You may attach additional pages if you wish. Use both sides of the paper. Label the problems clearly and indicate your final answer/s clearly. Work alone on these problems.

HOMEWORK 2

DUE DATE: Friday 11 September

Section 2.2. Separable Equations

1) Use separation of variables to solve \( e^x y \frac{dy}{dx} = e^{-y} - 2e^{-4x-y} \).

2) Use separation of variables to solve \( \frac{dy}{dx} - \tan x = y^2 \tan x \) with \( y(0) = \sqrt{3} \).

Section 2.3. Linear Equations

3) Use an integrating factor to solve \( x \frac{dy}{dx} - y = 2x^2 \) with \( y(5) = 1 \).

4) Pollution in a Lake. Consider a lake with a stream flowing out of it and a nearby factory dumping pollution into it. Without worrying about the modeling details yet, the mass of pollution in the lake is represented by \( \frac{dP}{dt} = -\frac{r}{V} P + F \), where \( P \) is the mass of pollution in the lake \((kg)\), \( r \) is the flow rate of the stream \((m^3/sec)\), \( V \) is the volume of the lake \((m^3)\) and \( F \) is the mass of pollution dumped per time by the factory \((kg/sec)\). Treat \( r \) and \( F \) as constants.

   Use an integrating factor to solve the ODE in general form. Find the constant of integration if the initial condition is \( P(0) = A \), and write the solution for \( P(t) \) in a clean, final form.