lower, upper, number of trials)`, the default on the number of trials is 1. Use `randInt(1,6,10)`.

**OTHER GRAPHING TECHNIQUES**

Piecewise Functions:

Graph \( f(x) = \begin{cases} \frac{x-1}{2} & \text{if } x < -2 \\ x^2 & \text{if } x \geq -2 \end{cases} \)

Press the \( Y= \) key. Let \( Y1 = (0.5x-1)(x<-2) + (x^2)(x\geq-2) \). Press the \( \text{TEST} \) key (2nd, MATH (4A)) for the inequalities symbols.
Tracy and his friends are going to the amusement park and find that they have two ticket options. In one option each person could buy an admission ticket for $5.00 and then pay $.25 for each ride. The other option is to buy an admission ticket for $2.00 and then pay $.75 a ride. What do you think Tracy should do?

Suppose on Monday, Tracy’s grandmother gave him $6.00 for the amusement park, which option should he use?

Suppose on Wednesday, Tracy’s grandfather gave him $10.00 for the amusement park, which option should he use?
Method 1: Recursion

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Ans+.25</td>
<td>5.25</td>
<td>Ans+.75</td>
</tr>
<tr>
<td>5.50</td>
<td>3.50</td>
<td>5.75</td>
</tr>
</tbody>
</table>

Method 2: Pattern

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5+2*.25</td>
<td>5.25</td>
<td>5+3*.25</td>
</tr>
</tbody>
</table>

Method 3: Lists

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
<th>L3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>2.00</td>
<td>5.00</td>
</tr>
<tr>
<td>3.00</td>
<td>4.00</td>
<td>5.00</td>
</tr>
<tr>
<td>5.00</td>
<td>6.00</td>
<td>5.00</td>
</tr>
<tr>
<td>7.00</td>
<td>8.00</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Method 4: Tables & Graphs

<table>
<thead>
<tr>
<th>V1</th>
<th>V2</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>

Method 5: Sequences

Change Mode to sequence!

Picture of graph and table showing sequence values.

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Managing Memory on the TI83Plus

The TI83+ has 184K bytes of memory, total of RAM and ROM. The 24K RAM is active memory used for storing functions, programs, and data. The 160K ROM is used to archive programs, data, and applications. The information in ROM is not as transient as that stored in RAM which is lost with battery failure. This ROM can be used to store up to ten applications.

Teachers and students can use the ROM archive and grouping feature to store and restore program and data configurations to and from the 24K RAM. This allows the RAM to be used efficiently for active information while important but inactive information is preserved in the Archive.

The memory functions are accessed using 2↓. The first choice 1:<about> shows the current version of the calculator code as well as the product-id and the calculator ID and the TI website address for product upgrades.

```
MEMORY
2↑Mem Mgmt/Del...
3:Clear Entries
4:ClrAllLists
5:Archive
6:UnArchive
7:Reset...
8:Group...
```

Use 2K or M to return to the Home screen.

The 3:<Clear Entries> clears the Home Screen history. 4:<ClrAllLists clears the contents of all lists in RAM.

The 7:<Reset…> allows the user to clear RAM, ARCHIVE, or ALL.

```
RAM ARCHIVE ALL
1:All RAM...
2:Defaults...

RAM ARCHIVE ALL
1:Wars...
2:Apps...
3:Both...

RAM ARCHIVE ALL
1:All Memory...
```

<RAM> allows options that clear the 24K RAM or reset the factory defaults while leaving data unchanged. The Defaults option sets factory defaults, window, etc, turns off functions and plots. But does not delete any data or programs.
Resetting ARCHIVE has suboptions. Resetting VARS removes all programs and data from the ARCHIVE. If this information is important it can be stored to a computer backup. A small portion could be moved to RAM while the rest is deleted by the reset.

The remaining Memory options:

2: Mem Mgmt/Del
5: Archive
6: UnArchive
8: Group...

are really useful in effectively using the extra memory (ROM) of the TI-83Plus.

The 2:<Mem Mgmt/Del…> reports the free memory in RAM and ARC.

For each of the variable categories the user may delete variables or move them between Archive and RAM. Programs and data in Archive can not be used in computation unless moved to RAM.

The Ungroup feature (to be discussed later) allows the programs and data of a group to be copied to RAM for use while the group remains safely stored in Archive.

**Memory Management using <Mem Mgmt/Del…>**

**Delete a Program or Data Item**

To delete a program or data item use 2↓ 2: Mem Mgmt/Del… choose the category of an item to be deleted. In this example choose 7:<Program>. To delete program A move to that item line use the 8 key, respond 2:<yes>. Use 2Κ or Μ to return to the Home screen.

Note the asterisk in the example above. It indicates that PROG2 is an archived program. An archived item can be deleted in the same way.

**Moving Items Between RAM and ARCHIVE.**

Again, use 2↓ 2: Mem Mgmt/Del… choose the category of an item to be moved. In this example choose 7:<Program>. To move Prog2 move to the item line and hit the ÷ to toggle the item between RAM and ARCHIVE. The Astrisk,* indicates the item is archived; an item without is in RAM.
Use 2K or M to return to the Home screen.

Items can be moved between Archive and RAM using the 5:<Archive> and 6:<UnArchive> commands. These should be called from the Home screen using either 2↓ or 2↓.

Archiving information using the 8:<Group> command

The Group option has two sub options <GROUP> and <UNGROUP>. A group must contain more than one item. The <GROUP> sub option allows the creation of a new group. Type the name then select the category of items for inclusion in the group. Use ÷ to select the items. After selecting all the items use the <DONE> option. Use 2K or M to abort the process.

In this example 3:<Prgm…> was chosen. All three programs were chosen using the ÷ key and the Δ keys. After choices are complete select <DONE> and then ÷.
Please note that the three programs are still in RAM. Use the choice #8 key to check.

Resetting RAM will remove them but they can be restored using the <UNGROUP> option.

Note using the choice #8 demonstrates programs have been removed.

Use the <UNGROUP> option to make a copy in RAM.