



NATIONAL OPEN UNIVERSITY OF NIGERIA
Plot 91, Cadastral Zone, Nnamdi Azikwe Expressway, Jabi, Abuja
FACULTY OF SCIENCES
DEPARTMENT OF MATHEMATICS
September Examination, 2020_1

Course Code: MTH382
Course Title: Mathematical Methods IV
Credit Unit: 3
Time Allowed: 3 Hours
Instruction: Answer Number One (1) and Any Other (4) Questions

1. Prove the uniqueness of the function $f(x)$ on R' to R^n defined for $|x - x_0| < r$ where

$$r < \min\left(a, \frac{b}{M}\right) \quad (22 \text{ marks})$$

2. (a) Show that $r(z)r(1-z) = \frac{\pi}{\sin \pi z}$ for $z \neq 0, 1, 2$ (8 marks)

(b) Prove that $(\alpha)_n = \frac{r(\alpha+n)}{r(\alpha)}$ (4 marks)

3. Show that if $R(c-a-b) > 0$ and if c is neither zero nor a negative integer

$$2F_1(a, b, c) = \frac{r(c)r(c-a-b)}{r(c-a)r(c-b)} \quad (12 \text{ marks})$$

4. Prove that

$$\text{If } 1 \leq 1 \leq 1 \text{ and } R(c) > R(b) > 0 \text{ then } 2F_1(a, b, c, z) = \frac{r(c)}{r(b)r(c-b)} \int_0^1 t^{b-1} (1-t)^{c-b-1} (1-tz)^{-c} dt$$

(12 marks)

5. Given that $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - v^2)y = 0$, Where $x=0$, Assume that v is not an integer,

$$y = \sum_{n=1}^{\infty} c^n x^{m+r} \quad (12 \text{ marks})$$

6. Prove that $\int_0^{\frac{\pi}{2}} J_0(z \cos \theta) \cos \theta d\theta = \frac{\sin Z}{Z}$ (12 marks)