An Introduction to the TI-92®

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An Overview of the Features

We begin by observing the assortment of keys: the QWERTY keyboard along with a ⁄ (the shift key – although the TI-92 is *not* case sensitive); the eight function keys (through); the 2 and ∞ keys (used in conjunction with other keys); a pentagonal O key; three ÷ keys; a cursor movement wheel key, ⊕; an escape key, ESC; gray keys for numerical entries; and various black keys (arithmetic operations, trigonometric functions, CLEAR, LN, and MODE)

It is good to get familiar early with the MODE key since it controls the appearance of entity output by the TI-92. The two MODE screens appear below:

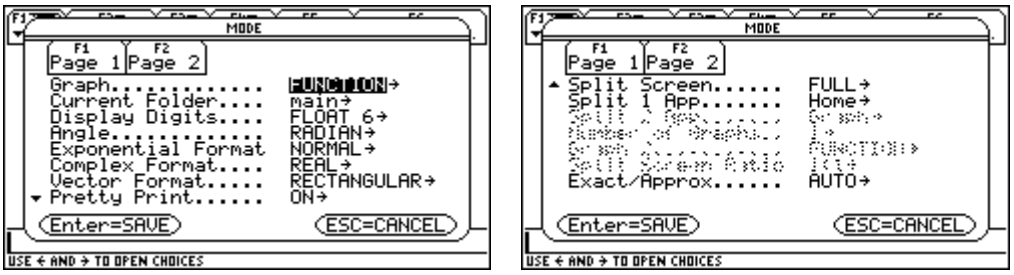


FIGURE 1
The MODE Screens.

Let's examine the "Display Digits" component of the MODE key. In Figure 2 below, we enter the fraction $\frac{3}{7}+\frac{1}{8}$. In AUTO mode, the exact value is returned (if possible). Next, we press the ∞÷ keys to get a six-digit display of the approximation. Change the "Display Digits" to FLOAT and the maximum twelve digits are displayed.

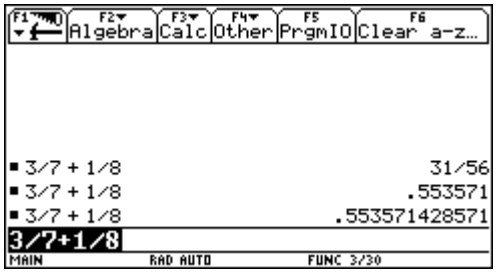


FIGURE 2
The exact value of 3/7 + 1/8 is 31/56. The two different approximations depend on "Display Digits" in the mode settings.

Algebra and Calculus on the HOME Screen[1]

There are eleven algebra commands available from the pull-down menu F2 "Algebra" on the HOME screen. In Figure 3, we demonstrate the results returned when we invoke some of them:

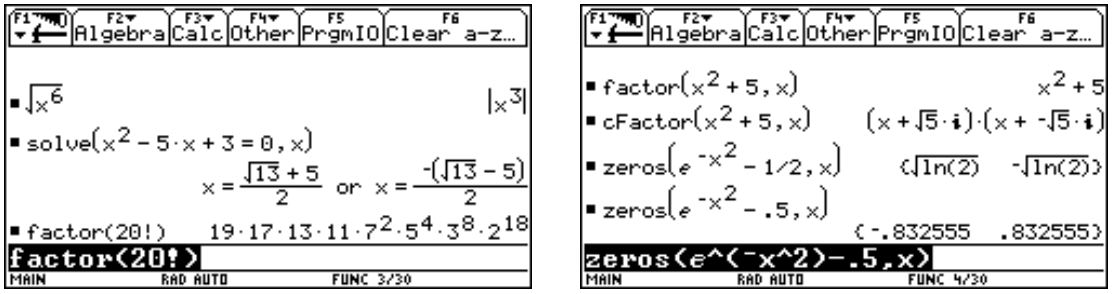


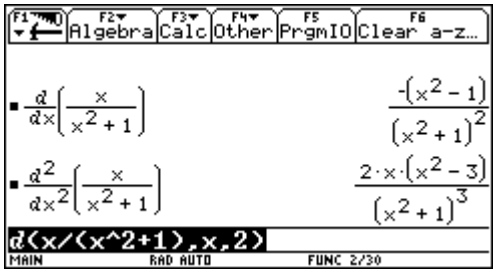
FIGURE 3
Algebra on the HOME Screen

Similarly, there are eleven calculus commands available (a twelfth, "deSolve" on the TI-92+) from the F3 "Calculus" pull down menu. They are displayed in Figure 4 below.

FIGURE 4
Eleven Calculus Commands

To find the first derivative of $f(x) = \frac{x}{x^2+1}$, we choose menu choice #1 (alternatively, we can enter the derivative command by pressing 2nd 8), enter the function followed by a comma, followed by the independent variable *x*, followed by a right parenthesis. For a higher order derivative, follow the independent variable by a comma and then the desired order. See Figure 5.

