Math 274 In-Class **Worksheet 3a**
Section: 2.6 and 3.2 (Kegs)

1. The magnetic field lines of a dipole (in the xy-plane) satisfy

$$\frac{dy}{dx} = \frac{3xy}{2x^2 - y^2}.$$

(a) Sketch a direction field for this differential equation.

(b) Is this equation homogeneous?

(c) Find a general solution of this ODE.

(d) Sketch some solution curves on the graphic you made in part (a).

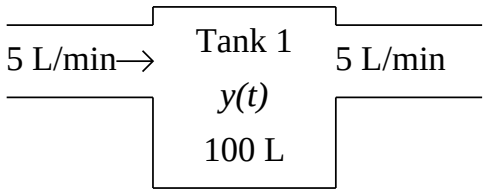
2. Consider the differential equation

$$y' + \frac{y}{x} = x^2 y^2$$

(a) Find a general solution.

(b) Find a solution $y(x)$ such that $y(1) = 1$.

3. Consider a 100 L tank of pure water (imported from the Alps) into which a saline solution begins to flow at a constant rate of 5 L/min. The solution in the tank is well-mixed and flows out of the tank at 5 L/min. The concentration of the saline solution entering the tank is 0.5 kg/L.



(a) Letting $y(t)$ denote the mass of salt in the tank after t minutes, determine $y(t)$.

(b) At what time will the concentration of salt in the tank reach 0.1 kg/L?