Differential Equations Made Easy

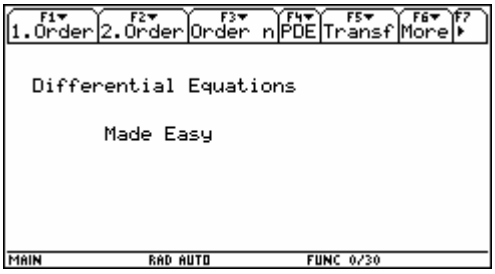
Review and Description of some features, Josef Böhm

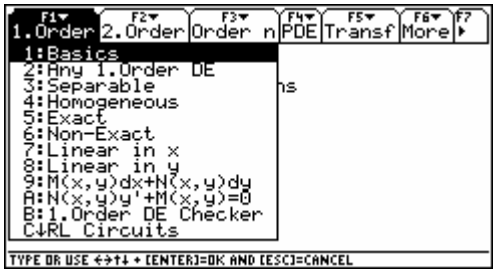
DUG Member Nils Hahnfeld gathered a bundle of programs and functions into one application DEQME v.7.0, which can be downloaded and purchased from www.ti89.com. The application is available for TI-89, TI-92+ and Voyage 200.

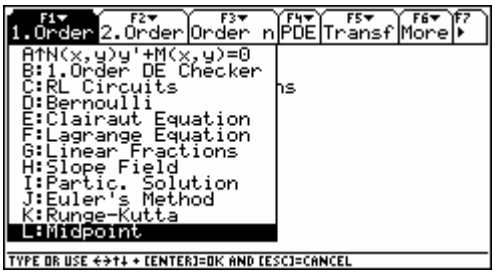
Nils and I had an extended exchange of emails and files. In some details he could refer to earlier DNL contributions.

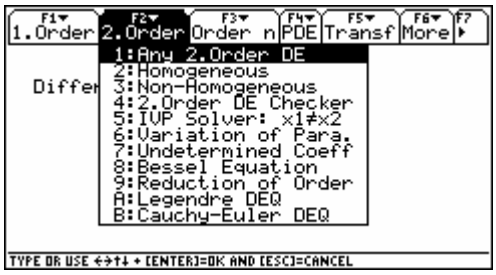
I will give an overview about the many features of DEQME.

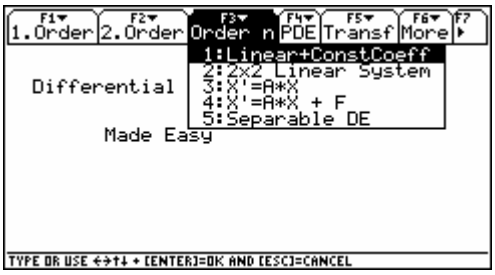
First of all see screen shots which show all options offered in the various menus reaching from Basics of 1st order DEs over PDEs to special DEs, Laplace Transforms and Eigenvalues.

