Teaching Calculus with the TI-89

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Getting acquainted:

- TI-83: "think green"
- The **C**omputer **A**lgebra **S**ystem
- **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 **Home**work!
- Organize your files

Warm-up:

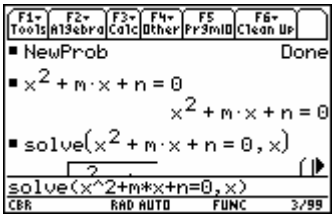
Find, in terms of m and n, the sum of the reciprocals of the roots of $x^2 + mx + n = 0$

Web Resources:

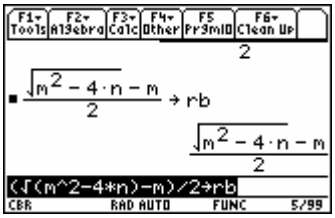
- John Hanna: http://www.johnhanna.us
  see 'calculators'
- TI Education: http://education.ti.com
  see **Activities Exchange**
- T^3 • Teachers Teaching with Technology
  see TI Education, Professional Development

Step-by-Step

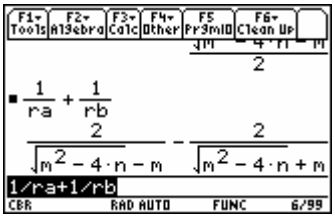
1. Find, in terms of m and n, the sum of the reciprocals of the roots of $x^2 + mx + n = 0$



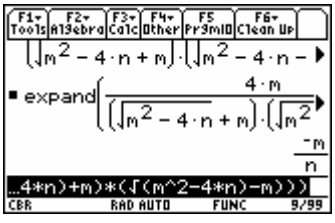
First, start a "NewProb" ([F6] 2:)
Enter the equation to solve *(for later use)*
Use [F2]: **solve(** to solve for *x*: First, put the command down, then go up (⊙)and retrieve ([ENTER]) the equation, then type a *'comma'* and the letter *x*, close parentheses, and press [ENTER] to evaluate the command.



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.

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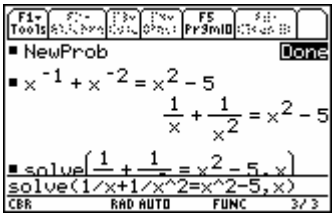
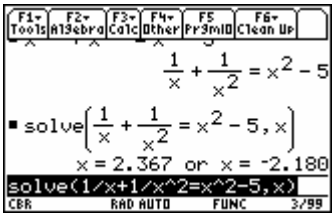
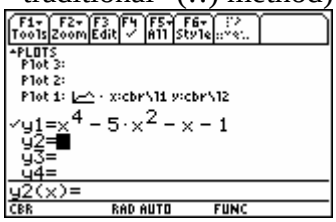
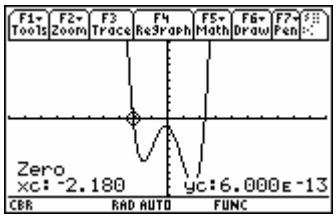
2. Solve for x to the nearest hundredth: $x^{-1} + x^{-2} = x^2 - 5$





Or (the "traditional" (!!) method) …





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Calculus Topics

Limits:

Limit(expression, independent var, value, optional direction)

Limit(sin(x)/x, x, 0, 1) → $\lim_{x \to o^+} \frac{\sin(x)}{x}$

Definition of the Derivative

Define der(x) = limit((f(x+h) – f(x))/h, h, 0)

Applications of the Derivative: Related Rates and Optimization

RR: Sand is falling into a conical pile at the rate of 100ft^3/min. The diameter of the base is 4*height. How fast is the height changing when the pile is 10*ft* high?

define v(t) = 1/3*pi*r(t)^2*h(t)
define r(t) = 2*h(t)
d(v(t),t) → dvdt
dvdt|d(h(t),t) = dhdt → dvdt
solve(dvdt=100,dhdt)→ dhdt
dhdt|h(t)=10

Answer: 1/4pi

OPT: see **Volume of a Can**

Implicit Differentiation

The secret… write y(x) instead of y…
Given $x+y^2 = 2x^2y + 1$, find dy/dx.
Enter: **x+y(x)^2 = 2x^2*y(x)→eq**
d(eq,x)
In resulting equation, replace d(y(x), x) with dydx.
Solve for dydx.

