CONTS

TI-89 Titanium Workshop

Saturday, July 17th 2004

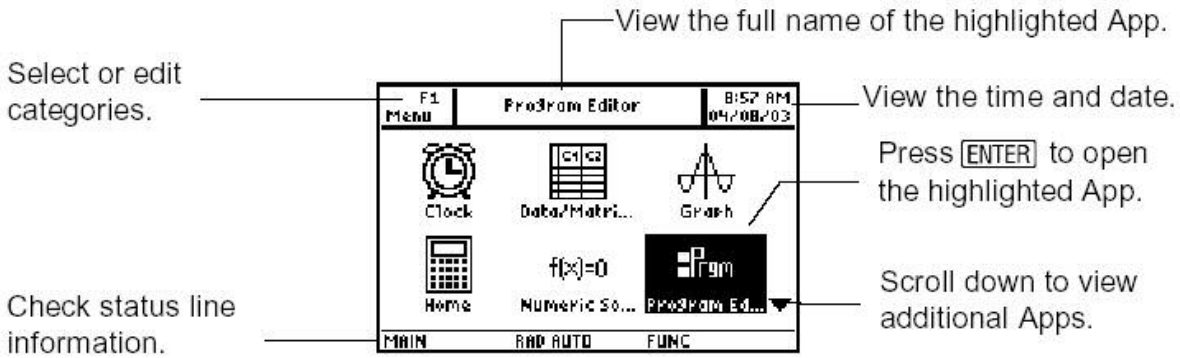
TI-89 Titanium Hands-On Activities

TI-89 Titanium "Geography":

Apps Desktop

Turning ON the Apps Desktop:

1. Press MODE
2. Press F3
3. Scroll down to the Apps Desktop field.
4. Select 2:ON



TI-89 Apps desktop

USB Connectivity:

- VAR-LINK Send commands try USB first
- SendCalc, GetCalc have now optional port parameters

CONTS

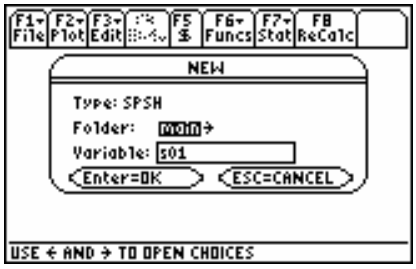
Introduction to Some Applications Preloaded on the TI-89 Titanium:

CellSheet™

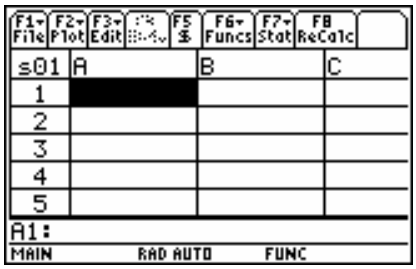
Key Features:

- Create cell formulas using calculator functions (including CAS!), and automatically recalculate results.
- Analyze spreadsheet data by using calculator graphing and statistics capabilities.
- Import and export variables, lists, and matrices, as well as CBL 2™/CBL™/CBR™ data.
- Save and re-open spreadsheet files.

Activity: *Recursive Derivatives and Integrals for f(x) =x, x^2,…, x^5*

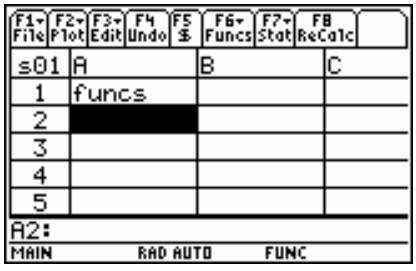


Press APPS, choose Flash Apps, then CellSheet, and New. The New dialog box will pop up. Notice that it will appear with a default name (s01, s02, etc.) already in the variable box. You can edit this name for the SPSH variable or press Enter to accept the default name.



The CellSheet screen will then come up, with the cursor in cell A1. The 64 columns are lettered A - BL, the rows 1-999. The top left cell contains the first three letters of the current filename (s01 here). Notice the edit line at the bottom of the screen, the menus at the top.