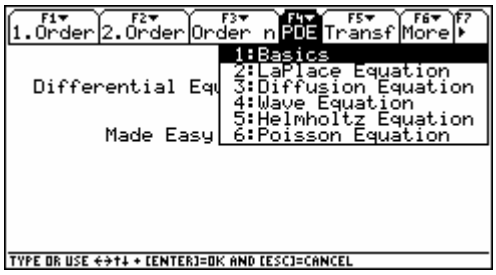


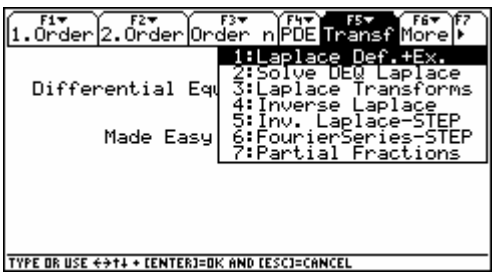


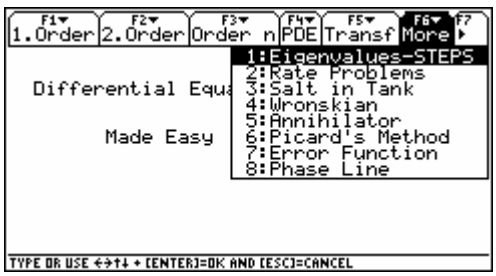




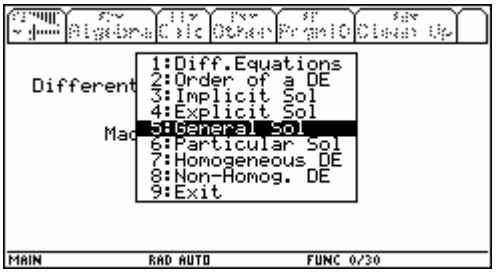


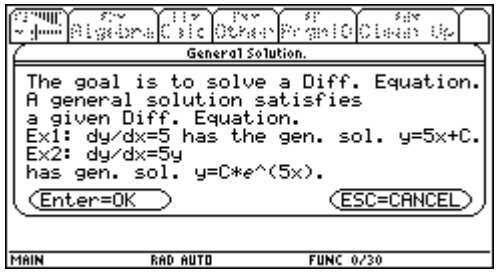






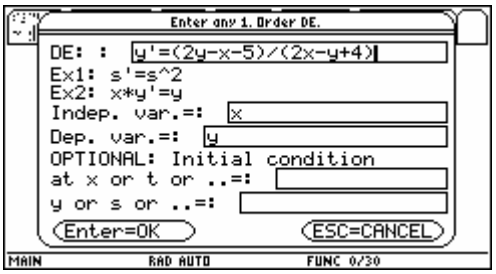
I open the first menu point under F1 1.Order, 1:Basics and want to inform about General Sol(ution):

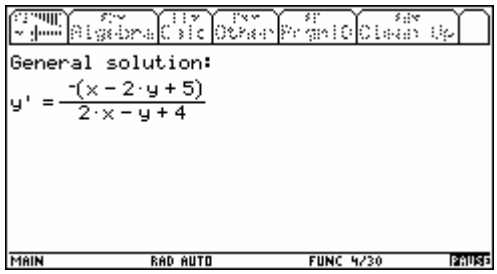




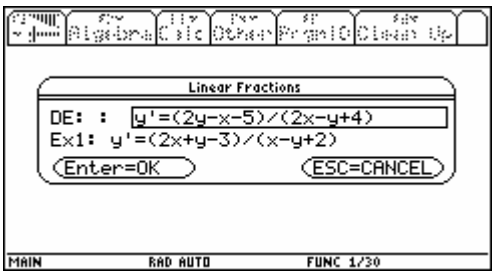
Then I switch back to F1, 2:Any 1.Order DE and would like to solve the differential equation

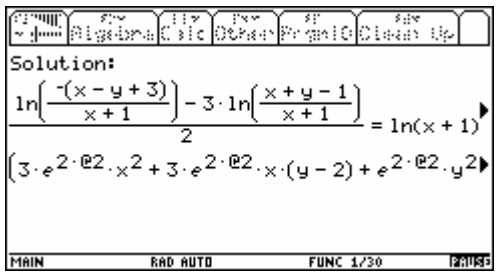
$$y' = \frac{2y - x - 5}{2x - y + 4};\ y(0) = 4\,.$$



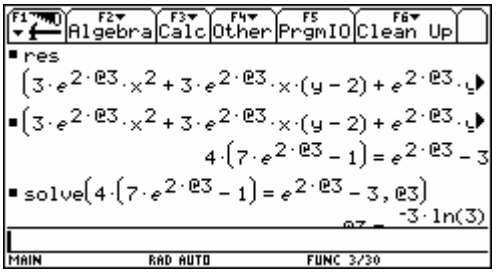


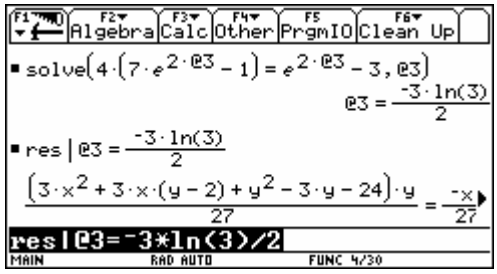
I don´t receive the solution because the TI built in desolve cannot solve this kind of DE. Under F1 I can find the option G:Linear Fractions. So I try again:

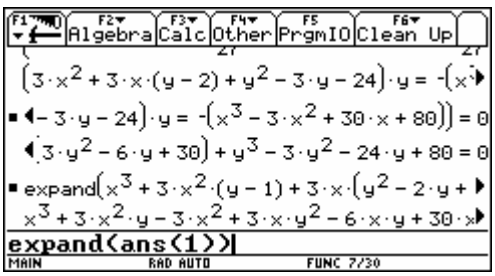




This is the general solution, but how to obtain the special solution? The solution which is presented in the Prgm IO screen is stored as res and can be recalled in the Home screen. In F7 Menu you can find the respective note.







