Section 1.3 – Slope Fields and Solution Curves

For #1, sketch the slope fields and at least 5 solution curves ***(must be done by hand)*** for the following differential equation by filling in the slope chart and sketching those slopes on a graph.

1) $dy/dx = x + y$

$y \backslash x$	0	1	2	3	4
0					
1					
2					
3					
4					

For #2-4, draw the slope fields and at least 5 solutions curves for the following differential equations. ***You can use what we learned in lab, dfield7.m, in matlab and print out your slope fields with solution curves.*** Please use a [-3, 3] x [-3, 3] window.

2) $dy/dx = -y - sin(x)$
3) $dy/dx = x - y$
4) $dy/dx = y - x + 1$

Section 2.4 – Euler's Method

For #5-7,
a) Use Euler's Method, $x_{n+1} = x_n + h$
$y_{n+1} = y_n + h*f(x_n, y_n)$
to approximate the solution to the following initial value problems on the interval [0, 1] with step size h = 0.2.

b) Then solve for the exact solution curve, $y(x)$, using the methods from sections 1.4 and 1.5 and compare the final approximate solution, y_n, to the final exact solution, $y(x_n)$. ***(This must be done by hand.)***

5) $y' = y - 2$, $y(0) = 1$
6) $y' = ½(y - 1)^2$, $y(0) = 2$
7) $y' = 2xy^2$, $y(0) = 1$

Section 2.5 – Improved Euler's Method

For #8-10 (same problems as #5-7),
a) Use the Improved Euler's Method,

$$k_1 = f(x_n, y_n)$$
$$u_{n+1} = y_n + h^* k_1$$
$$k_2 = f(x_{n+1}, u_{n+1})$$
$$y_{n+1} = y_n + h^*1/2(k_1 + k_2)$$

to approximate the solution to the following initial value problems on the interval [0, 1] with step size h = 0.2.

b) Then compare the final approximate solution, y_n, from the Improved Euler's method with step size h = 0.2 to both the final approximate solution, y_n, and the exact final solution, $y(x_n)$, you found in #5-7. How much did the Improved Euler's Method improve the approximate solution?
(This must be done by hand.)

8) $y' = y - 2$, $y(0) = 1$
9) $y' = ½(y - 1)^2$, $y(0) = 2$
10) $y' = 2xy^2$, $y(0) = 1$