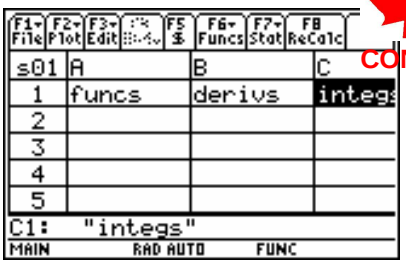
Arrow around the spreadsheet to show how the cursor moves. 2nd with arrows will move the cursor up/down/left/right one page at a time. Diamond with arrows will go to the extremes of the spreadsheet.



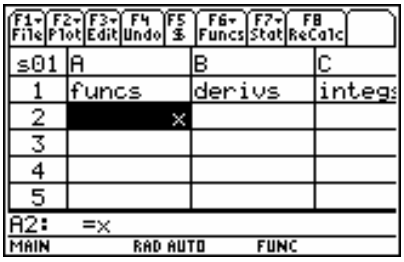
Put some titles in the first row to denote the functions, derivatives, and integrals. Press the alpha key twice to turn one alpha lock, and simply start typing. Notice that the cursor jumps to the edit line once you start typing. Type in funcs in cell A1. Press Enter.

Notice that the contents from the edit line are pasted to the cell and that the cursor moves to the cell below.

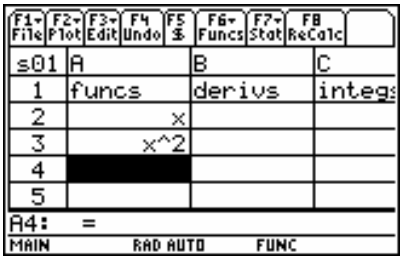
Arrow to cell B1 and enter the text derives. Press Enter. Cursor to cell C1 and enter the text integs. After pressing Enter for cell C1, cursor back up to it. Notice that, on the edit line, that integs has quotation marks around it. This is so that the calculator will understand it as text and not as a variable. You can type in text with quotes around it, but the app does not make you do this.



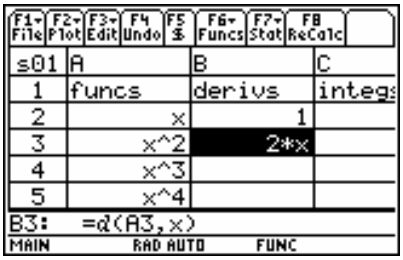
Arrow to cell A2. We are going to build a sequence of functions. To start it, put =x in cell A2. This is so that CellSheet understands this as an expression to update, not as text.



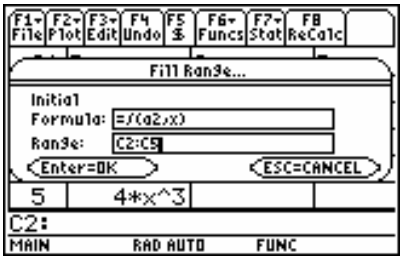
To continue the sequence, type the formula =A2*x in cell A3. Note that you can use upper- or lowercase letters when writing cell references. In cell A4, create the formula =A3*x, but try a different way to get the cell reference into the formula. Type =, then press Sto. Notice that the cursor has left the edit line and that cell A4 is now dark. Arrow up to cell A3 and press Enter. The reference A3 has been pasted to the edit line, none of the cells are dark, and the cursor is back on the edit line. Finish the formula by typing x. Press Enter. Create a similar formula in cell A5 (=A4x).



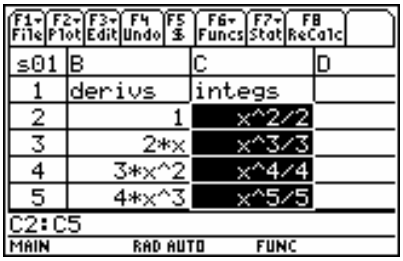
Arrow to cell B2. Create the formula = *d*(A2,x). Arrow back up to cell B2. Press diamond copy. Arrow down to cell B3. Press diamond paste. The results should be as at right. To copy the same formulas to cell B4 and B5, press and hold the shift key, and press the up arrow. Press diamond copy. Arrow down to cell B4. Press diamond paste. Now you have all the derivatives of the functions in column A.



Arrow to cell C2. Press F3 for the Edit Menu, choose Fill Range. For the initial formula, type in =∫(A2,x). Notice that C2 (the cell you were in when you chose Fill Range) is already in the Range box. Finish the range by typing :C5 at the end of the box. Press Enter, Enter to execute.