Just for checking the result I load DERIVE and apply the LIN_FRAC-function:

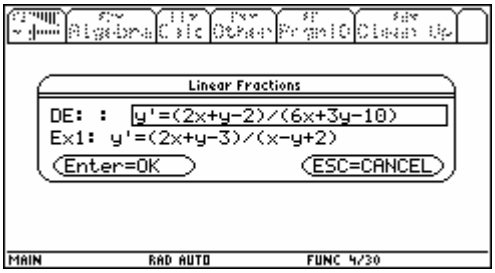
$$\text{LIN\_FRAC}\left(\frac{2\cdot y - x - 5}{2\cdot x - y + 4}, -1, 2, -5, 2, -1, 4, x, y, 0, 4\right)$$

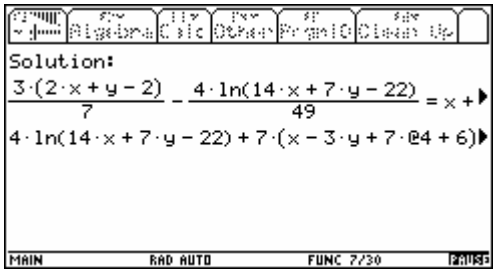
$$\frac{\text{LN}\left(-\frac{x - y + 3}{x + 1}\right)}{2} - \frac{3\cdot\text{LN}\left(\frac{x + y - 1}{x + 1}\right)}{2} = \text{LN}(x + 1) - \frac{3\cdot\text{LN}(3)}{2}$$

After some manipulations I obtain the same solution! Well done, DEQME!!

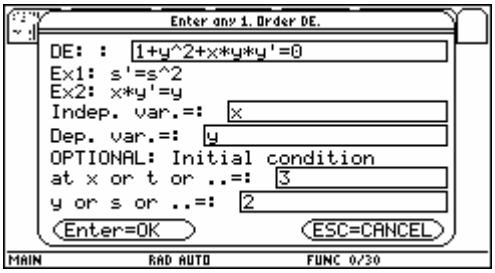
$$\#11:\quad x^3 + 3\cdot x^2\cdot y - 3\cdot x^2 + 3\cdot x\cdot y^2 - 6\cdot x\cdot y + 30\cdot x + y^3 - 3\cdot y^2 - 24\cdot y = -80$$

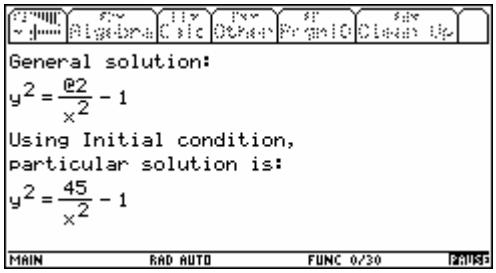
In case of non intersecting linear functions in numerator and denominator DERIVE provides a special utility function FUN_LIN_CFF_GEN. Nils implemented this special case as you can see below:



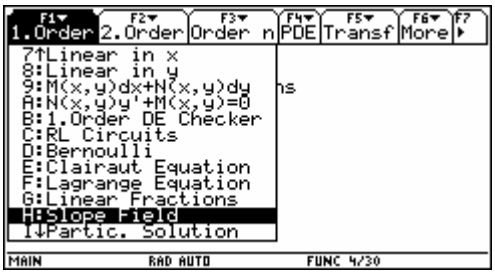


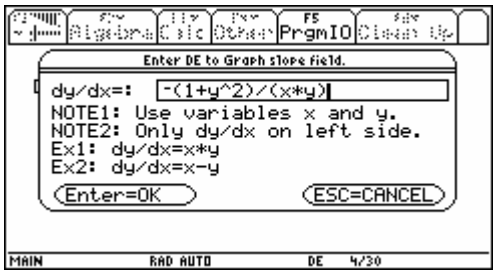
I try solving another DE using the first menu point "Any 1. Order DE" $1+y^2+x\cdot y\cdot y'=0;\ y(3)=2$.