FIGURE 5



The first and second derivatives of $y = \frac{x}{x^2+1}$

Indefinite integrals, definite integrals, and multiple integration are possible on the TI-92. We depict some examples in Figure 6.

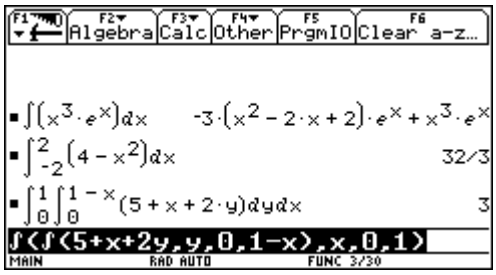


FIGURE 6
Integration

In Figure 7 we display additional calculus commands such as limits, sums and products. Notice in the screen on the left that two-sided limits as well as left and right-hand limits can be obtained.

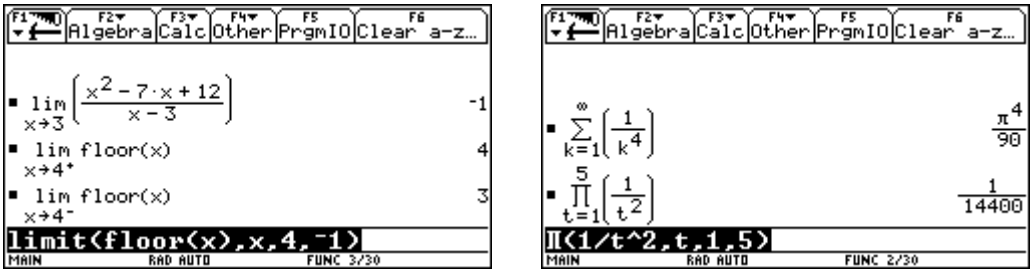


FIGURE 7
Left: a two-sided, a right-hand and a left-hand limit. Right: a summation and a product.

Let's apply the TI-92 to an example. We want to plot the sine function and compare it visually to its fifth and eleventh order Taylor polynomial approximations about $c = 0$ (Maclaurin). From the HOME screen we use the "9:taylor(" option to compute the fifth and eleventh polynomials. A useful editing feature is to copy (using ♦ C) each polynomial and paste it (using ♦ V) into the [Y=] list. See Figure 8.

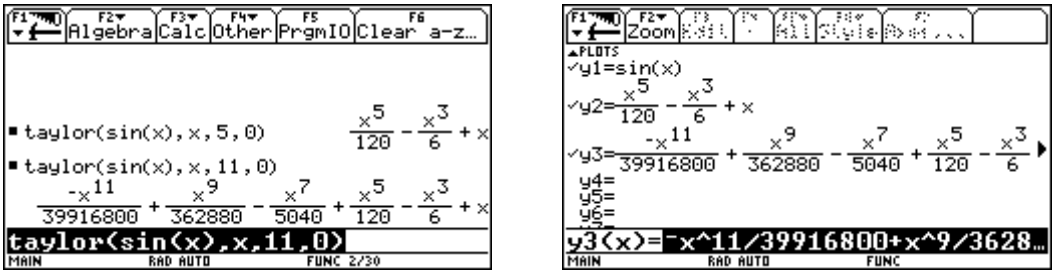


FIGURE 8
Left: Fifth and eleventh degree Taylor polynomials are output on the HOME screen. Right: The sine curve (*y*1), the fifth (*y*2) and eleventh degree (*y*3) appear in the [Y=] editor.

Finally, we graph all three curves in Figure 9. We used the text captioning feature to label the "tails" of the polynomial curves.

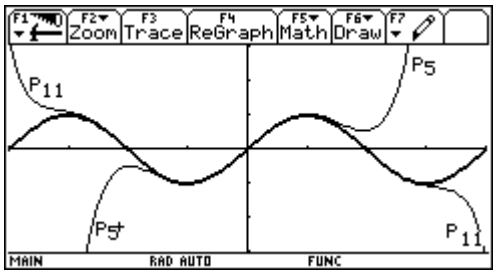


FIGURE 9

$y = \sin(x)$ **with its fifth and eleventh degree Taylor polynomial approximations.**

Data and Statistics: Newton's Law of Cooling

Recently in a differential equations class, I brought in a cup of hot coffee and had students measure its temperature at 30-second intervals for six minutes. The temperature of the room was 20.5°C and the data is displayed in the table below:

Time (minutes)	0	.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Temperature (°C)	96	94	92	90	88.5	87	85.5	84	83	81.5	80.5	79	78

We can use the TI-92 to plot the points and to calculate regression equations. To do this, we enter the Data/Matrix editor by selecting the pentagonal [APPS] key. Then, the thirteen entries for time can be entered by using the command seq(k,k,0,6,.5)

