USING THE TI-89  A Primer for TI-83 Users (Easy Calculus Summer Assignment)
Come to school on the first day with your TI-89. We will start school by learning calculus, so this assignment will help you have a good time learning about the amazing features of your new calculator.

[Thanks to Tom Reardon for the following document]

Section 1. <MODE> key

With the cursor flashing on the word FUNCTION, press the right cursor button

Notice 3 different pages

Notice all the different modes of graphing. The first four are on the TI-83 but the last two are not. We will investigate those later. Press <ENTER> to get back to the mode page. Leave angle in Radian mode for now.

Go ahead and investigate the Display Digits and Angle and anything else on that page.

Press <F2>. Do NOT hit <ESC> -- it cancels all changes!

Investigate the Exact/Approx item.

2:EXACT means the answer will be displayed as an exact number (no decimal approximations) 3:APPROXIMATE means the answer is not shown exactly, but as a decimal. 1:AUTO means the answer will be displayed as exact, if possible. If not – decimal approximation. We will usually use AUTO.

Press <F3>

You can investigate the options here if you like.

Press <ENTER> to keep the changes.

Press <ESC> to leave the screen but NOT keep the changes.

This usually takes a while to completely understand/remember, for some unknown reason.

The HOME screen

Notice along the top of the screen: the function keys F1, F2, ...
Along the very bottom of the screen, it displays the MAIN folder, RADian mode, AUTO mode, FUNCTION mode.
The bar just above that is called the command line. The vertical cursor should be blinking.

The difference between EXACT and APPROXIMATE on the TI-89.

<2ⁿᵈ> <SIN>  
<3> <2ⁿᵈ> <π> / <4> <ENTER>  (Notice the pretty print)
To obtain the approximate value, Press the green diamond key, ♦, then <ENTER>

Try a similar idea but with a radical expression.

Now press the green diamond key ♦, then <ENTER>

Section 2  The F1 menu

Press <F1>

Press <8> to Clear the Home screen

Notice that the screen was cleared, but not the command line. <CLEAR>

<F1> and cursor down to A:About…

Press <ENTER>

Notice that your screen probably has many different codes than mine. If your Titanium isn’t OS v. 3.10 you’ll want to update it.

Section 3  Evaluate expressions two different ways

Type <5> <STO> <alpha> <A> <ENTER>

Type <-> (negative NOT the minus sign) <6> <STO> <alpha> <B> <ENTER>

Type <alpha> <A> <alpha> <B> <^2>
**IMPORTANT**

You must realize that you HAD to type the times sign between the a and the b. On this calculator, ‘ab’ is an acceptable variable name. ‘ab’ does NOT mean a times b on this calculator. You will forget this and get frustrated but I warn you anyway. ☺

Just like on the TI-83, the value stored in ‘a’ is 5 and the value stored in ‘b’ is -6. These values will not change until other values are stored in ‘a’ or ‘b’. To verify this:

Press <alpha> <A> <ENTER> You could try the same but with ‘b’.

Now type \( x^2+3|_{x=3} \) the ‘|’ is located below the = sign.

Press <ENTER> What value is stored for ‘x’ now? <x> <ENTER>

Surprised? ‘x’ is still a variable. It does not retain the value 3 when you use the ‘|’ ‘such that’ key. Hmmm…

Do you remember how you could go through the ‘history’ on your TI-83? By pressing <2^{nd}> <ENTER>? This is done much easier, much cooler on the TI-89. You just use the cursor keys and press the up arrow until you get to the expression you want. Press the up arrow key until \( a \cdot b + b^2 \) is highlighted:

Press <ENTER> \( a=7 \) <ENTER>
Hmmm… now what happened here? Investigate by finding out what values are stored in ‘a’ and in ‘b’.

What happened to the ‘7’? Think about it. Ask around if you are unsure.

Section 4 The <F2> Algebra menu … POWERFUL!

The TI-89 has a Computer Algebra System (CAS) that can do just about anything that you learned how to do in Algebra 1 and Algebra 2. Let’s look at just a little of what the CAS can do. First of all, clear the HOME screen. Hint: <F1> <8>. Then press the <CLEAR> button to clear the command line. [Bird recommends against clearing the HOME screen. It is fun having the option of scrolling back 30 times to see what I’ve done lately.]

