

**MTH 211 - 0211 DIFFERENTIAL EQUATIONS MIDTERM  
EXAM**

1. Solve the initial value problem

$$x \frac{dy}{dx} + y = (xy)^{3/2}, \quad y(1) = 4.$$

2. Solve the differential equation

$$\left(x^3 + y^2 \sqrt{x^2 + y^2}\right) dx - xy \sqrt{x^2 + y^2} dy = 0.$$

3. Solve the differential equation

$$\left(1 + \frac{y}{x^2} \cos x\right) dx + \left(\frac{x}{3y} + 2 \frac{\sin x}{x^2}\right) dy = 0$$

by using an integrating factor in the form

$$\mu(x, y) = x^a y^b.$$

4. A virus causing an infection is spreading in a town that has a population of 30000. Assume that the rate of change in the infected population is directly proportional to the infected population at that time. Let the number of infected people is 10 at the beginning and 1000 after 10 days.

- a. Find the number of infected people at any time  $t$ .
- b. How long will it take for half of the population to become infected?