

# The TI-89: a handheld CAS

John Hanna, Teaneck High School

[jhanna@teaneckschools.org](mailto:jhanna@teaneckschools.org)

[www.johnhanna.us](http://www.johnhanna.us)

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## Getting acquainted:

- TI-83: “think green”
- The Computer Algebra System
- **F6**: NewProb
- ‘by hand’ Algebra
- Close all parentheses ( )
- **F2**: Algebra
- **F3**: Calculus
- Use **CATALOG** for *syntax hints*
- Use the **History**
- Editing includes *select, cut, copy, paste, Home, End*
- Save your **Homework!**
- Organize your files

## Problems from the *AMTNJ* HS Mathematics Contest:

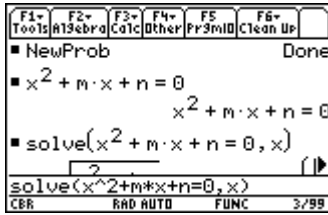
- Find, in terms of  $m$  and  $n$ , the sum of the reciprocals of the roots of  $x^2 + mx + n = 0$
- For how many values of  $x$ , where  $10^{-4} < x < 10^4$ , is  $\log_2(x)$  an integer?
- Solve for  $x$  to the nearest hundredth:  $x^{-1} + x^{-2} = x^2 - 5$
- Solve for  $x$ :  $\cos(2x) = \sin(x) - 2$  for  $0 \leq x \leq 2\pi$
- Solve for  $x$ :  $\frac{e^x + e^{-x}}{2} = 3, x \geq 0$

## Web Resources:

- John Hanna: <http://www.johnhanna.us>  
see ‘calculator’
- TI Education: <http://education.ti.com>  
see Educators ‘button’: **Classroom Activities**
- T<sup>3</sup> – Teachers Teaching with Technology: <http://www.t3ww.org/t3>  
see Summer Institutes and Conferences

## Step-by-Step

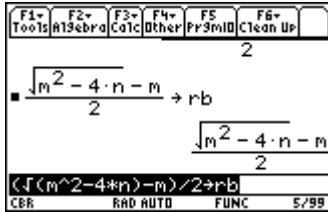
1. Find, in terms of  $m$  and  $n$ , the sum of the reciprocals of the roots of  $x^2 + mx + n = 0$



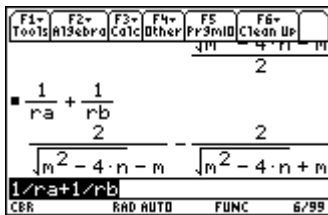
First, start a “NewProb” ([F6] 2:)

Enter the equation to solve (*for later use*)

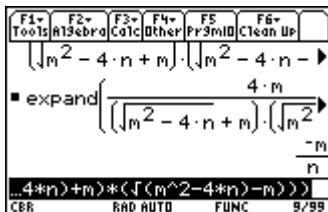
Use [F2]: **solve**( to solve for  $x$ : First, put the command down, then go up (⊖) and retrieve (ENTER) the equation, then type a ‘comma’ and the letter  $x$ , close parentheses, and press [ENTER] to evaluate the command.



Use copy and editing tools to store the two roots in the variables  $ra$  and  $rb$ . Follow the presenter!

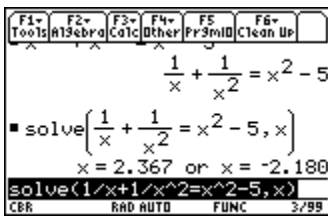
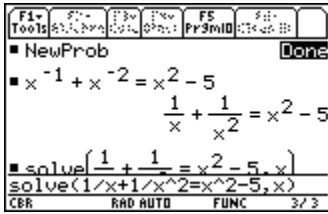


Evaluate  $1/ra + 1/rb$ . Look good? (NO), but it IS right.

