P425/1

PURE MATHEMATICS

Paper 1

July/August, 2025

3 hours

ASSHU BUSHENYI DISTRICT MOCK EXAMINATIONS 2025

Uganda Advanced Certificate of Education

PURE MATHEMATICS

Paper 1

3 hours

INSTRUCTIONS TO CANDIDATES

This paper consists of **two** sections; A and **B.**

Section A is **compulsory.**

Answer only **five** questions from section **B.**

Any additional question (s) answered will **not** be marked.

All necessary working **must** be shown clearly.

Begin each answer on a fresh page.

Graph paper is provided.

Silent, non-programmable scientific calculators and mathematical tables with a list of formulae maybe used.

SECTION A (40 MARKS)

*Answer **all** the questions in this section.*

1. Solve the pair of simultaneous equations (05 marks)
   Log (x + y) = 0, 2logx = log(y-1).

2. An arc AB subtends an angle $\frac{\pi}{6}$radians at the centre, O of the circle of radiusr units.Show that the area of the segment formed (cut off) by this arc is given by $\frac{r^2(\pi-3)}{12}$. (05 marks)

3. Evaluate $\int_0^1 \frac{x^2}{1+x^2} dx$. (05 marks)

4. Find the Cartesian equation of the line of intersection of the planes (05 marks)
   $x + 3y = 5 + 2z$ and $\mathbf{r}.(2\mathbf{i} - \mathbf{j} + 4\mathbf{k}) = 10$.

5. Show that the equations x =4cosΘ and y = 5sinΘ represent an ellipse. Hence state its foci. (05 marks)

6. If$y = \text{Cos}\left(\log \frac{x}{e}\right)$, prove that $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$. (05 marks)

7. The sum of the first 5 terms of an Arithmetic progression (AP) is 32.5. Also five times the 7[th] term is the same as six times the 2[nd] term. Findthe common difference and the fourth term. (05 marks)

8. Solve the differential equation
   $(x+2)\frac{dy}{dx} + (x+1)y = 0$, where x>-2 given that y(0) = 2. (05 marks)

SECTION B (60 MARKS)

*Answer any **five** questions from this section.*

***All** questions carry equal marks.*

9. The curve is defined parametrically by the equations

$x = \frac{t}{1+t}$ and $y = \frac{t^2}{1+t}$.

(a) Find the Cartesian equation of the curve. (03 marks)

(b) Hence sketch the curve by clearly distinguishing the turning points. (09 marks)

10. (a) Using De Moivre's theorem, evaluate the square roots of $-1 + 3\sqrt{2}i$, correct to 4 decimal places. (06 marks)

(b) Find and describe the equation of the locus of the complex number $z = x + iy$ when it moves in the argand diagram such that

$\text{Arg}\left(\frac{z-3}{z-2i}\right) = \frac{\pi}{4}$. (06 marks)

11. (a) Show that the points A, B and C with the respective position vectors $\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$, $2\mathbf{j} + 3\mathbf{i} + \mathbf{k}$ and $-2\mathbf{j} - \mathbf{k}$ are vertices of a triangle. (05 marks)

(b) Two lines L_1 and L_2 have vector equations

$\mathbf{r} = (2 - 3t)\mathbf{i} + (1 + t)\mathbf{j} + 4t\mathbf{k}$ and

$\mathbf{r} = (-1 + 3\mu)\mathbf{i} + 3\mathbf{j} + (7 - \mu)\mathbf{k}$ respectively. Find the ;

(i) coordinates of their point of intersection. (05 marks)

(ii) angle between the two lines. (02 marks)

12 (a) Evaluate $\int_0^{\frac{\pi}{2}} x\sin^2 x dx$. (05 marks)

(b) Show that $\int \sec\theta\, d\theta = \ln k\tan\left(\frac{\pi}{4} + \frac{\theta}{2}\right)$, where k is a constant. (07 marks)

13. (a) The a cute angle, α is such that $\tan\left(\alpha + \frac{\pi}{4}\right) = 41$. Find, without using a calculator, the exact value of tanα and hence deduce that $\cos\alpha = \frac{21}{29}$. (05 marks)

(b) Find the maximum value of $\frac{3}{3\cos\theta - 12\sin\theta + 16}$ and state the smallest value of Θ for which it occurs. (07 marks)

14 (a) A closed, right circular cylinder of the base r cm and height h cm has a volume of $54cm^3$. Show that S, the total surface area of the cylinder is given by $S = \frac{108\pi}{r} + 2\pi r^2$. Hence find the radius and height which make the surface area minimum. (06 marks)

(b) A container in the shape of a hollow cone of semi-vertical angle 30^0 is held with its vertex pointing downwards. Water is poured into the cone at a rate of $5cm^3s^{-1}$. Find the rate at which the depth of water in the cone is increasing when the depth reaches 10cm. (06 marks)

15. (a) Show that the equation of the tangent to the parabola $y^2 = 4ax$ at the Point.$R(ar^2, 2ar)$ is $ry = x + ar^2$. (05 marks)

(b) The tangents to the above parabola at the points $P(ap^2, 2ap)$ and $Q(aq^2, 2aq)$ interest at T,

(i) Find the co-ordinates of T.

(ii) If the tangents at P and Q are inclined to each other at an angle of 45^0, show that the locus of T is the curve $y^2 = x^2 + 6ax + a^2$. (07 marks)

16. (a) Find the equation of a curve given that it passes through the point (1,0) and that its gradient at any point (x,y) is $x(y-1)^2$. (05 marks)

(b) In a certain culture of bacteria, the population grows in such a way that at time, t years, the rate at which the population increases is proportional to the size, P, of the population at that time.

Initially, the population size of the population is 2 million.

(i) Show that $P = 2e^{\lambda t}$, where λ is a positive constant.

After 6 years, the population size is 100 million.

(ii) Show that $\lambda = \frac{1}{6}\ln 50$ and hence calculate an estimate to the nearest million, the population size by the 21st year. (07 marks)

END

P425/2

APPLIED MATHEMATICS

PAPER 2

JULY/AUGUST 2025

3 HOURS

UGANDA ADVANCED CERTIFICATE OF EDUCATION

APPLIED MATHEMATICS

PAPER 2

3 HOURS

INSTRUCTIONS TO CANDIDATES

- *Attempt all the* ***eight*** *questions in section A and only* ***five*** *questions from section B.*
- *Any additional question(s)answered will not be marked.*
- *All necessary working must be shown clearly.*
- *Any graphical number should fully be attempted on a graph paper.*
- *Silent non-programmable scientific calculator and mathematical tables with a list of formulae may be used.*
- *In numerical work take acceleration due to gravity(g) to be $9.8ms^{-2}$.*