<F2> has the algebra menu. Let’s first expand a binomial.

<F2> <3>:expand( (x+2)^5) <ENTER> Oh, wow

In order to see the rest of the answer, cursor up and to the right. Cursor back down to the command line and press <CLEAR>

Type y^2 – y – 6) <ENTER> Press the right cursor
Use the backspace key← to delete as shown:
Press the up cursor to go up to the line as shown:
Press <ENTER>

\[
\begin{align*}
\text{expand}(x + 2)^5 & = 4 + 40 \cdot x^3 + 60 \cdot x^2 + 60 \cdot x + 32 \\
\text{factor}(y^2 - y - 6) & = (y - 3) \cdot (y + 2) \\
\text{factor}(x^5 + 10 \cdot x^4 + 40 \cdot x^3) & = (x + 2)^5 \\
\end{align*}
\]

You still need to add the right )
Now <ENTER> Oh, wow, WOW!
<F2> <1:solve( x^2-x=6,x)>

\[
\begin{align*}
\text{solve}(x^2 - x - 6, x) & = 3 \text{ or } x = -2 \\
\text{solve}(x^2 - x - 6, x) & = 3 \text{ or } x = -2 \\
\end{align*}
\]

<ENTER> I love the word 'or' here
Press the right cursor key
Backspace as below

\[
\begin{align*}
\text{type } y = m \cdot x + k, x) & \text{ * means 'times'} \\
\text{solve}(x^2 - x - 6, x) & = 3 \text{ or } x = -2 \\
\text{solve}(y - m \cdot x + k, x) & = y - k \\
\end{align*}
\]

a+d=b*c,d)
<ENTER>
Press the right cursor key and backspace

\[
\begin{align*}
\text{solve}(x^2 - x - 6, x) & = 3 \text{ or } x = -2 \\
\text{solve}(y = m \cdot x + k, x) & = y - k \\
\text{solve}(a + d = b \cdot c, d) & = -6 - c - 5 \\
\end{align*}
\]

This is NOT what was expected. WHY?

Answer: Because there are values stored into a and b. This is a concern and something we have to deal with.
We need to clear out the values that are stored in a and b. We do this using:

\[ \text{<F6> <1:Clear a–z> (F6) is 2nd <F1> } \]

\[ \text{<1> or <ENTER> } \]

\[ \text{<ENTER> for YES } \]

Press <ENTER> again to re-solve the equation

\[ 2 \div a - 6 \div b \]

\[ \text{<F2> <6:comDenom(} \]

\[ 2 \div a - 6 \div b \]

\[ \text{<ENTER> } \]

\[ \text{Oooh...Aaaahh... } \]

\[ \text{<F2> <9↓Trig> Cursor to the right } \]

\[ \text{Type EXACTLY as below: } \]

\[ \text{<ENTER> } \]

\[ \text{<F2> <9> <2> } \]

'Grab' the previous answer

\[ \text{<ENTER> right ) } \]

\[ \text{<ENTER> } \]
SO! This calculator even knows the trig identities. Well at least some of them, anyway.

Section 5 Graphing on the TI-89

Notice that the Graphing Keys on the TI-89 are where they are on the TI-83 but are green. So we need to use the green diamond key (GRN♦) to access these keys.

GRN♦ <F1> for y=  
x^2 – 4 <ENTER>  
<F2> <6:ZoomStd>

Voila!  
<F3> to trace  
Type 3 <ENTER>

GRN♦ <F2> for WINDOW  
Type as below:  
GRN♦ <F3> for GRAPH

GRN♦ <F4> for TblSet  
Type as below:  *Use the down cursor to go to Δtbl box.  
Press <ENTER> to save (You may have to press <ENTER> twice)
This is just a small, minute part of what the TI-89 is capable of doing. It is an awesome machine, as you will find out even more as you use it.

**BIG IMPORTANT MESSAGE – DO NOT UNDERESTIMATE THIS**

The TI-89 is a very powerful calculator. It is like a mini-computer with $1500 of software on it. The AP exam allows it on half of the test. NO calculator of any kind is allowed on the other half of the test. None, nada, zilch.

Some colleges allow students to use the TI-89. Many do not. Many colleges require all students to have laptops or allow other types of calculators (TI-83, HP, scientific, …). At some colleges it depends upon the individual professor as to whether or not you can use any kind of technology.