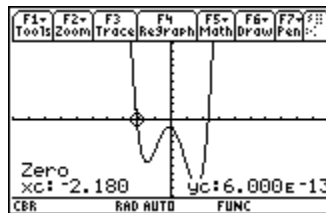


Use [F2]: **expand**( and [F2]: **comDemon**( to simplify the expression. First, put the command down, then go up (⊖) and retrieve (ENTER) the last result, then press [ENTER] to evaluate.

2. Solve for  $x$  to the nearest hundredth:  $x^{-1} + x^{-2} = x^2 - 5$



Or (the “traditional” (!!)) method) ...



## Managing your work: Folders and files

To make a folder:

- Press VAR-LINK (2nd[-])
- Press [F1] Manage, and choose **5: Create Folder**
- Enter a 'legal' folder name and press [ENTER]

To make a folder the 'active' folder:

- Press [MODE],
- Go down to the '**Current Folder...**' setting,
- Press ⏴ to see the list of folders to choose from.
- Press [ENTER] to choose it and
- Press [ENTER] again to save the mode settings.

To 'Save your HOME work':

- On the HOME screen, press [F1] **Tools**
- Choose **2: Save Copy As...**
- If you like,
  - choose a different folder by pressing ⏴ and choosing one from the list.
- Press ⏵ to go down to the filename textbox and
- Type a 'legal' filename.
- Press [ENTER] to enter it and
- Press [ENTER] again to save and close the dialog box.

To retrieve and use your saved HOME work:

- Use the Text Editor App to open your saved file (Press [APPS]).
- Feel free to edit the file (add notes).
- A horizontal split screen with the text file on top and the HOME screen on bottom looks best: use the [MODE] screen to set it up.
- Execute C: command lines: Press [F4] on each line.

## Miscellaneous screens

1

F1+ Tools	F2+ Algebra	F3+ Calc	F4+ Other	F5 Pr3mid	F6+ Clean Up
■ NewProb					Done
■ factor(74)					2·37
■ factor(54)					2·3 <sup>3</sup>
■ 1·2·27·37					1998
CALCULUS RAD AUTO FUNC 4/30					

Numerical

2

F1+ Tools	F2+ Algebra	F3+ Calc	F4+ Other	F5 Pr3mid	F6+ Clean Up
$h = \frac{200}{\pi \cdot r^2} \quad   \quad r = \frac{10^{2/3}}{\pi^{1/3}}$ $h = \frac{2 \cdot 10^{2/3}}{\pi^{1/3}}$					
CALCULUS RAD AUTO FUNC 7/30					

Volume of a can

3

F1+ Tools	F2+ Algebra	F3+ Calc	F4+ Other	F5 Pr3mid	F6+ Clean Up
■ NewProb					Done
■ $\frac{1}{\sqrt{2}}$					$\frac{\sqrt{2}}{2}$
■ $\sqrt{16+28}$					$2\sqrt{11}$
■ $\pi \cdot 6^2$					$36 \cdot \pi$
CALCULUS RAD AUTO FUNC 4/30					

Symbolic answers

4

F1+ Tools	F2+ Zoom	F3 Edit	F4 All	F5+ Style	F6+ Rec	F7+ ...
*PLOTS						
Plot 2:						
Plot 1:						
$y1 = \begin{cases} 5 - x^2, & x \leq 1 \\ x + 2, & \text{else} \end{cases}$						
y2 = x <sup>2</sup> - 1						
y3 =						
y1(x) = when(x ≤ 1, 5 - x <sup>2</sup> , x + 2)						
CALCULUS RAD AUTO FUNC						

Piecewise graphing

5

F1+ Tools	F2+ Command	F3+ View	F4 Execute	F5 Find...
:1998 AB-1				
C: NewProb				
:a)				
C: f(√(x), x, 0, 4)				
:b)				
C: solve(f(√(x), x, 0, h) = 8/3,				
h)				
:c)				
C: f(π*(√(x))^2, x, 0, 4)				
CALCULUS RAD AUTO FUNC				

Scripting

6

F1+ Tools	F2+ Zoom	F3 Tracs	F4 ReGraph	F5+ Math	F6+ Draw	F7+ Pen	F8 C
CALCULUS RAD AUTO G1 FUNC							