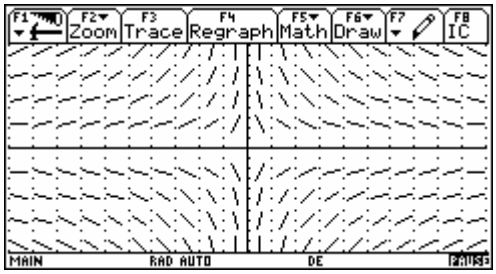


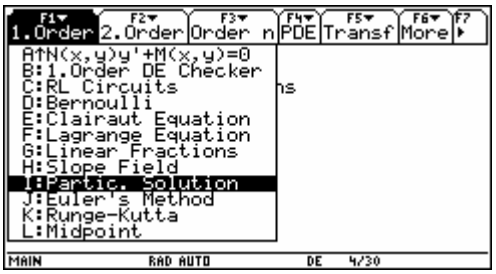
And I'd like to plot its slope field and the special solution.

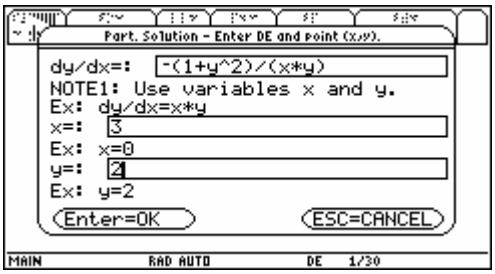


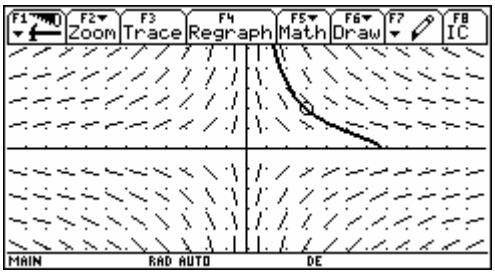


As you can read in the bottom line, the GRAPH Mode changed from FUNC to DE.

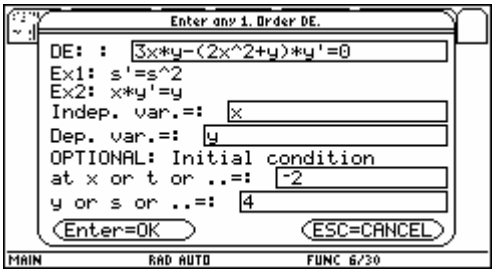


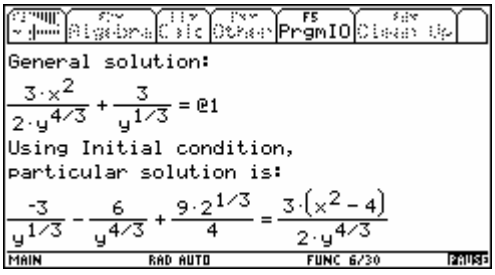


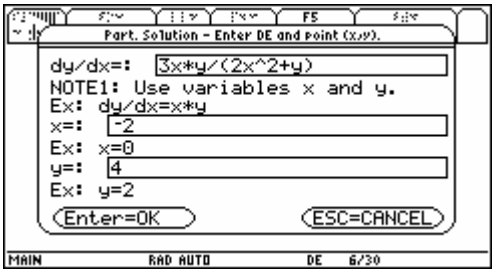


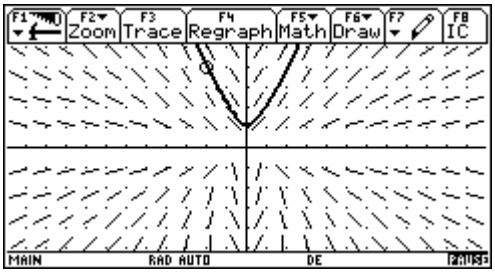


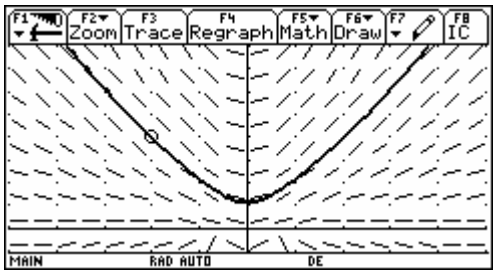
$y' = \dfrac{3xy}{2x^2+y}$, $y(-2) = 4$. Solve and plot the solution together with the direction field.



