



(Knowledge for Development)

KIBABII UNIVERSITY
UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR
THIRD YEAR FIRST SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATION
FOR THE DEGREE OF BACHELOR OF EDUCATION AND
BACHELOR OF SCIENCE

COURSE CODE: MAT 321/MAA 311

COURSE TITLE: ODE I

DATE: 15/11/2022

TIME: 2 PM -4 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE (30 MARKS)

a) Define the following terms

- i) Ordinary differential equation (2 mks)
- ii) Linearity of a differential equation (2 mks)
- iii) Linearly independent solutions (2 mks)

b) Find the general solution of the differential equation

$$\frac{d^3y}{dx^3} - 4\frac{d^2y}{dx^2} + 4\frac{dy}{dx} = 0 \quad (6 \text{ mks})$$

c) Solve the differential equation $(2x + y - 5)dy + (2y + x - 4)dx = 0$ (6 mks)

d) Test for exactness and solve the differential equation

$$(y^2 - xy)dx + x^2dy = 0 \quad y(1) = -1 \quad (6 \text{ mks})$$

e) A cake at 200°C is placed in a room of 37°C constant temperature. What should be the constant of proportionality in order that the cake be at 80°C after 5 minutes?

(6 mks)

QUESTION TWO [20 MARKS]

(a) Solve the differential equations using appropriate method

(i) $(2xy + y^2) - x^2 \frac{dy}{dx} = 0$ (5 mks)

(ii) $y' + 3xy = 3xe^{-x^2}$ (8 mks)

(b) Obtain the differential equation having a solution as

$$y = Ae^{-3x} + Be^{2x} \quad (7 \text{ mks})$$

QUESTION THREE [20 MARKS]

- (a) Solve the differential equation

$$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 3x^2 + \sin x \quad (7 \text{ mks})$$

- (b) Show that it is homogeneous and solve the differential equation

$$(y^2 + 2xy)dy + (x^2 + xy + y^2)dx = 0 \quad (6 \text{ mks})$$

- (c) Solve the equation by method of variation of parameter

$$y'' + 2y' + y = 2e^x \quad (7 \text{ mks})$$

QUESTION FOUR [20 MARKS]

- (a) Perform the multiplication $(Dx - 3)(D^2 + 4D - 8)$ (6 mks)

- (b) Solve the differential equation $(x^3 + 2y)dy + (3x^2y - 6x)dx = 0$ (7 mks)

- (c) Use the method of undetermined coefficients to solve

$$y'' - 3y' - 4y = 5x - 3 \quad (7 \text{ mks})$$

QUESTION FIVE [20 MARKS]

- (a) The sum of Kshs 4200 is invested at a rate of 14.5% per annum compounded continuously. What will be the amount after 5 years? (4 mks)

- (b) Solve the differential equation by use of the integrating factor $2x + y^2 + xy\frac{dy}{dx} = 0$ (9 mks)

- (c) Solve the following Bernoulli's equation

$$x\frac{dy}{dx} + (1+x)y = xy^2 \quad y(0) = 2 \quad (7 \text{ mks})$$