S475/1
SUBSIDIARY MATHEMATICS
Paper 1
June 2024
$2\frac{2}{3}$ hours

Uganda Advanced Certificate of Education

SUBSIDIARY MATHEMATICS

Paper 1

2 hours 40 minutes

INSTRUCTIONS TO CANDIDATES:

Attempt all **eight** *questions in* Section **A** *and any* **four** *from* Section **B with** atleast one question from each part. *Any additional question(s) will not be marked.*

All necessary working must clearly be shown.

Graph papers are provided.

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

SECTION A: (40 MARKS)

Attempt **all questions** in this section

1. Solve the following pair of simultaneous equations. *(05 marks)*

$\log_{10}(x+y)=0$

$2\log_{10}x=\log_{10}(y-1)$

2. An arithmetic progression $(A.P)$ has its first term as 5 and its last term as 65. The sum of all the terms s 350. Find the number of terms of this **A. P** and the common difference. *(05 marks)*

3. The weights, in kg of 6 bags of maize were $141, 163, 176, 145, 165$ and 188. Calculate the:

(a) Mean

(b) Standard deviation. *(05 marks)*

4. Find the possible values of the constant β given that the vectors $a=-\beta i-8j$ and $b=(1-\beta)i+(\beta-1)j$ are perpendicular.

(05 marks)

5. Given that $\mathbf{A}=\begin{pmatrix}1 & 0\\ -2 & 2\end{pmatrix}$ and $\mathbf{B}=\begin{pmatrix}a & -3\\ 3 & -5\end{pmatrix}$ and that **AB** is a singular matrix, find the value of a. *(05 marks)*

6. Events A and B are such that $P(A)=0.7$, $P(B)=0.3$ and $P(AUB)=0.8$ determine

(a) $P(AnB)$

(b) $P(B/A)$ *(05 marks)*

7. A farmer learns that two seeds out of every five seeds sown do not germinate. If 10 seeds are sown, what is the probability that at least 8 seeds germinate.

(a) Exactly six questions.

(b) Between three and six questions. *(05 marks)*

8. The prices of certain items in the year $\mathbf{2021}$ were recorded in the table below and the corresponding price relatives for the year $\mathbf{2022}$.

Items	**Price(per kg) in 2021**	**2022 price relatives (2021=100)**
Millet flour	3800	120
Cow peas	2900	110
Beans	4300	115
Maize flour	3000	130
Rice	4000	125

Calculate the price for each item in $\mathbf{2022}$. *(05 marks)*

SECTION B: (60 MARKS)

Attempt **four questions** in this section with at least one question from each part

PART ONE: PURE MATHEMATICS

9. (a) By eliminating $\boldsymbol{\theta}$ from the equations $\boldsymbol{x = \sec\theta + \tan\theta}$ and $\boldsymbol{y = \sec\theta - \tan\theta}$, show that $\boldsymbol{xy = 1}$. *(07 marks)*

(b) Solve the equation $\boldsymbol{cosec^2\theta = 3 + cot\,\theta}$ for values of $\boldsymbol{\theta}$ between $\boldsymbol{0^o}$ and $\boldsymbol{360^o}$. *(08 marks)*

10. (a) Find the values of $\boldsymbol{k}$ for which the equation $\boldsymbol{kx^2 + 4x + 9k = 0}$ has equal roots. *(03 marks)*

(b) The polynomial $\boldsymbol{f(x) = ax^2 + bx - 7}$ has $\boldsymbol{x - 1}$ as a factor and leaves a remainder of $\mathbf{6}$ when divided by $\boldsymbol{x + 2}$. Find the values of $\boldsymbol{a}$ and $\boldsymbol{b}$. *(06 marks)*

(c) The roots of the equation $\boldsymbol{x^2 - 6x + 9 = 0}$ are $\boldsymbol{\alpha^2}$ and $\boldsymbol{\beta^2}$. Find the values of $(\boldsymbol{\alpha + \beta})$. *(06 marks)*

11. The number of motorcycle accidents in years on Mbale−Jinja highway was found to be increasing at a rate directly proportional to the number of accidents recorded at a *time(t)* in years. Initially at the beginning of 2020, the number of accidents was $\mathbf{80}$. At the beginning of 2022, the number of accidents had increased to $\mathbf{120}$.