Now you have all the integrals of the functions in column A as well as the derivatives. You can really experiment with this now, entering different functions into column A and seeing how columns B and C recalculate.



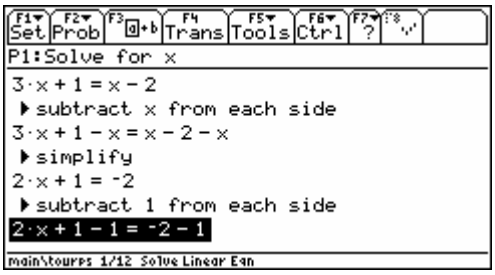
Symbolic Math Guide

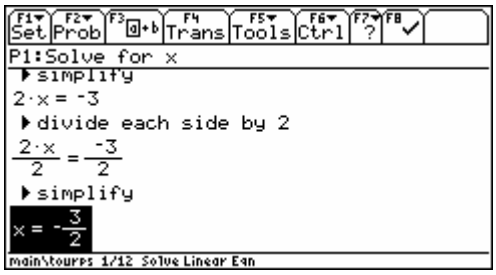
Let's start solving problems with Symbolic Math Guide!

- Press [ON] to start the calculator.
- Press [APPS] and highlight Symbolic Math Guide.
- Press [ENTER].
- Press [ENTER].
- Choose New; press [ENTER].
- Type in a name and press [ENTER].

Problem 1: Solve linear equation $3 \cdot x + 1 = x - 2$ for *x*.

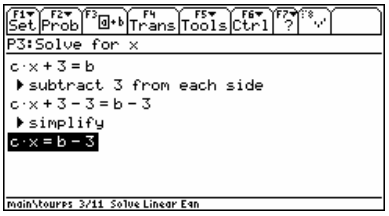
- Press [F2]:1 to type in the new problem
- Choose [F3]: 1 for solving linear equations.
- Type in solve($3 \cdot x + 1 = x - 2$,*x*) and press [ENTER]
- Press [F4] and choose a transformation that will accomplish this goal, for example:
- Press [F4] and choose 'subtract ? from each side' and type *x* when prompted.
- Press [ENTER] to clean-up the result.
- Move the 1 to the right-side. Press [F4] and choose 'subtract…'.
- Press [ENTER] to clean-up result.
- Press [F4] and choose 'divide…'.
- Press [ENTER] to clean-up result.
- Press ⊙ repeatedly to scroll through your solution.

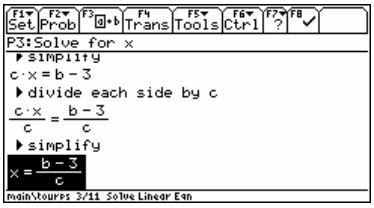


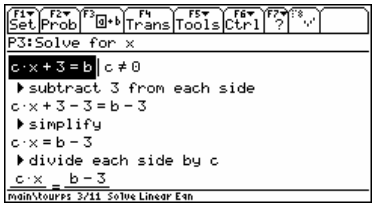


Problem 2: Solve linear equation $c \cdot x + 3 = b$ for x.

- Press [F2]:1 to type in the new problem
- Choose [F3]: 1 for solving linear equations.
- Type in solve($c \cdot x + 3 = b$,*x*) and press [ENTER]
- If you are not sure of the goal of solving this problem, press [F7]:1. We want to move the 3 on the left-side to the right-side.
- Press quick key [−]. Type 3. Press [ENTER].
- Press [ENTER].
- Press [÷]. Type c. Press [ENTER]. Dialog box "This action …" shows up.
- Press [ENTER] to Continue. Please note that the Problems statement has been modified to include the constraint $c \neq 0$.
- Press [ENTER] to simplify the result.