Two graphs

7

F1+ Tools	F2+ Command	F3+ View	F4 Execute	F5 Find...
:tan <sup>-1</sup> (∞)				
:ln(0)				
:e <sup>-(∞)</sup>				
:∫ <sup>67</sup>				
:f(-1)				
:f(-i)				
:e <sup>(iπ)</sup>				
:sin <sup>4</sup> (-2)				
:(-8) <sup>(2/3)</sup>				
CALCULUS RAD AUTO FUNC				

Special numbers

8

F1+ Tools	F2+ Algebra	F3+ Calc	F4+ Other	F5 Pr3mid	F6+ Clean Up
■ NewProb					Done
■ 3·x + 5·x					8·x
■ 3·x + 5·x   x = 3					24
■ 3·x + 5·x					8·x
■ 3·x + 5·x   x = a					8·a
3x+5x   x=F					
CALCULUS RAD AUTO FUNC 5/30					

"simple" algebra

9

F1+ Tools	F2+ Algebra	F3+ Calc	F4+ Other	F5 Pr3mid	F6+ Clean Up
■ factor(x <sup>4</sup> + x <sup>2</sup> - 12)					(x <sup>2</sup> - 3)·(x <sup>2</sup> + 4)
■ factor(x <sup>4</sup> + x <sup>2</sup> - 12, x)					(x + √3)·(x - √3)·(x <sup>2</sup> + 4)
factor(x <sup>4</sup> + x <sup>2</sup> - 12, x)					
CALCULUS RAD AUTO FUNC 3/30					

"better" algebra

10

F1+ Tools	F2+ Algebra	F3+ Calc	F4+ Other	F5 Pr3mid	F6+ Clean Up
■ expand((x - 5) <sup>5</sup> )					
x <sup>5</sup> - 25·x <sup>4</sup> + 250·x <sup>3</sup> - 1250					
■ expand(((√(x - 1) + 2) <sup>2</sup> )					
4·√(x - 1) + x + 3					
CALCULUS RAD AUTO FUNC 3/30					

More cool algebra tools

11

F1+ Tools	F2+ Command	F3+ View	F4 Execute	F5 Find...
:solve...				
$\begin{array}{r} 3x - 2y = 7 \\ 4x + 5y = 18 \end{array}$				
:solve(3x-2y=7, x)				
:solve(4x+5y=18, y)   x=...				
:x=...   y=...				
CALCULUS RAD AUTO FUNC				

Simultaneous equations

12

F1+ Tools	F2+ Algebra	F3+ Calc	F4+ Other	F5 Pr3mid	F6+ Clean Up
■ Define sec(xx) = $\frac{1}{\cos(xx)}$					Done
■ sec( $\frac{\pi}{6}$ )					$\frac{2\sqrt{3}}{3}$
HANNA RAD AUTO FUNC 2/30					

Defining functions

**Volume of a can:**

A tin can is to be constructed in the shape of a cylinder and is to hold 1 liter of soup. Determine the dimensions of the can (radius and height) that minimize the surface area of the cylinder.

**NewProb**

**Define** the formula for the Surface Area of a cylinder (the function to minimize, in terms of  $h$  and  $r$ ).

Enter the *equation* for the Volume of the cylinder.

**Solve** the Volume *equation* for  $h$ .

Now replace the  $h$  in the Surface Area function with its equivalent expression in terms of  $r$ .

Next...?

*do the math*

**Prime?**

Fermat proposed that  $F(x) = 2^{(2^x)} + 1$  is *prime* when  $x$  is a Natural number. What is the first value of  $x$  for which this conjecture fails?

**Fun stuff**

What is the square root of **12345678987654321**?

What is the slope of  $y=|x^x|$  at  $(0, 1)$ ?

Find the area of the largest rectangle that has one side on the positive  $x$ -axis and the other two vertices on the function  $y=xe^{-x}$