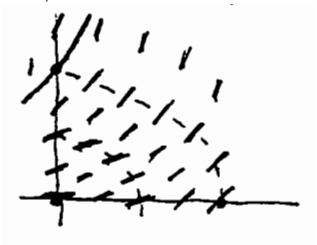
Part I Problems and Solutions

Problem 1: *Use the Euler method and the step size .1 on the IVP* $y' = x + y^2$, $y(0) = 1$, *to calculate an approximate value for the solution* $y(x)$ *when* $x = .1, .2, .3$. *(Make a table.) Is your answer for* $y(.3)$ *too high or low?*

Solution: Euler method formula: $y_{n+1} = y_n + hf(x_n, y_n)$.

x_n	y_n	$f(x_n, y_n)$	$hf(x_n, y_n)$	
0	1	1	.1	$h = .1$
.1	1.1	1.31	.131	$f(x, y) =$
.2	1.23	1.72	.172	$x + y^2$
.3	1.403			



Isoclines $x + y^2 = C$ (parabolas).

Solution curve through $(0, 1)$ is convex (concave up), so Euler method gives too *low* a result.

18.03SC Differential Equations
Fall 2011