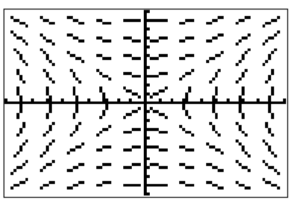
TI Lab 8: Differential Equations

In this lab, you will: use a program to approximate a numerical solution to a differential equation using Euler's Method; and use a program to generate a slope field.

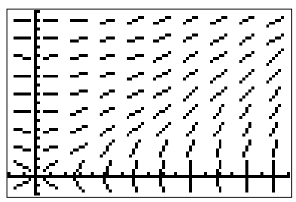
1. The program `SLOPEFLD` draws a slope field for a differential equation. To use this program, the differential equation must be solved for y'. Enter the resulting equation in `Y1` in terms of `X` and `Y` (`Y` is found by pressing `ALPHA` and `1`), then adjust your window to the appropriate size. Then run the program.

The only limitation to this program is that the program always draws 100 slope segments in a 10 by 10 array. Thus, if you want slopes at integer points, you will need a window of $-0.5 < x < 9.5$ and $-0.5 < y < 9.5$. This will create slope segments at integer values along each axis (up to 9) and throughout the first quadrant (up to the point $(9, 9)$). Any multiple of this window will create slope segments at integer points as well: for instance, multiplying by 2 results in a window of $-1 < x < 19$ and $-1 < y < 19$ and creates slopes at even integer points. If you want other quadrants as well, simply shift the window: subtracting 9 from both x and y results in a window of $-10 < x < 10$ and $-10 < y < 10$ and creates slopes at odd integer points.

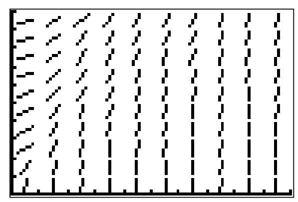
Plot a slope field for the differential equation $y' = x/y$. The graphs below show you the difference a window makes.



$-10 < x < 10,\ -10 < y < 10$



$-2 < x < 18,\ -2 < y < 18$



$0 < x < 50,\ 0 < y < 20$

Try using the -0.5 by 9.5 window. What happened? Why?

2. The program `EULER` approximates the value of a differential equation and is self-explanatory. The differential equation must be solved for y'. Enter the resulting equation in `Y1` in terms of `X` and `Y`, and run the program. "`FINAL X`" is the point at which you want the approximation. Press enter repeatedly to get the successive approximations.

Plot a slope field for the differential equation $x + y' = xy$. Use an appropriate window to get a good idea of what happens around the origin. Then use Euler's method to approximate y at $x = 2$ with an initial value $y(0) = 1$ and step size 0.2.