

# Practice Exam for Exam 1, Math 3303, ODE, Spring 2007

Print Your Name:

**Direction:** Show all your work. Work without sufficient detail will not get full credits.

1. (10 points) Find all  $m$  such that  $y = e^{mx}$  is a solution of  $y'' - 5y' + 6y = 0$ .
2. Consider  $\frac{d^3y}{dx^3} - \left(\frac{dy}{dx}\right)^4 = x^2 \sin(x)y$ .
  - a) (5 points) What is the order of this equation?
  - b) (5 points) Is this linear?
3. Does the initial value problem  $\frac{dy}{dx} = \sqrt{y} + y$ ,  $y(1) = 2$  have a unique solution? (3 points)  
Explain your answer. (7 points)
4. (10 points) Solve the initial value problem  $xy' - 2y = 0$ ,  $y(1) = 2$ .
5. (10 points) Find the general solution of  $xy' - 2y = x^4$ .
6. (10 points) Solve  $\frac{dy}{dx} = \frac{x^2-1}{y^2-1}$ .
7. (15 points) Solve  $2xy dx + (x^2 - 1)dy = 0$ .
8. (15 points) Solve the Bernoulli's equation  $x\frac{dy}{dx} + y = \frac{1}{y^2}$ .
9. (10 points) The population  $P(t)$  of a community is known to increase at a rate  $\frac{dP}{dt}$  that is proportional to the number of people present  $P(t)$  at time  $t$ . Suppose that the initial population  $P_0 = 2000$  has doubled in 4 years. Find  $P(10)$ , the population after 10 years.
10. (15 points) Solve  $\frac{dy}{dx} = \cos(x + y)$ ,  $y(0) = \frac{\pi}{4}$ .
11. (15 points) Solve  $(y^2 + yx)dx - x^2 dy = 0$ .