(a) Form an a differential equation for the rate of increase of accidents.

(03 marks)

(b) Solve the differential equation in (a) above. *(07 marks)*

(c) Estimate the number of accidents expected at the beginning of 2024.

(05 marks)

12. The owner of a certain sugar factory in Bamunanika sub county wants to buy two types of motorcycles namely Bajaj and Honda for his sugarcane plantations' supervisors to ease the process supervising the different sugarcane plantations. A Bajaj costs £$\mathbf{2000}$ and requires £$\mathbf{16}$ per month to maintain it. A Honda costs £$\mathbf{2400}$ and requires £$\mathbf{10}$ per month to maintain it. The factory owner has £$\mathbf{18000}$ to spend on the purchase of the motorcycles and £$\mathbf{120}$ per month for maintenance. He must buy at least $\mathbf{4}$ Bajaj motorcycles and at least $\mathbf{2}$ Honda motorcycles.

By letting x to be the number of Bajaj motorcycles $and\ y$ to be the number of Honda motorcycles.

(a) Write down four inequalities apart from $x \geq 0\ and\ y \geq 0$ to describe the given condition. *(04 marks)*

(b) Represent the inequalities on the same graph and shade the unwanted regions. *(07 marks)*

(c) List the possible number of motorcycles of each type that the factory owner should buy. *(02 marks)*

(d) Determine the possible number motorcycles of each type that the factory owner should buy in order to keep the maintenance as low as possible. *(02 marks)*

PART TWO: STATISTICS

13. A continuous random variable X has a probability density function given by:

$$f(x) = \begin{cases} \frac{a}{7}(x^2 - 3); 2 \leq x \leq 3 \\ 0 \qquad\qquad else\ where \end{cases}$$

Find

(a) The value of a. *(04 marks)*

(b) the $P(X > 2.5)$ *(04 marks)*

(c) Variance. *(07 marks)*

14. The table below shows the marks (%) awarded by interviewers in Oral interview subjected to **10** interviewees who had applied for a teaching job at Bombo Central College.

Interviewees	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Interviewer (X)	60	40	70	90	65	37	55	82	44	75
Interviewer (Y)	57	80	50	20	72	92	66	35	80	43

(a) Plot a scatter diagram and a line of best fit to illustrate the given data.

(b) Draw a line of best fit on the scatter diagram. *(07marks)*

(c) Estimate the mark awarded by Interviewer X for an Interviewee awarded **62**% by Interviewer Y. *(02marks)*

(d) Calculate the rank correlation coefficient between the two Interviewers and comment on your results. *(06marks)*

15. The table below shows the marks obtained by S.4 students in Fresh High school marked out of 100.

Marks	10−	20−	30−	40−	50−	60−	70−	80−90
Cumm. Freq	3	7	12	17	25	31	35	40

(a) Calculate the

(i) Modal mark

(ii) variance *(07 marks)*

(b) Draw a cumulative frequency curve and use it to estimate the;

(i) 60^{th} percentile

(ii) Number of students who scored 55% and above in the examination. *(08 marks)*

16. The following table shows the quarterly number of trays of eggs sold for the years 2021, 2022 and 2023 to a school.

	QUARTER			
YEAR	**1^{st}**	**2^{nd}**	**3^{rd}**	**4^{th}**
2021	500	400	350	450
2022	620	440	390	510
2023	700	490	420	520

(a) Calculate the four quarterly moving averages. *(04 marks)*

(b) On the same axes plot the original data and the four-quarterly moving averages. Comment on your results. *(07 marks)*

(c) Draw a trend line through the points and use it to predict the number of trays to be sold in the 1^{st} quarter of 2024. *(04 marks)*

END