DEPARTMENT OF MATHEMATICS

UGANDA ADVANCED CERTIFICATE OF EDUCATION

MOCK 1 EXAMINATIONS, JUNE 2016

MATHEMATICS PAPER 1

TIME: 2 HOURS 40 MINUTES

INSTRUCTIONS:

- Answer **ALL** the **eight** questions in Section A and any **five** from Section B.
- All necessary working must be shown clearly.

SECTION A (40 MARKS)

1. Solve the simultaneous equation:
   $p + 2q - r = -1$
   $3p - q + 2r = 16$
   $2p + 3q + r = 3$ (05mks)

2. Differentiate: $\log_e(1 - 2x^2)^{\frac{-1}{2}}$ with respect to x. (05mks)

3. Find $\int \frac{dx}{1-cosx}$ (05mks)

4. Solve the differential equation $x(1 - y)\frac{dy}{dx} + y = 0$ given that
   $y = 1 \ when \ x = e$ (05mks)

5. Show that $\frac{sin\theta-2sin2\theta+sin3\theta}{sin\theta+2sin2\theta+sin3\theta} = -tan^2\frac{\theta}{2}$ (05mks)

6. Prove by induction that $\sum_{r=1}^{n} 3^{r-1} = \frac{3^n-1}{2}$ where n is a whole number. (05mks)

7. Solve for x in the equation. $\log_4(6 - x) = \log_2 x$ (05mks)

8. Show that $2 + i$ is a root of the equation $2z^3 - 9z^2 + 14z - 5 = 0$.
Hence find the other roots. (05mks)

SECTION B (60 MARKS)

9. (a) Use Maclaurin's theorem to expand $\frac{1}{\sqrt{1+x}}$ up to the term in x^3 (06mks)

(b) Using the binomial theorem expand $(8 - 24x)^{\frac{2}{3}}$ as far as the 4th term.
Hence evaluate $4^{\frac{2}{3}}$ to one decimal place. (06mks)

10. (a) $\int \frac{x^4 - x^3 + x^2 + 1}{x^3 + x}\, dx$ (07mks)

(b) Evaluate $\int_0^{\pi/2} x\sin^2 2x\, dx$ (05mks)

11. A circle cuts the $y - axis$ at two points A and B. It touches the $x - axis$ at a distance 4 units from the origin and distance AB is 6 units. A is a point $(0,1)$:
Find the:
(a) Equation of the circle (06mks)

(b) Equations of the tangents to the circle at A and B. (06mks)

12. Sketch the curve $y = \frac{4(x-3)}{x(x+2)}$ (12mks)

13. (a) Determine the coordinates of the point of intersection of the line.
$\frac{x+1}{2} = \frac{y-3}{5} = \frac{z+2}{5}$ and the plane $x + y + z = 12$. (06mks)

(c) Find the angle between the line $\frac{x+1}{2} = \frac{y-3}{5} = \frac{z+1}{-1}$ and the plane $x + y + z = 12$.
(06mks)

14. (a) Given that x and y are real. Find the values of x and y which satisfy the equation.

$\frac{2y+4i}{2x+y} - \frac{y}{x-1} = 0$ (06mks)

(b) Express a complex number $z = 1 - i\sqrt{3}$ in modulus – argument form and hence find z^2 and $\frac{1}{z}$ in the form $a + bi$ (06mks)

15. (a) The tenth term of an arithmetic progression (A.P) is 29 and the fifteenth term is 44. Find the value of common difference and the first term. Hence find the sun of the first 60 terms. (07mks)

(b) A cable 10m long is divided into ten pieces whose lengths are in a geometrical progression. The length of the longest piece is 8 times the length of the shortest piece. Calculate to the nearest centimeters the length of the third piece. (05mks)

16. (a) Solve the differential equation: $\frac{dy}{dx} - ytanx = cos^2x$

(b) Given that $y = e^{tanx}$. Show that $\frac{d^2y}{dx^2} - (2tanx + sec^2x)\frac{dy}{dx} = 0$ (12mks)

END