



NATIONAL OPEN UNIVERSITY OF NIGERIA
University Village Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi, Abuja
FACULTY OF SCIENCES
DEPARTMENT OF MATHEMATICS
2022_2 Examinations

Course Code: MTH311
Course Title: CALCULUS OF SEVERAL VARIABLES
Time Allowed: 3 Hours
Total: 70 Marks
Instruction: Answer Question One (1) and Any Other 3 Questions

1. a. If $f(x, y) = \frac{xy^2}{x^2+y^2}$ does $\lim_{x \rightarrow 0, y \rightarrow 0} f(x, y)$ exist? (5 marks)
 b. Find the derivative of $z = x^2 + 2xy + y^2$ (8 marks)
 c. Define the following functions: (i) constant function. (ii) identity function (iii) modulus function (iv) square root function. (v) trigonometric function. (12 marks)

2. a. If $f(x, y) = \frac{xy}{(x^2-y^2)}$, does $\lim_{(x,y) \rightarrow (0,0)} f(x, y)$ exist (5 marks)
 b. When is $f_{xy} = f_{yx}$? (5 marks)
 c. Using implicit differentiation, find $\frac{d(x^3+y^3=6xy)}{dx}$ (5 marks)

3. a. Find the first order partial derivatives for $w = x^2y - 10y^2z^3 + 43x - 7 \tan(4y)$ (5 marks)
 b. Define Curl. (5 marks)
 c. Define a polynomial function of two variables. (5 marks)

4. a. Where is the function continuous?

$$F(x) = \frac{x^2+y^2}{x^2+y^2}$$
 (7.5 marks)
 b. Define Jacobian matrix (7.5 marks)

5. a. Define Taylors series (7.5 marks)
- b. Find $f_{xxyz} = z^3 y^2 \ln(x)$ (7.5 marks)
6. a. Differentiate $x^2 - 2xy + y^3 = c$ (7.5 marks)
- b. Prove that $\frac{d(\tan^{-1} x)}{dx} = \frac{1}{1+x^2}$ (7.5 marks)