Math 1B Discussion Problems 9 Apr

1. Solve the following differential equations.

   (a) $y' = 3x^2 e^y$

   (b) $y' = 2x\sqrt{1 - y^2}$

   (c) $3y^2\sqrt{x^2 + 1}y' + x = 0, y(0) = 1$

   (d) $y' = xy - x - y + 1, y(0) = 2$

2. Find the orthogonal trajectories of the family of curves $y' = \frac{1}{x+k}$.

3. The air in a room with volume $180m^3$ contains 0.15% carbon dioxide initially. Fresher air with only 0.05% carbon dioxide flows into the room at a rate of $2m^3$ /min and the mixed air flows out at the same rate. Find the percentage of carbon dioxide in the room as a function of time. What happens in the long run?