

TI-89 – Slope Fields, Euler, etc.  
(assuming basic TI-89 knowledge)

Mode → Graph → Diff Equations

◇ Y= → F1 → (9) Graph Formats  
Set: Solution Method → Euler  
Fields → Slpfld

To graph a slope field:

Under ◇Y= , enter the differential equation in  $y1' =$ .

Example:  $y1' = .2 * y1 * (4 - y1)$  (Those are regular multiplication asterisks.)  
Set the desired Window (using  $x$ - and  $y$ -values) and Graph. Under Window,  $tstep$  is the usual Step size in the Euler program.

To plot a solution to a differential equation using Euler's Method:

As before, enter the differential equation under  $y1'$ .

The initial condition will be seen as the point  $(t0, y1)$ , and you will need to enter each of these coordinates in the appropriate places. Under Window, set  $tstep$  for the usual step size. There are several options for seeing solution curves.

(1) Under Window, for example, set:  $ncurves = 4$ . This will graph 4 distinct solution curves on the slope field.

(2) With a specific initial condition given on the solution curve:

Example:  $y1' = .2 * y1 * (4 - y1)$ , with initial values  $(0, .3)$

You should have:

$$t0 = 0$$

$$y1' = .2 * y1 * (4 - y1)$$

$$y1 = .3$$

After seeing the graph, you may use Trace (F3) to see the coordinates at each step.

(3) By interactively choosing a starting point on the solution curve:  
Again, enter  $y_1'$  as before. (Ignore  $t_0$ . Leave  $y_1$  blank.) Graph, using  
◇ Graph. (This will graph only the slope field.)

From this window with the slope field, choose F8. Two choices:

- (i) Use the cursors to move to the desired point (approximate) and press Enter.
- (ii) Start typing numbers to enter the desired value of  $t$ . Press Enter and type in the desired value of  $y_1$ . Press Enter.

### To find an analytic solution to a differential equation:

F3 → deSolve(diff eq, independent var, dependent var)

Example:  $y' = t + y$

deSolve( $y' = t + y$ ,  $t$ ,  $y$ )      (Note that the '(prime) in  $y'$  is the yellow mark above the "=" sign.)

Example:  $y' = y(1 - y)$

deSolve( $y' = y*(1 - y)$ ,  $t$ ,  $y$ )

Example:  $y' = t + y, y(0) = 2$       (DE with initial condition)

deSolve( $y' = t + y$  and  $y(0) = 2$ ,  $t$ ,  $y$ )

(The " and " comes from the catalog or it may be typed. It must have the blank spaces before and after the word.)

If you wish to see your solution on the slope field, first graph the slope field. Then, on the Home screen, take your solution function and replace the  $t$ 's by  $x$ 's. (This may be done by entering:  $y = 3e^t - t - 1 | t = x$  for example.) Also make sure that you have replaced any arbitrary constants by specific values.

Then, from the graphing window, go to F6 Draw and DrawFunc. This will take you back to the Home screen. Copy your solution function with  $x$ 's, eliminate the " $y =$ " and press Enter. For the example above, this line should read:

DrawFunc  $3e^x - x - 1$