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 $\lim_{x\to 0, y\to 0} f(x,y)$ 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 $\lim_{(x,y)\to(0,0)} f(x,y)$ 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 $f_{xxyzz} = z^3 y^2 \ln(x)$ **(7.5 marks)**

6. a. Differentiate $x^2 - 2xy + y^3 = c$ **(7.5 marks)**

    b. Prove that $\dfrac{d(\tan^{-1} x)}{dx} = \dfrac{1}{1+x^2}$ **(7.5 marks)**