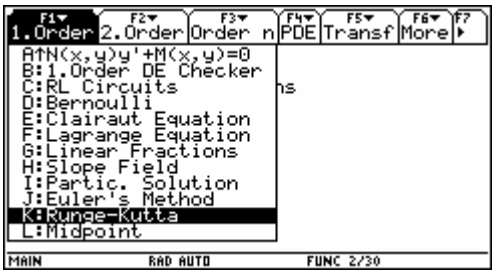


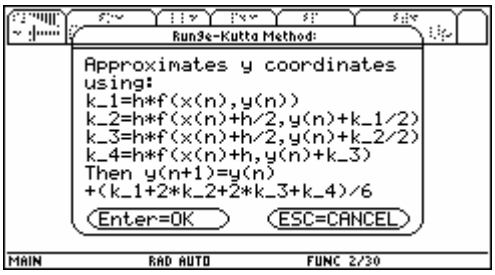


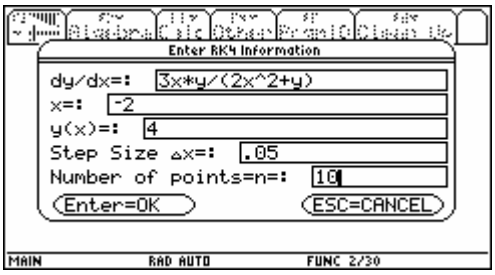




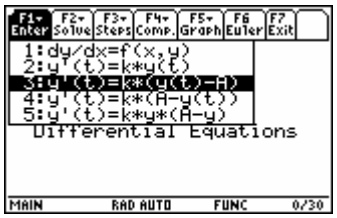
Runge-Kutta is implemented in order to find numerical solutions.

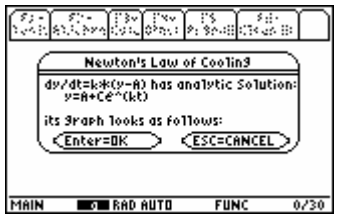


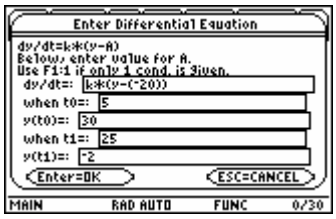


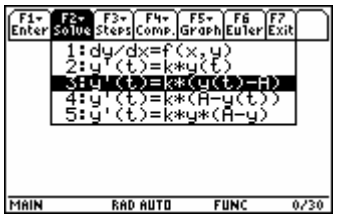


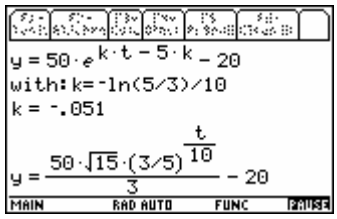
Next examples deal with separation of variables – and I switch to the TI-89:



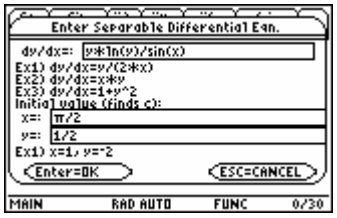


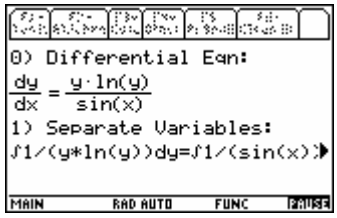


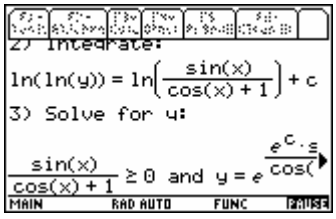


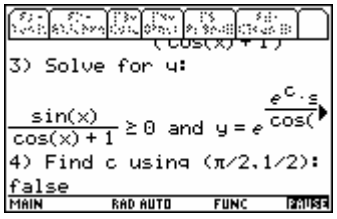


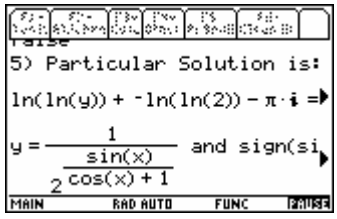
I´d like to see the calculation steps:

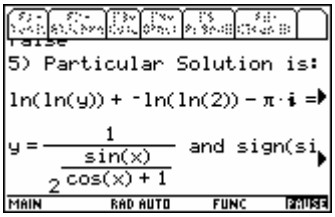




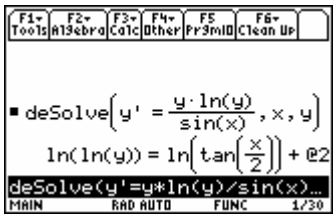


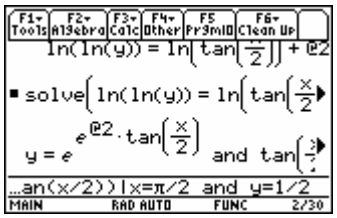


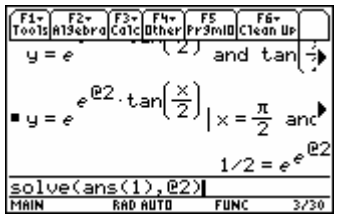




Compare with the deSolve – result. It might be a nice problem for students to verify the identity of the trig expressions.