Reimann Sums (programs)

Definition of the Definite Integral

define f(x) = x^2

define Integral(f(x),x,a,b) = limit(sum( ),i,1,n),n, inf)

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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.

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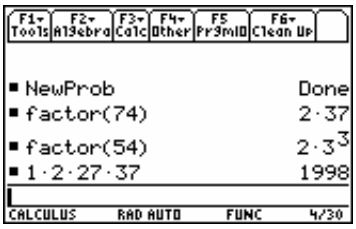
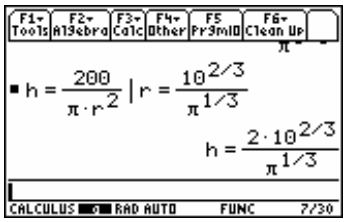
Miscellaneous screens

1



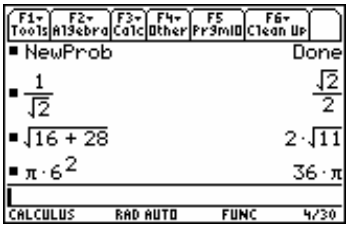
Numerical

2



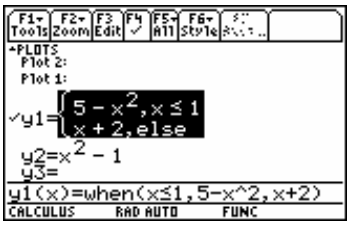
Volume of a can

3



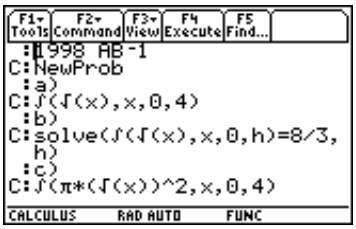
Symbolic answers

4



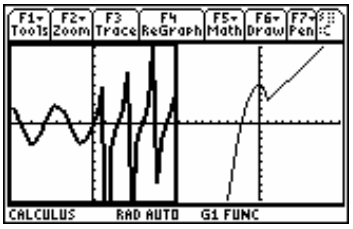
Piecewise graphing

5



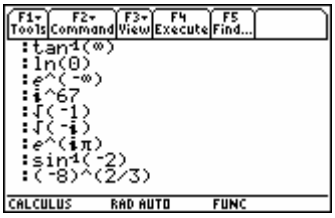
Scripting

6



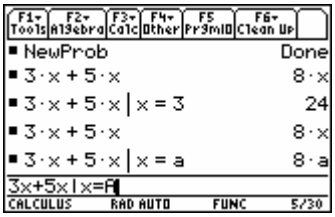
Two graphs

7



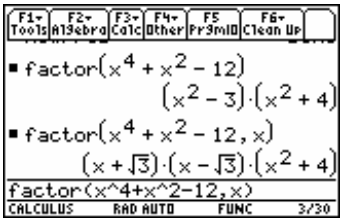
Special numbers

8



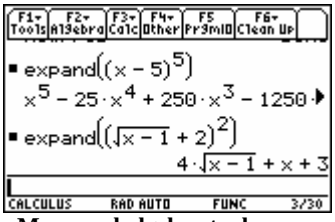
"simple" algebra

9



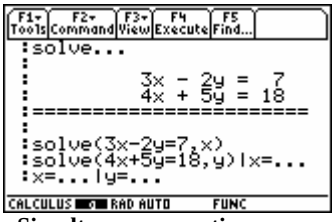
"better" algebra

10



More cool algebra tools

11



Simultaneous equations

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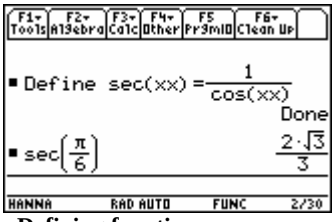

Defining functions

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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 $F(x) = 2^{(2\wedge x)} + 1$ 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 $y=xe^{-x}$

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