S475/1
SUBSIDIARY
MATHEMATICS
Paper 1
1 August 2024
2 hours 40 mins

ENTEBBE JOINT EXAMINATION BUREAU

Uganda Advanced Certificate of Education

SUBSIDIARY MATHEMATICS

Paper 1

2 hours 40 minutes

INSTRUCTIONS TO CANDIDATES:

The paper consists of **two** Sections *A and B.*

Attempt all **eight** *questions in* Section **A** *and any* **four** *from* Section **B.**

Section **B** *comprises* ***two*** Parts; Part **I** *and* Part **II**. *You are required to select at least* ***one*** *question from each* Part.

Each question in Section *A carries five marks while each question in* Section *B carries fifteen marks.*

Begin each answer on a fresh page.

Graph papers are provided.

Any extra question(s) **will not** *be assessed.*

All working must be shown clearly.

Silent, non-programmable Scientific Calculators and Mathematical tables with a list of formulae may be used.

SECTION A

Answer **all** *questions in this* Section.

1. Given that $p = \log_a(a^3y^{-2})$ and $q = \log_a(ay^2)$, find the value of $p + q$. *(05 marks)*

2. Given that $y = 3t^2 + 2t$ and $x = 1 - 2t$. Find $\frac{dy}{dx}$ in terms of x. *(05 marks)*

3. $p, 10, q$ are first three terms of arithmetic progression (A.P) and $10, p, q$ are the first three terms of a geometric progression (G.P). Show that $p^2 + 10p - 200 = 0$, hence find the values of p and q. *(05 marks)*

4. Solve the equation $5\cos^2\theta = 3(1 + \sin\theta)$ for $0° \le \theta \le 360°$ *(05 marks)*

5. A man's chance of hitting a target with each of his shots is $\frac{1}{5}$. If he has to fire 5 shots, calculate the probability that; *(05 marks)*
   (i) exactly 3 shots hit the target.
   (ii) at least 2 shots hit the target.

6. Events A and B are independent such that $P(A) = \frac{1}{3}$ and $P(B) = \frac{3}{4}$. Find the probability that *(05 marks)*
   (i) both A and B occur.
   (ii) only one of the events occur.

7. The table below shows scores in percentages obtained by candidates in Geography (y) and History (x).

x	35	65	55	25	45	75	20	90	51	60
y	86	70	84	92	79	68	96	58	86	77

Calculate the rank correlation coefficient between the scores of the subjects. *(05 marks)*

8. A discrete random variable X, assumes values 0, 1, 2 and 3. Given that $P(X \le 2) = 0.9$ and $P(X \le 1) = 0.5$ find the *(05 marks)*
   (i) $P(X = 3)$
   (ii) $P(X = 2)$

SECTION B

You are required to select at least one question from each Part.
Each question in this Section carries fifteen marks.

Part I

9. Sketch the curve $y = x^3 - 6x^2 + 9x$ and find the area enclosed between the curve and the x −axis. *(15 marks)*

10. (a) The roots of the equation $x^2 + bx + 2 = 0$ are α and β. Given that $\alpha = \sqrt{5} + \sqrt{3}$.
    (i) Show that $b = -2\sqrt{5}$
    (ii) Find the value of $\alpha^2\beta - \alpha\beta^2$.

    (b) $(x - 1)$ and $(x + 1)$ are factors of $x^3 + ax^2 + bx + 2$. Find the values of a and b. *(15 marks)*

11. A science club in a certain school wishes to go for a seminar. The club has hired a mini-bus and a bus to take the students. Each trip for a bus is Shs 50,000 and that for the mini-bus is Shs 30,000. The bus has a capacity of 54 students and a min-bus has a capacity of 18 students. The maximum number of students allowed to go for a seminar is 216. The number of trips the bus makes do not have to exceed those made by the mini-bus. The club has mobilized as much as Shs 300,000 for transportation of the students.
    If x and y represent the number of trips made by the bus and the mini-bus respectively,
    (i) Write down **five** inequalities representing the above information.
    (ii) Plot these inequalities on the same axes.
    (iii) By shading out the unwanted regions, show the region satisfying all the above inequalities.
    (iv) List the possible number of trips each vehicle can make.
    (v) State the greatest number of students who went for the seminar.

    (15 marks)

12. (a) Given matrices $A = \begin{pmatrix} 3 & 5 \\ -2 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 8 & -3 \\ -4 & 7 \end{pmatrix}$, find the
    (i) matrix C such that $3A - 2C + B = I$ where I is a 2×2 identity matrix.
    (ii) determinant of C.

    (b) Using the matrix method, solve the simultaneous equations: *(15 marks)*
    $3x - y = 16$
    $x - 3 = -2y$

Part 2

13. The table below shows marks scored by 100 students in a Sub math examination.

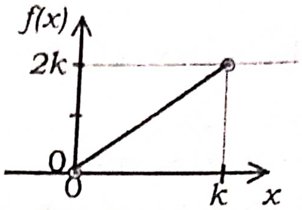
Marks (%)	21−	31−	41−	51−	61−	71−	81−	91−100
Cumulative frequency	5	20	40	59	75	90	97	100

(a) Calculate the
    (i) mean mark
    (ii) variance.

Turn Over

(b) Draw a cumulative curve and use it to estimate the
(i) median mark
(ii) pass mark if 60 students passed. *(15 marks)*

14. A continuous random variable X has a pdf $f(x)$ defined in the interval $0 < x < k$ and zero elsewhere. The graph of $f(x)$ is drawn as in the figure below.



Find the
(a) value of k
(b) expression for $f(x)$
(c) expectation, E(X)
(d) variance, Var(X)

(15 marks)

15. The cost of making a cake is calculated from the cost of baking flour, sugar, milk and eggs. The following table gives the cost of these items in 2010 and 2011.

Item	Cost (Shs)		Weight
	2010	**2011**	
Flour per kg	3,000	4,500	12
Sugar per kg	2,500	3,000	5
Milk per litre	800	1,000	2
Eggs per kg	1,000	2,000	1

(a) Using 2010 as the base year,
(i) calculate the price relative for each item.
(ii) find the weighted aggregate price index for the cost of the cake.

(b) If the unit of making a cake in 2011 was Shs 500, find the cost in 2010 using the index in (ii) above. *(15 marks)*

16. (a) A random variable X is distributed normally such that $X \sim N(50, 20)$. Find
(i) $P(X > 60.3)$
(ii) $P(X < 59.8)$

(b) The marks of 600 candidates in an examination are normally distributed with a mean mark of 40 and standard deviation of 15.

(i) Given that the pass mark is 30, how many candidates passed the examination?
(ii) If 10% of the students scored a distinction, determine the lowest mark for the distinction.

(15 marks)

END