ME 564 Homework 1

Due date: 10/12/2020

Problem 1. Solution by several methods and compare the amount of work

a) $y'e^y coshx + e^y sinhx = 0$ as an exact ODE and by separation of variables.
   $\int sinhxdx = coshx + c$, $\int tanhxdx = ln(coshx) + c$

b) $y'secy + (1 + 2x)cosy = 0$ using integrating factor and by separation of variables
   $\int tanxdx = -\ln|cosx| + c$, $\int \frac{1}{\cos^2 y} dx = tany + c$

c) $x^2 + y^2 - 2xyy' = 0$ using integrating factor and by separation of variables (transform to separable form)

Problem 2. A simple model for the spread of contagious disease is obtained by assuming that the rate of spread is proportional to the number of contacts between infected and noninfected persons, who are assumed to move freely among each other. The math model for the percentage of infected people is $y' = ky(1 - y)$, where $k > 0$.

a) Find the equilibrium solutions and indicate their stability or instability.
b) If k=2, plot the numerical solution and the analytical solution of y(t), tspan=[0,5], for the initial conditions y(0)=0.1 and y(0)=0.5.