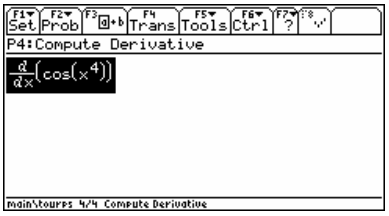


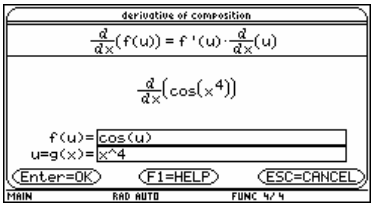


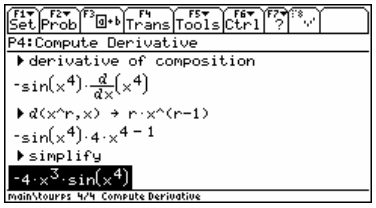


Problem 3: Compute the derivative $\frac{d}{dx}\cos\left(x^4\right)$

- Press F2:1 to type in the new problem
- Choose F4: 1 for computing derivative
- Type in $d(\cos(x\text{^}4),x)$ and press ENTER
- Press F4 and apply 'derivative of composition'.
- SMG provides a dialog box which requests definitions for the outside function, *f*, and the inside function, *g*. Enter the information or press for Help (SMG will provide possible choice for the two functions.) Make sure that the choice is the one you want. Change it if it is not. Press ÷ twice to continue to the display.
- Think about the result (or write it down). Then press ÷ to see SMG's result.
- Compare results and explain any significant differences.
- Press F4 and look for a way to transform the remaining derivative. Choose for example $\frac{d}{dx}x^r \rightarrow r\cdot x^{r-1}$.



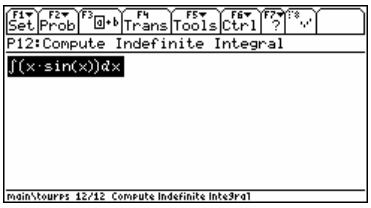


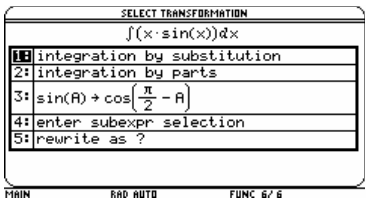


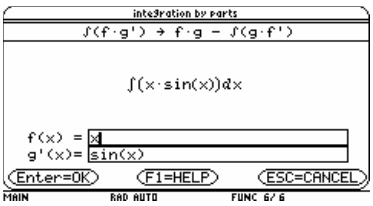
Problem 4: Compute the indefinite integral $\int x\cdot\sin(x)dx$

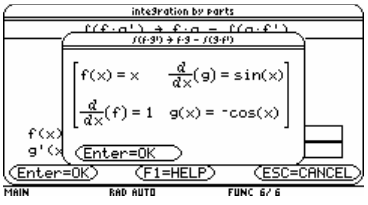
- Press F2:1 to type in the new problem
- Choose F4: 2 to compute indefinite integral
- Type in $\int(x\cdot\sin(x),x)$ and press ENTER
- Press F4 and choose 'integration by parts'.
- SMG provides a dialog box which requests f(x) and g'(x). Enter the information or press F1 for Help (SMG will provide possible choice for f(x) and g'(x)). Make sure that the choice is the one you want. Change it if it is not.
- Press ÷ until a dialog with f(x), f'(x), g(x) and g'(x) is displayed.
- Press ÷.

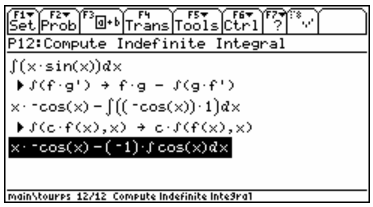
- Press F4 and choose $\int (c \cdot f(x))dx \rightarrow c \cdot \int (f(x))dx$.
- Press ENTER to simplify.
- Press F4 and choose $\int \cos(x)dx \rightarrow \sin(x)$.

