



NATIONAL OPEN UNIVERSITY OF NIGERIA
Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi, Abuja.

FACULTY OF SCIENCES
DEPARTMENT OF MATHEMATICS
2021 Examination

Course Code: MTH421

Course Title: Ordinary Differential Equations

Credit Unit: 3

Time Allowed: 3 Hours

Total: 70 Marks

Instruction: Answer Question Number One and Any Other Four Questions

1. (a) Define the following .
 - i. Initial value problem (IVP).. (3 marks)
 - ii. Domain (1 mark)
 - iii. Closed Domain (1 mark)
- (b) . Find the total differentials of the following functions:
 - (i) $u(x, y) = x^2 \cos x + 3x^2 y^3$. (2 marks)
 - (ii) $p(x, y) = 2x^3 y^2 + xy^3$. (2 marks)
 - (iii) $m(x, y) = 3x^2 y^5 + 7x^3 y^2$. (2 marks)
- (c)
 - i. Define five types of critical points (5 marks)
 - ii. Solve the IVP using integrating factor
 $y' = 3y, y(0) = 5.7$. (6 marks)
2. (a) Solve the ODE $y' = 1 + y^2$. (4 marks)
- (b) Find the particular solution to the IVP: $y' = ky, y(0) = y_0$. (4 marks)
- (c) Differentiate:
 - i. $n(x, y) = 7x^4 y - 5xy$. (2 marks)
 - ii. $q(x, y) = \sqrt{2}x^2 + y$. (2 marks)
3. (a) Solve the ODE: $\cos(x + y) dx + (3y^2 + 2y + \cos(x + y))dy = 0$
(6 marks)
- (b) Find the general solution to the ODE: $\left(x^2 y + \frac{1}{3}y^3\right) dx + \left(\frac{1}{3}x^3 + xy^2\right) dy = 0$.
(6 marks)

4. (a) Obtain the solution to the following equation: $\frac{1}{8}xy^8dx + \frac{1}{2}x^2y^7dy = 0$.
(6 marks)
- (b) Find the particular solution to the initial value problem:
 $y'' + y = 0$, $y(0) = 3$, $y'(0) = 0.5$. (6 marks)
5. (a) Solve the 2nd-order ODE: $y'' + y' - 2y = 0$, $y(0) = 4$, $y'(0) = 5$.
- (b) Obtain the particular solution to:
 $y'' + y' + 0.25y = 0$, $y(0) = 3.0$, $y'(0) = 3.5$. (6 marks)
6. (a) Find the general solution to: $y'' + 0.4y' + 0.4y = 0$. (5 marks)
- (b) Solve the following system of ODEs:
 $y_1' = 8y_1 - y_2$,
 $y_2' = y_1 + 10y_2$.
(7 marks)