

King Fahd University of Petroleum and Minerals
Department of Mathematical Sciences
Semester II, 2004-2005(042)
MATH 202
Major Exam 2
Date: April 25, 2005

Student Name: _____

Student ID: _____

Section: _____

Note:

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

1. Make an appropriate substitution to reduce the following differential equations to separable equations:

(a) $-y \, dx + (x + \sqrt{xy})dy = 0$.

(b) $\frac{dy}{dx} = \tan^2(x + y)$.

2. The half-life of radium-226 is 1590 years. A sample of radium-226 has a mass of 100 mg. Find a formula for the mass of radium that remains after t years: assume that the rate of decay at time t is proportional to the amount present at time t .

3. (a) Find m so that x^m is a solution of

$$4x^2y'' + 8xy' + y = 0.$$

- (b) Find a second solution by reduction of order.

4. Find the general solution of

$$\frac{d^3u}{dt^3} + \frac{d^2u}{dt^2} - 2u = 0.$$

5. (a) Find the annihilator of lowest order of $x + x^2 + e^{2x} + \sin x$.
- (b) Find the **form** of a particular solution of $y'' + y' + y = x \sin x$.

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1. Make an appropriate substitution to reduce the following differential equations to separable equations:

(a) $x dy - (y + \sqrt{x^2 + y^2})dx = 0.$

(b) $\frac{dy}{dx} = \sin(x + y).$

2. A thermometer is removed from a room where the air temperature is 70°F and is taken outside where the temperature is 10°F . After $1/2$ minute, the thermometer reads 50°F . Using Newton's law of cooling, find a formula for the temperature of the thermometer after t minutes.

3. (a) Find m so that x^m is a solution of

$$x^2y'' + 5xy' + 4y = 0.$$

- (b) Find a second solution by reduction of order.

4. Find the general solution of

$$\frac{d^3x}{dt^3} - \frac{d^2x}{dt^2} - 4x = 0.$$

5. (a) Find the annihilator of lowest order of $x^2 + x^3 + e^{3x} + \sin x$.
- (b) Find the **form** of a particular solution of the equation $y'' - 2y' + 5y = e^x \sin x$.