



King Saud University

Department of Mathematics

2nd Semester 1433-1434 H

MATH 225 (Differential Equations)

2nd Midterm Exam

Duration: 90 Minutes

Student's Name : _____

Question Number	I	II	III	Total
Mark				

Question I:

Choose the correct answer:

(1) $x^2 \frac{d^2y}{dx^2} - 5x \frac{dy}{dx} + 8y = 24$, $y(1) = 3$, $y(2) = 15$, is

(a) an initial value problem

(b) a boundary value problem

(c) a homogeneous differential equation

(d) None of the previous

(2) If $y_1(x)$ and $y_2(x)$ are two linearly independent solutions of the same second order differential equation, then

(a) $W(y_1, y_2) \neq 0$

(b) $\frac{y_1}{y_2} = \text{constant}$

(c) $W(y_1, y_2) = 0$

(d) None of the previous

(3) The initial value problem $\frac{d^2y}{dx^2} + 9y = x^2$, $y(0) = 0$, $\frac{dy}{dx}(0) = 0$ has

(a) no solutions

(b) many solutions

(c) a unique solution

(d) None of the previous

(4) To obtain the general solution of a homogeneous linear differential equation of order n , we construct a linear combination of

- (a) any set of n linearly independent solutions (b) any set of n linearly dependent solutions
(c) any set of n solutions (d) None of the previous

(5) If the auxiliary equation of a homogeneous Cauchy- Euler differential equation is $m^2 + 4 = 0$ then

- (a) $y = c_1 \ln \cos 2x + c_2 \ln \sin 2x$ (b) $y = c_1 \cos 2 \ln x + c_2 \sin 2 \ln x$
(c) $y = c_1 \cos 2x + c_2 \sin 2x$ (d) None of the previous

Question II:

A. Find only the form of the particular solution for the differential equation by superposition approach

$$\frac{d^3 y}{dx^3} - \frac{d^2 y}{dx^2} = x^2 + 3e^x + \sin x.$$

B. Find a second solution of the differential equation

$$x \frac{d^2 y}{dx^2} + \frac{dy}{dx} = 0,$$

if $y_1(x) = \ln x$ is a solution of the differential equation.

Question III:

A. Solve the initial-value problem using the annihilator method

$$\frac{d^2y}{dx^2} + 4y = 4\cos x + 3\sin x - 8, \quad y(0) = 0, \frac{dy}{dx}(0) = 0.$$

B. Solve the following differential equation

$$x^2 \frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} + 2y = x^2 \ln x.$$

Good Luck😊