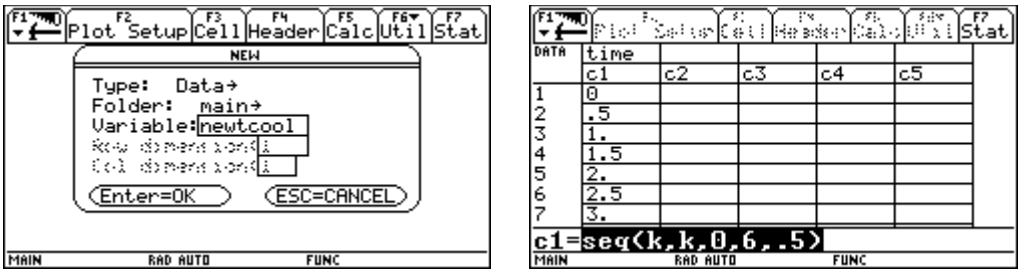


FIGURE 10

Left: Entering the Data/Matrix Editor

Right: The thirteen times are entered using the sequence function.

In Figure 11, we have entered the temperatures in column c2 with the label "tempc". Then, by choosing [F2] for "Plot Setup", we can define the scatter plot for c1 vs c2. After assigning appropriate window values, we view the plot in Figure 12.

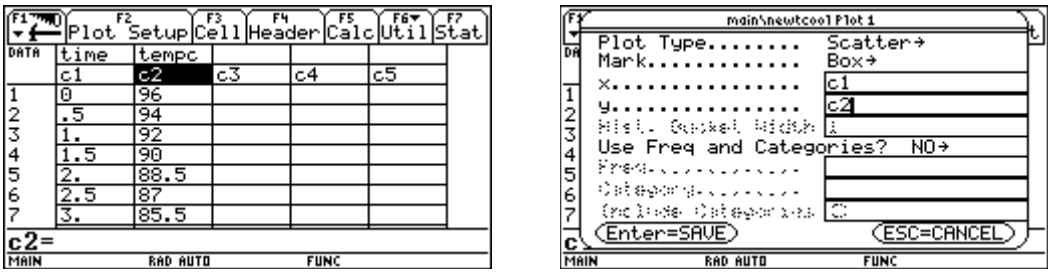


FIGURE 11

Left: Temperatures were manually entered. Right: the Plot Setup definition.

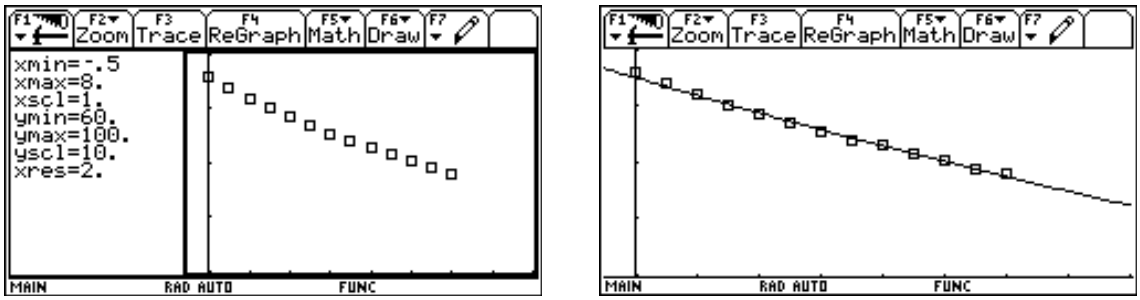


FIGURE 12

Left: A scatter plot of time vs. temperature. Right: The plot along with an exponential regression curve.

Additional Graphing Modes

In addition to the polar and parametric graphs covered in the workshop, the TI-92 has capability of doing sequence plots and 3D graphing. We conclude with some examples of each.

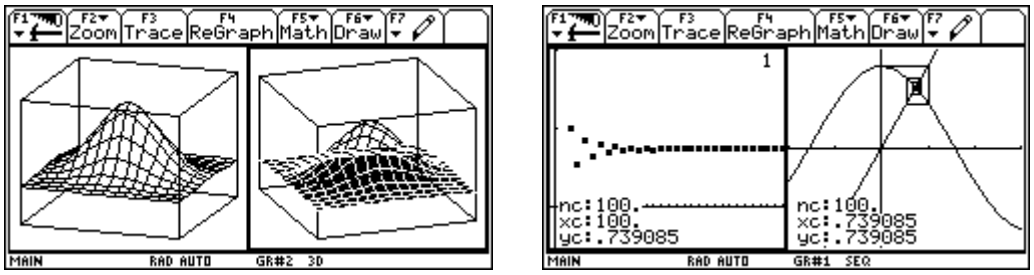


FIGURE 13

Left: Two 3D plots of $z = e^{-x^2-0.5y^2}$ from two viewpoints. Right: A TIME and WEB plot of the recursion of the cosine function.

[1] Adapted from Rich, N., Rose, J., and Gilligan, L., *Mastering the TI-92: Explorations from Algebra through Calculus* (Gilmar Publishing: Cincinnati, 1996).