For these reasons, I must teach you how to do calculus WITH the technology and without the technology. I must prepare you for any college – any professor – any situation. I cannot, will not, let you become calculator dependent. (Sam I am. ☺) But you have to help me with this. Do NOT let yourself become dependent on a calculator.

Consider the following:

There are three types of calculations in this world:

- Mental Math
- Paper and Pencil
- Calculator/Computer

It is my job to not only teach you HOW to do each of those three types of calculations, but also – and just as important – WHEN to use each of those three types of calculations. I will be stressing ‘appropriate use of a calculator.’
PRACTICE WHAT YOU HAVE SEEN SO FAR
(And don’t be afraid to ‘play around’ and try other features. Investigate. Try some other problems. Start to see just what mathematical power you hold in your hands.)

Suggestions: Write something for the bolded problems.
Work with other people on this – even if it is over the telephone.
Start to refer to the TI-89 manual.
WHAT?! You think that we are going to read the manual?!! Did you see that document? …Yes, I do believe that you will read the manual, but as a reference. Get used to doing things like this.☺ Old people like me have to do this all the time.

2. a) Go to the HOME screen.
   b) Use the <MODE> key to change DisplayDigits to FLOAT6 and the Angle to DEGREE
   c) Type the π key and <ENTER>
   d) Did you get 3.14159? Why not? How could you get the approximate value for π?
   e) That’s right, use the GRN ♦ key
   f) Evaluate sin 30 both exact and approximate
      Evaluate cos 30 both exact and approximate
      Evaluate tan 30 both exact and approximate
      Evaluate √28 both exact and approximate
   g) Reset the MODE back to FLOAT and RADIANT

3. a) Store 3 into c; - 4 into d
   b) Evaluate the expression: c^2 + c · d with the TI-89
   c) Store - 5 into c; 2 into d. Grab c^2 + c · d and reevaluate with the new values
   d) Evaluate x^3 − x^2 + 2x + 5 for x = 6 using the ‘|’ key
   e) Use <F6> to ‘clean up’, that is, Clear a-z

4. Using the algebra menu:
   a) Expand: (a + b)^2 (a + b)^3 (a + b)^4
   b) Factor: y^2 + 2y − 15 x^3 − 16x a^3 − 64 b^3 + 8
   c) Use the up arrow to highlight the answer to (a + b)^3 and then factor that answer
   d) Factor: x^2 − 5
   e) OK so part e didn’t factor. Just for fun, type: factor(x^2 − 5, x) and <ENTER>
      Hmm...
   f) Factor y^2 − 12 in the same way as we did part e
   g) Solve: 3x + 4 = 14 Exact solution and approximate solution.
      Solve: y^2 = 6y Exact solution and approximate solution.
      Solve: 3z^2 − z = 5 Exact solution and approximate solution.
      Solve: a = \frac{1}{2} · h · (c + d) for c
      Solve: a = \frac{1}{2} · h · (c + d) for h
   h) Use the trig expand feature to expand each of the following:
      sin(a + b) cos(x − y) tan(c + d)

OK so the calculator doesn’t know ALL of the trig identities.
5. a) In y1, type \( y_1 = -3x + 2 \) Graph with ZoomDecimal

b) Leave y1 on. Graph \( y_2 = x^2 - 2 \) using the same window

c) Use <F5> <5:Intersection> to find a point of intersection in the fourth quadrant
(See if you can figure this out, OK? Don’t forget about referring to the manual)
d) Highlight y1 and ‘turn it off’ by pressing the <F4> key to ‘uncheck’ it. Do the same for y2.
e) Graph \( y_3 = x^3 - 4x^2 + 2x - 3 \) using ZoomSatndard

f) Use <F5> <3> to find the coordinates of the relative minimum point.
   Use <F5> <4> to find the coordinates of the relative maximum point.
   Label your answers as ordered pairs rounded to 4 decimal places.
g) Regraph y3 using the following window: X[-5, 8]2 Y[-20, 20]5

h) Set up a table that starts with \( x = 2 \) and a \( \Delta \text{tbl} \) of 1. View the table for the values generated by y3. Use that table to evaluate the following:
   - when \( x = 6 \), \( y_3 = ? \)
   - when \( x = -1 \), \( y_3 = ? \)