JINJA JOINT EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

MOCK EXAMINATIONS – AUGUST, 2023

SUBSIDIARY MATHEMATICS

Paper 1

2 hours 40 min

INSTRUCTIONS TO CANDIDATES

*Answer **all** the **eight** questions in section A and four questions from section B.*

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

Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.
In numerical work, take acceleration due to gravity g to be 9.8 ms^{-2}.

SECTION A.

SECTION: A (40 MARKS)

1. Solve the following pair of simultaneous equations

$$\log_{10}(x + y) = 0$$
$$2\log_{10} x = \log_{10}(y - 1)$$

(05marks)

2. The prices of certain items in the year 2021 were recorded in the table below and the corresponding price relatives for the year 2022.

Items	Prices (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 2022.

(05marks)

3. An Arithmetic progression (A.P) has its first term as 5 and its last term as 65. The sum of all the terms is 350. Find the number of terms that this A.P has and the common difference.

(05marks)

4. The weights, in kg of 6 bags of maize were; 141,163,176,145,165 and 188. Find the standard deviation.

(05marks)

5. Find the possible value(s) of the constant β given that the vectors

$$\underset{\sim}{a} = -\beta i - 8j \text{ and } \underset{\sim}{b} = (1 - \beta)i + (\beta - 1)j \text{ are perpendicular.}$$

(05marks)

6. Events A and B are such that $P(A \cup B) = 0.8, P(A) = 0.7 \text{ and } P(B) = 0.3$.

Find (i) $P(A \cap B)$

(03marks)

(ii) $P(B/A)$

(02marks)

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

8. A farmer learns that two seeds out every five seeds sown do not germinate. If 10 seeds are sown, what is the probability that at least 8 seeds germinate. (05marks)

SECTION B: (60 MARKS)

Answer only four questions from this section with at least one question from each part. All questions carry equal marks.

PART ONE

9. The owner of a certain sugar factory in Busoga region wants to buy two types of motor cycles namely Bajaj and Honda for his sugarcane plantations' supervisors to ease the process of supervising the different sugarcane plantations. A Bajaj costs £2000 and requires £16 per month to maintain it. A Honda costs £2400 and requires £10 per month to maintain it. The factory owner has £18000 to spend on the purchase of the motorcycles and £120 per month for maintenance. He must buy at least 4 Bajaj motorcycles and at least 2 Honda motorcycles.

(a) (i) By taking x to be the number of Bajaj motorcycles and y be the number of Honda motorcycles that the factory owner buys, write down all the inequalities representing the above information. (04marks)

(ii) On the same axes draw the inequalities in (i) above. Shade the unwanted regions.

(use a scale of 1 cm to represent 1 unit on both axes). (07marks)

(b) Find the possible number of motorcycles of each type that the factory owner should buy in order to keep the maintenance costs as low as possible. (04marks)

10. The number of motorcycle accidents in years on Jinja-Mbale 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 80. At the beginning of 2022, the number of accidents had increased to 120.

(a) Form a differential equation for the rate of increase of accidents. (03marks)

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

(c) Estimate the number of accidents expected at the beginning of 2024. (05marks)

11.(a) Find the values k for which the equation $kx^2 + 4x + 9k = 0$ has equal roots. (03marks)

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

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

12. (a) By eliminating θ from the equations $x = sec\theta + tan\theta$ and $y = sec\theta - tan\theta$, show that $xy = 1$. (07marks)

(b) solve the equation $cosec^2\theta = 3 + cot\theta$ for values of θ between 0^0 and 360^0 (08marks)

PART TWO

13. The table below shows the marks (%) awarded by 2 interviewers in an oral interview subjected to 10 interviewees who had applied for a teaching job at Lira west S.S.S.

Interviewees	A	B	C	D	E	F	G	H	I	J
Interviewer 1(X)	60	40	70	90	65	37	55	82	44	75
Interviewer 2(Y)	57	80	50	20	72	92	66	35	80	43

(a) (i) Draw a scatter diagram for the above data. (06marks)

(ii) on the same diagram, draw a line of best fit. (01marks)

(iii) use the line of best fit to estimate the marks awarded to an interviewee by interviewer 1 who was given 62% by interviewer 2. (02marks)

(b) Calculate the spearman's rank correlation coefficient. Comment on your result. (06marks)

14. The table below shows the marks scored by S.4 candidates of a certain school in a Pre-Mock mathematics examination which was marked out of 100.

Marks(%)	10 −	20 −	30 −	40 −	50 −	60 −	70 −	80 − 90
Cumulative frequency	3	7	12	17	25	31	35	40

(a) Calculate the;

(i) Mean. (06marks)

(ii) Modal mark. (03marks)

(b) Draw a cumulative frequency curve (Ogive) and use it to estimate
(i) the number of students who scored above 55%. (04 marks)
(ii) 60th percentile. (02marks)

15. A continuous random variable X has a probability density function given by;

$$f(x) = \begin{cases} \frac{a}{7}(x^2 - 3); 2 \le x \le 3 \\ 0; \quad\quad elsewhere \end{cases}$$

Where a is a constant.

(a) Find
(i) The value of a (05marks)
(ii) $P(x > 2.5)$ (05marks)
(b) The expected value of X (05marks)

16. The table below shows the quarterly number of trays of eggs sold for the years 2020, 2021 and 2022 at Wanyange Egg center Jinja city.

YEAR	QUARTER			
	1st	2nd	3rd	4th
2020	500	400	350	450
2021	620	440	390	510
2022	700	490	420	535

(a) Calculate a four-point moving average for the data. (06marks)
(b) (i) Plot the original data and the four-point moving average on the same axes. (05marks)

(iii) Comment on the trend of the sales of trays of eggs at Wanyange Egg center. (01marks)

(iii) Use your graph to estimate the number of trays of eggs that will be sold in the 1st quarter of 2023 Wanyange Egg center. (03marks)