S475/1

Subsidiary Mathematics

PAPER 1

2 HOURS 40 MINUTES

POST MOCK EXAMINATIONS-2023

UGANDA ADVANCED CERTIFICATE OF EDUCATION

SUBSIDIARY MATHEMATICS

2 HOURS 40 MINUTES

INSTRUCTIONS TO CANDIDATES:

- Attempt **ALL** questions in Section A and any **FOUR** from Section B with at least one from each part.
- All working must be shown clearly.
- No paper should be given for rough work.
- Squared papers and mathematical tables are provided.
- Silent, non programmable scientific calculators may be used.
- Where necessary, use $g = 9.8ms^{-2}$

SECTION A: (40 MARKS)

Attempt ***all*** questions in this questions

1. Simplify $\frac{3-\sqrt{3}}{3+\sqrt{3}}$ and express your answer in the form $a - b\sqrt{c}$ hence find $\boldsymbol{a}, \boldsymbol{b}$ and $\boldsymbol{c}$. *(05 marks)*

2. Evaluate: $\sqrt{\frac{5^{2015}-25^{1007}}{25^{1007}+5^{2014}}}$, give your answer to 3 significant figures. *(05 marks)*

3. A candidate offered Agriculture (A), Biology (B) and Chemistry (C) at A'Level. The probabilities of passing A, B and C were 0.6, 0.5 and 0.8 respectively. Given that the events of passing any subject are independent of each other, find the probability that the candidate passed only one subject. *(05 marks)*

4. In a triangle OAB, the position vector of the vertices A and B are $\boldsymbol{3i - 4j}$ and $\boldsymbol{5i + 12j}$ respectively. Use dot product to find angle AOB. *(05 marks)*

5. Three items required by a certain family were Food (F), Water (W) and Shelter (S). The family monthly expenditure on F, W and S were shillings 108,000, 120,000 and 150,000.
If F and W were each twice as important as S. Using W as the base, determine the cost of living index and comment on your results. *(05 marks)*

6. Given that: $\boldsymbol{y} = \frac{x^3+3x-1}{x^2}$, Find:

(i) $\frac{dy}{dx}$

(ii) $\frac{d^2y}{dx^2}$ *(05 marks)*

7. Given that $\boldsymbol{n_{c_3} = n_{p_2}}$, find the value of $\boldsymbol{n}$. *(05 marks)*

8. A certain poultry farm had ten thousand birds. Two thousand birds on this farm were diagnosed with a strange disease. If five birds were selected at random from the farm and diagnosed determine the probability that atleast two were free of the disease. *(05 marks)*

SECTION B (60 MARKS)

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

PART ONE: PURE MATHEMATICS

9. (a) Given $\boldsymbol{A} = \begin{pmatrix} \mathbf{4} & \mathbf{8} \\ \mathbf{-12} & \mathbf{0} \end{pmatrix}$ $\boldsymbol{B} = \begin{pmatrix} \mathbf{2x} & \mathbf{-2} \\ \mathbf{2y} & \mathbf{5} \end{pmatrix}$ find values of x and y for which $\boldsymbol{AB = BA}$. *(08 marks)*

(b) Two customers A and B went for shopping.
A bought 3kg of posho, 2kg of sugar
and 1 ½ kg of meat, while B bought 2kg of posho, 1kg of tea leaves and 2 ½ kg of meat. The cost per kg of sugar was 3,500, meat was shs. 10,000. Posho was shs. 2,500 and tea leaves was shs. 1,100.

(i) Write down the matrices for the items bought and for the prices of the items.

(ii) Use the matrices in b(i) above to determine the difference in expenditure. *(07 marks)*

10. (a) Solve the differential equation $\frac{\boldsymbol{dy}}{\boldsymbol{dx}} = \boldsymbol{(x-1)^2}$ given that $\boldsymbol{x = 2}$ when $y = 0$.

(b) The rate of increase of the price of a certain commodity is proportional to P the marked price at any time t. When $t = 0, P = shs.\,20{,}000$ and when $t = 2, P = shs.\,25{,}000$. Find the time taken for the price to double. *(15 marks)*

11. (a) The remainder obtained when $2x^3 + ax^2 - 6x + 1$ is divided by $\boldsymbol{x + 2}$ is twice the remainder obtained when the same expression is divided by $\boldsymbol{x - 1}$. Find

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

(ii) The remainder when the divided by *x +1* *(02marks)*

(b) An equation whose roots are α^2 and β^2 *is* $\boldsymbol{x^2 - 10x + 9 = 0}$, find

(i) Value of $\boldsymbol{\alpha + \beta}$ *and* $\boldsymbol{\alpha\beta}$ *(04 marks)*

(ii) The equation whose roots are $\frac{\boldsymbol{\alpha}}{\boldsymbol{\beta - 1}}$ *and* $\frac{\boldsymbol{\beta}}{\boldsymbol{\alpha - 1}}$ *(05 marks)*

12. A school intends to transport 1000bags of cement for the construction of teachers' quarters, using a Fuso truck and a Canter truck. The Fuso can carry a maximum of 80bags while a canter can carry a maximum of 20bags.
The Canter has to make more than twice the number of trips the lorry makes, and the total number of trips has to be less than 30. The cost per trip is shs 80,000 for the Fuso and shs 40,000 for the Canter.

(a) Write down the inequalities to represent this information. *(05marks)*

(b) (i) On the same axis, plot the graphs of the inequalities and shade the unwanted regions. *(06marks)*

(ii) List all the possible numbers of trips made by the Fuso and Canter. *(02marks)*

(c) Find the minimum expenditure. *(02marks)*

PART TWO: STATISTICS

13. The table below shows the frequency distribution of marks obtained by 130 students in a mathematics test.

Marks	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Frequency	2	4	8	27	35	30	14	10

(a) (i) Calculate the lower quartile and upper quartile hence the semi interquartile range.

(ii) If 20% of the students failed Mathematics text, what was the pass mark? *(10 marks)*

(b) (i) Draw a histogram to represent the data.

(ii) Use the histogram to estimate the mode. *(05 marks)*

14. The table below shows the monthly prices of a litre of milk over the year 2016.

Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Price(shs)	1900	1905	1910	1910	1920	1930	1920	1945	1965	1960	1980	2000

(a) Calculate the three monthly moving averages. *(06 marks)*

(b) On the same axes, plot the given data and the three point moving averages. Comment on your results. *(06 marks)*

(c) Use the graph in (b) above to estimate the price of milk in December of 2015. *(03 marks)*

15. (a) Given that $\boldsymbol{x \sim N(0.2,\ 0.0001)}$, find the:

(i) $\boldsymbol{P(x \geq 0.204)}$

(ii) $\boldsymbol{P(x > 0.196)}$ *(06 marks)*

(b) The heights of students of a certain school is normally distributed with a mean of 1.54m and standard deviation 0.2. Find the percentage of students whose heights are:

(i) less than 1.20m

(ii) between 1.10m and 1.45m

(iii) between 1.50m and 1.80m *(09 marks)*

16. The probability that a candidate completes an examination in $x\ hours$ after starting is given by the p.d.f

$$\begin{cases} \boldsymbol{f(x) = k(9 - x);\ 0 \leq x \leq 3} \\ 0 \qquad \text{otherwise.} \end{cases}$$

where k is constant,

(a) Determine the value of $\boldsymbol{k}$.

(b) Sketch $\boldsymbol{f(x)}$.

(c) Find the probability that a candidate selected at random took less than 2 ½ hours.

(d) Find the mean value. *(15 marks)*

END