

King Fahd University of Petroleum and Minerals
Department of Mathematical Sciences
Semester I, 2005-2006(051)
MATH 202
Major Exam 1
Date: October 9, 2005

Student Name: _____

Student ID: _____

Section: _____

Note:

FOR ALL PROBLEMS, SHOW WORK. NO CREDIT FOR ANSWERS NOT SUPPORTED BY WORK.

1. State the order of the given ordinary differential equation. Determine whether it is linear or nonlinear. Give a reason for your answer.

(a) $(1 - x)y' - 4xy = \cos x$.

(b) $x \frac{d^2y}{dx^2} - \left(\frac{dy}{dx}\right)^4 + y = 0$.

(c) $\frac{d^2u}{dr^2} + \frac{du}{dr} + u = \cos(r + 1)$.

(d) $\frac{d^2R}{dt^2} = -\frac{k}{R^2}$.

(e) $\ddot{x} - \left(1 - \frac{\dot{x}^2}{3}\right)\dot{x} + x = 0$.

(5 points)

2. Determine a region in the x -plane for which the differential equation would have a solution whose graph passes through a point (x_0, y_0) in the region:

$$(1 + y^3)y' = x^2.$$

(5 points)

3. By separating variables, solve the IVP

$$\sqrt{1-y^2}dx - \sqrt{1-x^2}dy = 0, \quad y(0) = \sqrt{3/2}.$$

(10 points)

4. Solve the first order linear equation:

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

(10 points)

5. Solve the equation

$$\left(1 - \frac{3}{y} + x\right) \frac{dy}{dx} + y = \left(\frac{3}{x} - 1\right)$$

by using the method for solving exact equations.

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Semester II, 2004-2005(042)
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2. Determine a region in the x -plane for which the differential equation would have a solution whose graph passes through a point (x_0, y_0) in the region:

$$(1 + y^3)y' = x^2.$$

(5 points)

3. By separating variables, solve the IVP

$$(1 + y^2)dx - (1 + x^2)dy = 0, \quad y(1) = 0.$$

(10 points)

4. Solve the first order linear equation:

$$y' = 2y + x^2 + 5.$$

(10 points)

5. Solve the equation

$$\left(1 - \frac{3}{y} + x\right) \frac{dy}{dx} + y = \left(\frac{3}{x} - 1\right)$$

by using the method for solving exact equations.