

# MATH371 - ODEs, Midterm - Version 1

Thursday, October 20th, 2011

It is an in class exam and you have 85 minutes to finish. Please show all work when possible, and simplify all answers when possible. Circle your final answer for each problem. Remember that the purpose of this exam is to test *your* knowledge of the material, not your neighbors'.

**Section:** \_\_\_\_\_ **Name:** \_\_\_\_\_

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**Please sign the pledge:**

*On my honor as a student, I have neither given nor received aid on this exam.*

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**Problem 1 (30 pts):**

**Problem 2 (30 pts):**

**Problem 3 (30 pts):**

**Problem 4 (30 pts):**

**Problem 5 (30 pts):**

**Problem 6 (30 pts):**

**Problem 7 (30 pts):**

**Problem 8 (30 pts):**

**Problem 9 (30 pts):**

**Problem 10 (30 pts):**

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**Total:**

1. (30 points) Solve the first order differential equation

$$xy' + y = 1 - 2x, \quad y(2) = 0.$$

2. (30 points) Find all solutions of the separable differential equation

$$y' = \frac{2x(y+1)}{x^2+1}.$$

3. (30 points) Check if the following is an exact differential equation. If exact, SOLVE IT. If not, find an integrating factor and show the new equation is exact. Then SOLVE IT.

$$(3y^2 + 4xy)dx + (x^2 + 2xy)dy = 0.$$

4. (30 points) Solve the following homogeneous (of degree) equation.

$$(x^2 + y^2)dx - xydy = 0.$$

5. (30 points) Solve the following Bernoulli equation.

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

6. (30 points)  $y_1 = e^x$  is a solution to the differential equation  $xy'' - (x+1)y' + y = 0$ . Find a second independent solution  $y_2$  using reduction of order.

7. (30 points) Find the general solution of the following differential equation.

$$y''' + 2y'' + y' = 0$$

8. (30 points) Use undetermined coefficients to solve the following differential equation.

$$y'' - 5y' + 6y = x - 4e^{2x}$$

9. (30 points) Solve the following differential equation by the method of Variation of Parameters.

$$y'' - 2y' + y = e^x$$

10. (30 points) Solve the Cauchy-Euler Equation and **check your solution**

$$x^2 y'' + xy' + y = 1$$