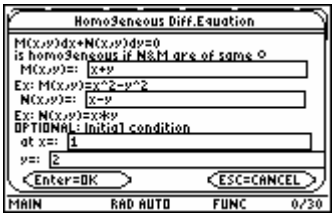


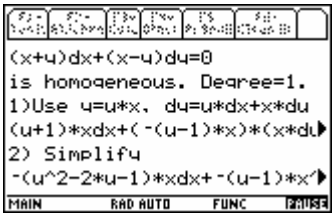


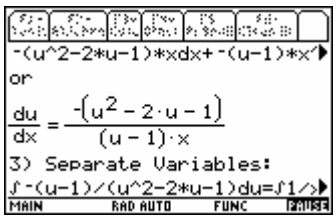


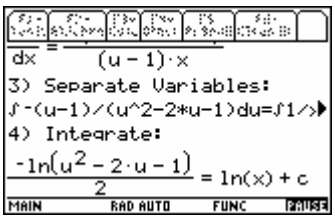
$y' = \dfrac{x+y}{y-x}$; $y(1) = 2$. This is a homogeneous DE.

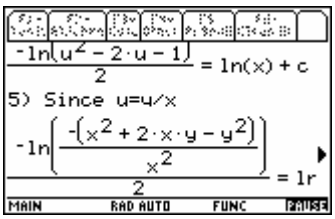
Again I´d like to I follow the steps. Then I will compare with deSolve.

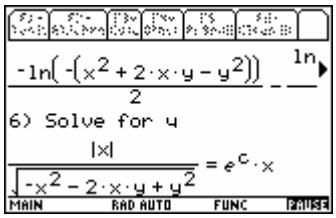


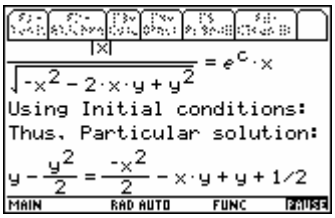


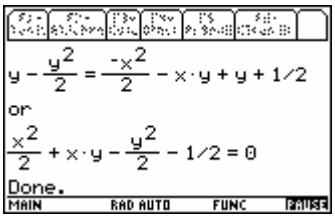


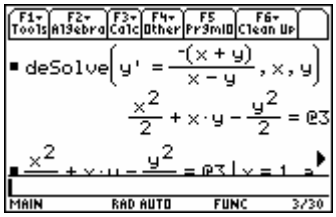


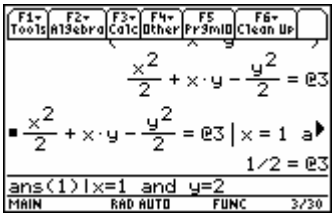




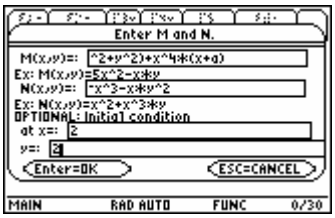


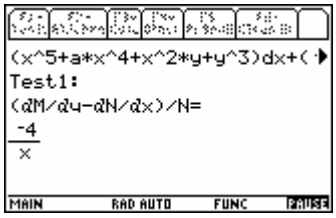


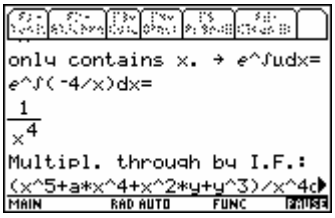


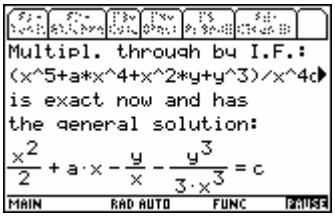


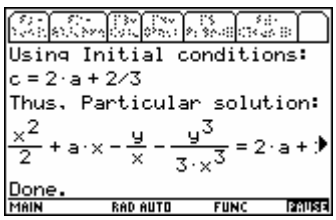
How to find an integrating factor–- if there is any? DEQME gives the answer:











(will be continued)