S475/1
SUBSIDIARY MATHEMATICS
AUGUST - 2024
2 hours 40 min

JINJA JOINT EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

MOCK EXAMINATIONS – JULY / AUGUST, 2024

SUBSIDIARY MATHEMATICS

Paper 1

2 hours 40 min

INSTRUCTIONS TO CANDIDATES

Answer **all** *the* **eight** *questions in section* **A.**
Answer only **four** *questions from section* **B** *with* **at least one** *question from each part.*
Any additional question(s) answered will **not** *be marked.*
Each question in section **A** *carries* **5** *marks while each question in section* **B** *carries* **15** *marks*
All *necessary working* **must** *be shown clearly.*
Begin each answer on a fresh sheet of paper.
Graph paper is provided
Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

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SECTION: A (40 MARKS)

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

1. The **fifth** and the **thirteenth** terms of an Arithmetic progression (A.P) are -6 and -30 respectively.
   Find the;
   (a) first term and the common difference. *(03 marks)*
   (b) sum of the first 20 terms of the A.P. *(02 marks)*

2. A committee of **6** people is to be seated on a round table such that the chairperson and the secretary are not seated next to each other. In how many ways can this be done. *(05 marks)*

3. Solve the differential equation $4y\frac{dy}{dx} = 7x^2 + 3$, given that $y(0) = 1$. *(05 marks)*

4. The table below shows the 3-point moving averages for the number of cartons of soda sold at Wanyange eggs and nutritional center Jinja per month in the year 2023.

Months	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**
3-point moving averages	56	49	32	62	47	28	25	59	37

It was noted that 37, 46, 49 and 40 cartons of soda were sold in February, March, September and October respectively. Determine the number of cartons of soda that were sold in January and November 2023. *(05 marks)*

5. Given that $\boldsymbol{a} = -2\boldsymbol{i} + 4\boldsymbol{j}$, $\boldsymbol{b} = 6\boldsymbol{i} - \boldsymbol{j}$ and $\boldsymbol{c} = -3\boldsymbol{i} + \beta\boldsymbol{j}$, determine the value of β for which vectors $2(\boldsymbol{a} + \boldsymbol{b})$ and $\boldsymbol{c}$ are perpendicular to each other. *(05 marks)*

6. Two events M and N are such that $P(M) = {}^{7}/_{10}$, $P(M \cap N) = {}^{9}/_{20}$ and $P(M^I \cap N^I) = {}^{9}/_{50}$

   Find;

   (i) $P(M \cup N)$ *(02 marks)*
   (ii) $P(N)$. *(03 marks)*

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7. The table below shows the traditional dance ranks(X) and creative dance ranks(Y) for 8 teams.

Team	T1	T2	T3	T4	T5	T6	T7	T8
Traditional dance ranks(X)	1	8	2	4	7	3	6	5
Creative dance ranks(Y)	2	5	6	3	4	7	8	1

Calculate the spearman's rank correlation coefficient and comment on your result.

(05 marks)

8. A discrete random variable X is given by;

$$P(X = x) = \begin{cases} k\binom{4}{x}; & x = 0,1,2,3,4 \\ k; & x = 5,6. \\ 0; & otherwise \end{cases}$$

Find the;

(i) value of k. *(02 marks)*

(ii) E(X). *(03 marks)*

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: PURE MATHEMATICS

9. A farmer **wishes** to spray 70 hectares of a plantation planted with coffee and bananas. The cost for spraying the coffee garden is shs. 300,000 per hectare and that of spraying the banana plantation is shs. 200,000 per hectare. He has shs. 18,000,000 available for spraying the plantation. The labour per hectare for spraying the coffee plantation is 19 men and 7 men for banana plantation. There is **at least** 665 men available to offer labour.

If x ***and*** y represent the number of hectares planted with coffee and bananas respectively

(a) Write down **five** inequalities representing the above information.

(b) Draw the inequalities above by shading the unwanted regions, using a scale of 1 cm to represent 5 units on both axes.

(c) Determine the number of hectares of each plantation that will keep the spraying costs as low as possible and hence determine the amount saved by spraying these hectares.

(15 marks)

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10. (a) Prove that $\frac{\sin\beta+\tan\beta}{1+\cos\beta} = \tan\beta$. *(04 marks)*

(b) Solve the equation $4\cot\theta = \tan\theta - 3$ for values of θ from 0^0 to 360^0.

(06 marks)

(c) By eliminating θ from the equations; $x = 2 + a\operatorname{cosec}\theta$ and $y = 2 + b\sec\theta$, show that

$$\frac{b^2}{(y-2)^2} + \frac{a^2}{(x-2)^2} = 1.$$ *(05 marks)*

11. A particle moves in a straight line so that its acceleration at any time t seconds is $6(t-2)ms^{-2}$.

Determine the;

(a) expression for velocity of the particle at any time (t) given that $V = 9ms^{-1}$ at $t = os$. *(06 marks)*

(b) the expression for distance(x) at any time (t) given that $x = 3$ at $t = 0s$.

(06 marks)

(c) distance of the particle at $t = 10s$. *(03 marks)*

12. The roots of the equation $3x^2 - 9x + 5 = 0$ are α and β.

(a) Determine the values of;

(i) $3(\alpha^2 + \beta^2)$ *(05 marks)*

(ii) $(\alpha - \beta)^2 - 2\alpha\beta$ *(05 marks)*

(b) Determine the quadratic equation with integral coefficients whose roots are

$3(\alpha^2 + \beta^2)$ and $(\alpha - \beta)^2 - 2\alpha\beta$. *(05 marks)*

PART TWO: STATISTICS

13. The marks scored by candidates in a subsidiary mathematics test were normally distributed with mean mark of 60% and standard deviation of 8%.

(a) Determine the probability that a student picked at random scored;

(i) below 64%. *(04 marks)*

(ii) between 62% and 66%. *(05 marks)*

(b) Estimate the number of students who scored between 51% and 63% given that 120 students did the test. *(06 marks)*

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14. The table below shows the prices of items and their correponding quantities recorded at St. George's Book house Wanyange for a period of two years. (2022 and 2023).

ITEMS	PRICE (UGX)		QUANTITY	
	2022	2023	2022	2023
A box of pens	22,000	23,000	35	62
A box of pencils	10,300	11,600	28	49
A box of mathematical sets	24,000	27,000	20	37
A box of books	180,000	191,100	40	70

Using 2022 as the base year,

(a) Calculate the;

(i) price relative for each item. *(04 marks)*

(ii) simple aggregate price index. *(04 marks)*

(iii) weighted aggregate price index and comment on your result. *(05 marks)*

(b) Estimate the price of an item in 2023 whose price was 13,000 in 2022. *(02 marks)*

(c)

15. The heights of students in s.6 at a certain school were recorded to the nearest cm as follows.

Heights(cm)	130-139	140-149	150-159	160-169	170-179	180-189	190-199
Number of students	10	13	11	15	20	9	2

(a) Calculate the;

(i) modal height of the candidates. *(06 marks)*

(b) Variance *(03 marks)*

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

(i) median height. *(04 marks)*

(ii) number of students with heights greater than 174cm. *(02 marks)*

16. In a certain town, it was observed that 20 people out of every 50 people checked had been vaccinated against covid-19. A sample of 10 people was selected.

(a) Find the probability that;

(i) at least 8 people were not vaccinated. *(06 marks)*

(ii) at most 3 people were vaccinated. *(03 marks)*

(iii) only 5 people were vaccinated. *(02 marks)*

(b) Determine the;

(i) expected number of people vaccinated. *(02 marks)*

(ii) standard deviation. *(02 marks)*

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