

CAS 4 ALL!

Computer Algebra Systems In Secondary Mathematics



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Getting acquainted with the TI-89 and Voyage 200:

- For TI-83/4 users: “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 **H**istory
- Editing includes *select, cut, copy, paste, Home, End*
- Save your **H**omework
- Organize your files

Problems:

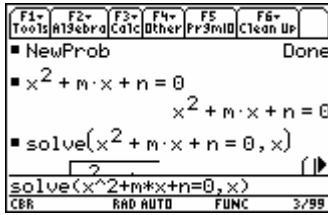
- Find, in terms of m and n , the sum of the reciprocals of the roots of $x^2 + mx + n = 0$
- For how many values $10^{-4} < x < 10^4$, is $\log_2(x)$ an integer?
- Solve for x to the nearest hundredth: $x^{-1} + x^{-2} = x^2 - 5$
- Solve for x : $\cos(2x) = \sin(x) - 2$ for $0 \leq x \leq 2\pi$
- Solve 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 **Activities Exchange**
- T³ – Teachers Teaching with Technology: <http://education.ti.com/t3>
see Summer Institutes, Professional Development, and Conferences

Step-by-Step

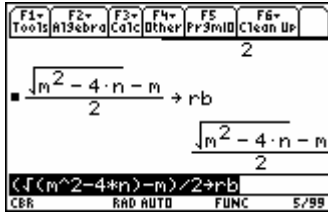
1. Find, in terms of m and n , the sum of the reciprocals of the roots of $x^2 + mx + n = 0$



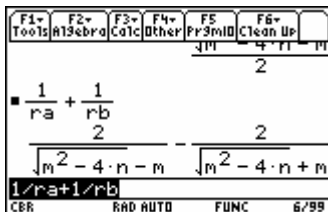
First, start a “NewProb” ([F6] 2:)

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

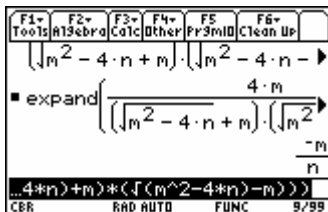
Use [F2]: **solve**(to solve for x : First, put the command down, then go up (⊖) and retrieve ([ENTER]) the equation, then type a ‘comma’ and the letter x , close parentheses, and press [ENTER] to evaluate the command.



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

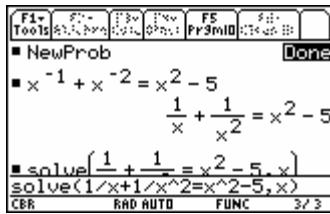


Evaluate $1/ra + 1/rb$. Look good? (NO), but it IS right.

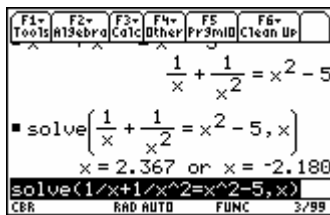


Use [F2]: **expand**(and [F2]: **comDemon**(to simplify the expression. First, put the command down, then go up (⊖) and retrieve ([ENTER]) the last result, then press [ENTER] to evaluate.

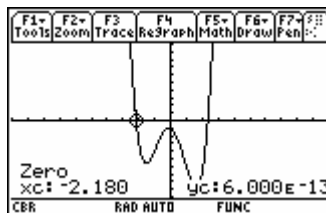
2. Solve for x to the nearest hundredth: $x^{-1} + x^{-2} = x^2 - 5$



F2: Solve(



And the “traditional” method...



Miscellaneous screens: capabilities of the TI-89

1

F1+ Tools	F2+ Algebra	F3+ Calc	F4+ Other	F5 Pr3Mid	F6+ Clean Up
■ NewProb					Done
■ factor(74)					2·37
■ factor(54)					2·3 ³
■ 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· π
CALCULUS RAD AUTO FUNC 4/30					

Symbolic answers

4

F1+ Tools	F2+ Zoom	F3 Edit	F4 Style	F5 Style	F6+ Style	F7+ Style
*PLDTs						
Plot 2:						
Plot 1:						
$y_1 = \begin{cases} 5 - x^2, & x \leq 1 \\ x + 2, & \text{else} \end{cases}$						
$y_2 = x^2 - 1$						
$y_3 =$						
$y_1(x) = \text{when}(x \leq 1, 5 - x^2, x + 2)$						
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 Trace	F4 ReGraph	F5+ Math	F6+ Draw	F7+ Pen:C
CALCULUS RAD AUTO G1 FUNC						

Two graphs

7

F1+ Tools	F2+ Command	F3+ View	F4 Execute	F5 Find...
:tand(ω)				
:ln(0)				
:e^(-ω)				
:e^67				
:√(-1)				
:√(-1)				
:e^(π)				
:e^ln(π)				
:sin(π)				
:ln(1/(-2))				
:(-8)^(2/3)				
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 ⁴ +x ² -12)					(x ² -3)·(x ² +4)
■ factor(x ⁴ +x ² -12, x)					(x+√3)·(x-√3)·(x ² +4)
factor(x ⁴ +x ² -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) ⁵)					
x ⁵ -25·x ⁴ +250·x ³ -1250					
expand(√(x-1)+2) ²)					
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...				
:-----				
3x-2y=7				
4x+5y=18				
:-----				
: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

HOMEWORK!

1. Volume of a can

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

- **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

2. 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?

3. Other Fun stuff

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

What is the slope of $y=1/x^x$ 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 $y=xe^{-x}$