MATLAB Project 1, due in the week of Feb 22, 2016.

Consider the initial value problem
\[ y' = r(t)y - \frac{1}{5}, \quad y(0) = y_0, \quad \text{where } r(t) = \frac{(1 + \sin(t))}{5}. \]

1. (a) Use dfield (Java version) or dfield8 (Matlab version) to plot the direction field of the differential equation with the Display window set for \(0 \leq t \leq 10\) and \(0 \leq y \leq 2\). Set the window properties to use arrows when displaying the direction field. Print out your plot, it is the answer to this part of the problem.

(b) Use the method of the integrating factor to find the general solution of the differential equation, and then find the solution of the initial value problem.

(c) Use dfield (Java version) or dfield8 (Matlab version) to plot solutions of the initial value problem for \(0.5 \leq y_0 \leq 1\) with increment of 0.1 (that is \(y_0 = 0.5, 0.6, 0.7, 0.8, 0.9, 1.0\)).

2. Use forward Euler’s method with step size \(h = 0.025\), \(h = 0.05\), \(h = 0.1\) and \(h = 0.2\) to find approximate values of the solution on the interval \(0 \leq t \leq 5\) for \(y_0 = 0.5\) and \(y_0 = 1\). Compare the results with the corresponding solutions from 1(b), and check which case (\(y_0 = 0.5\) or \(y_0 = 1\)) has “larger” error at \(t = 5\) in the approximate solution from forward Euler’s method.