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

FACULTY OF SCIENCES
DEPARTMENT OF MATHEMATICS
2021_1 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 4 Questions**

1. a. Define a real value function **(4 marks)**
   b. Given $u = x^2 + 2y$ where $x = r\sin(t)$ and $y = \sin^2(t)$, determine the value of $\frac{\partial u}{\partial r}$ and $\frac{\partial u}{\partial t}$ using the chain rule. **(6 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. Function f is defined by f(x) = - 2 x^2 + 6 x - 3 . find f(- 2). **(4 marks)**
   b. Find $\lim_{(x,y)} \frac{x^2-y^2}{x^2+y^2}$ if it exist **(4 marks)**
   c. Define Curl **(4 marks)**

3. **a.** If $f(x,y) = \frac{xy}{(x^2-y^2)}$, does $\lim_{(x,y)\to(0,0)} f(x,y)$ exist **(4 marks)**
   b. When is $f_{xy} = f_{yx}$? **(4 marks)**
   c. Using implicit differentiation, Find
   $$\frac{d(x^3+y^3=6xy)}{dx}$$ **(4 marks)**

4. a. Define a polynomial function of two variables **(6 marks)**
   b. Evaluate $\lim_{(x,y)\to(1,2)}(x^2y^3 - x^3y^2 + 3x + 2y)$. **(6 marks)**
5. **a.** Where is the function continuous?

   $$F(x) = \frac{x^2+y^2}{x^2+y^2}$$ **(6 marks)**

   b. Define Jacobian matrix **(6 marks)**

6. a. Define Taylors series **(6 marks)**

b. Find $f_{xxyzz} = z^3y^2\ ln(x)$ **(6 marks)**