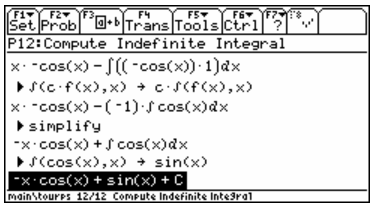






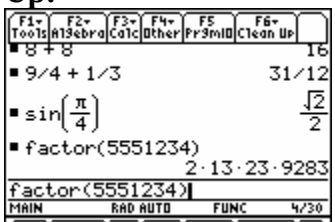


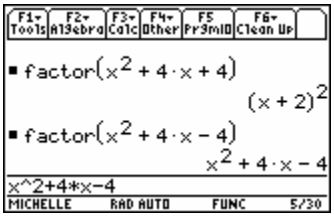


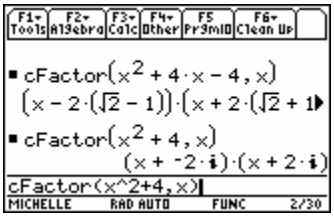


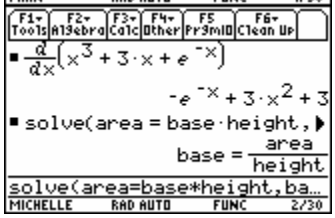
Calc Home Screen

Warm Up:





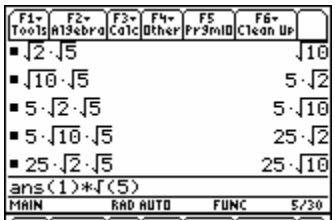


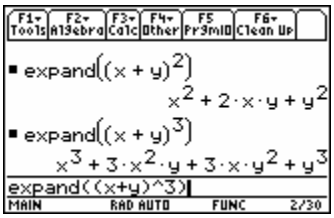


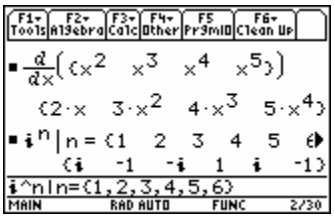
8 + 8	Notice input and output
9/4 + 1/3	Now press (green) Diamond, then ENTER
to see approximate answer	
sin(π/4)	π is located at 2nd ^. Notice the radical.
factor(your phone number)	Factor is in the F2 Algebra menu Does anyone have a prime phone number?
factor(x^2 + 4x + **4**)	Factors…
factor(x^2 + 4x - **4**)	Factors over integers only
factor(x^2 + 4x - 4, **x**)	Factors over reals
cFactor(x^2 + 4)	Factoring over complex numbers

d(x^3 + 3x + *e*^(-x), x)
solve(area = base * height, base) The CAS treats words as multi-char variables (up to 8 chars)

Patterns:







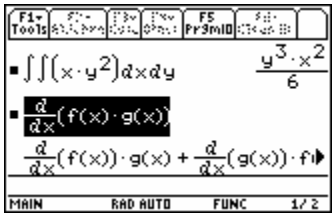
√(2) * √(5) enter Enter the first calculation
* √(5) enter Now multiply that answer by square root of 5
enter, enter…

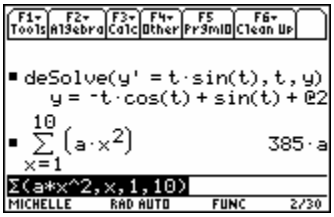
expand((x+y)^2) expand function is on the F2 Algebra menu
expand((x+y)^3) Edit the 2 to a 3 (press right cursor to edit)
Discuss patterns of coefficients

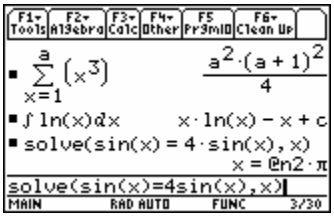
d({x^, x^3, x^4, x^5}) Show pattern of derivatives by using a list, with the brackets and commas
i^n | n={1,2,3,4,5,6} Another pattern, using the "such that" character and a list

d(5x^7, x) enter Enter the first calculated derivative
d(ans(1), x) enter Edit the author line (press right cursor) then put ans(1) instead of 5x^7.
Use 2nd (-) to get ans(1)
enter, enter… Press Enter to continue taking derivatives

Advanced:







∫ (∫((x * y^2 , x) , y) A double integral

CONTS

d(f(x)*g(x), x)	The Product Rule
deSolve(y' = t*sin(t), t, y)	Prime char is 2nd =, list indep then dependent variable, and @2 is a constant
Σ(a*x^2, x, 1, 10)	Summation character is in the F3 menu
Σ(x^3, x, 1, a)	
∫(ln(x), x, c)	Adding the last argument, a character, gives you the "+C" constant
solve(sin(x) = 4sin(x), x)	@n2 is a constant integer

Note: Calculus Tools app has Implicit Derivatives and other tools.