TI-84 Program Euler

Re: text p.123 for TI-85 implementation, 4th ed

Re: text p.114 for TI-84 plus implementation, 5th ed

Y'=F(x,y)

	Comment
PROGRAM:EULERSTR	Program title
:ClrHome	Clear the home screen
:Input "Y'=",Str1	Input Y' i.e. dy/dx, press ALPHA first, store Y' to the string variable Str1
:String->Equ(Str1, Y_1)	Converts *string* into an equation and store the equation to Y_1
:Input " X_0 =",X	Initial x value, i.e. x_0 note: subscript for X_0 near end of catalog
:Input " Y_0 =",Y	Initial y value, i.e. $y(X_0)$
:Input "X MAX=",M	Final x value i.e. $x_0 \le x \le M$
:Input "NO. OF STEPS=",N	Number of steps
:(M-X)/N->H	Step size
:0->L	Initialize the counter L to zero
:ClrAllLists	Sets to 0 the dimension of all lists in memory (use catalog)
:For(I,1,N)	Begin the loop
:ClrHome	Clear the home screen to start the output
:L+1->L	Update the counter
:X-> $L_1(L)$	Store X in list 1
:Y-> $L_2(L)$	Store Y in list 2
: Y_1 ->F	Assign the function value of Y_1 to F
:($L_1(L)$)+H->X	Updated x value

:($L_2(L)$)+HF ->Y	Euler iteration, updated approximate Y value, i.e. add H*F
:Disp "X=",X, "Y=",Y	Display x and approximate y values
:Pause	Requires user intervention to press the enter key
:End	End of the loop
:L+1->L	Update L counter
:X-> $L_1(L)$	Add last X value to L_1 list
:Y-> $L_2(L)$	Add last Y value to L_2 list
:DelVar Y_1	Delete from memory the contents of Y_1
:PlotsOn	Turn on all stat plots
:Plot1(Scatter, L_1, L_2)	Define Plot1 as a scatter plot with lists L_1 and L_2
:ZoomStat	Redefine the viewing window to display all points
:DispGraph	Display the graph
:Pause	Requires user intervention to press the enter key
:Disp "X in L_1","Y in L_2	In the graph, X values are in L_1 and Y values are in L_2
:Stop	Ends program execution and returns to home screen when "DONE" is printed

Notes:

1. Confirmation of the results when executing the above code can be seen on p.118 (4th ed) and p. 110 (5th ed) in the text in figure 2.4.8. In this example, prompts for Y' requires the input X+Y (i.e. ALPHA X+ALPHA Y). The prompt for X_0 requires the input 0, the prompt for Y_0 requires the input 1, the X MAX prompt requires input of 1, and the NO. OF STEPS prompt requires input of 10. Whenever a pause occurs on the TI screen, press enter. At the end, a scatter plot of the (x,y) values will appear, press enter and DONE will appear on the home screen indicating that program execution has ended.

2. Another example to try is: Consider $0 \le x \le 0.5$ and we want only 2 steps with y'=y and y(0)=1. For this example the actual solution is $y = Ce^x = e^x$. At the prompt for Y' enter Y, at the prompt for X_0 enter 0, at the prompt for Y_0 enter 1, the X MAX prompt requires input of 0.5, and the NO. OF STEPS prompt requires input of 2. A summary of generated values for this Euler problem follows:

X	0	0.25	0.5
Y actual	1	1.28403	1.64872
Y approximate	1	1.25	1.5625

Note that 5 place accuracy was used to show the comparison with results using the RKSTRING code for RUNGE-KUTTA.

3. When creating the TI-84 program, use the PGRM key to access commands.

4. When done creating the program, 2nd Quit.

5. One has to press the enter key whenever the Pause instruction is encountered in the program. This is done purposely to allow the user to read all lines of output.

6. -> is created with STO key.

7. To add lines to the code:

a) I first added as many lines as needed with the entry INPUT, i.e. 2nd insert->PGRM->select INPUT under I/O->enter, then do this repeatedly for as many lines as needed

b) Then rewrite over the newly created INPUT lines

c) Note that the PlotsOn command is from 2nd catalog