S475/1

SUBSIDIARY MATHS

Paper 1

July/Aug 2023

2⅔ hours

UGANDA TEACHERS' EDUCATION CONSULT (UTEC)

Uganda Advanced Certificate of Education

SUBSIDIARY MATHEMATICS

Paper 1

2 hours 40 minutes

INSTRUCTIONS TO CANDIDATES:

*Answer all **eight** questions in section **A** and any **four** questions from section **B**, selecting **atleast one** question from each part.*

*Any additional question(s) answered will **not** be marked*

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

*Each question in section **A** carries 5 marks while each question in section **B** carries 15 marks.*

Begin each answer on a fresh sheet of a paper

A graph paper is provided

Silent non- programmable scientific calculators and mathematical tables with list of formulae may be used.

Turn Over

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SECTION A (40 MARKS)

Answer all questions in this section

1. Given that $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}} = a - b\sqrt{6}$, find the values of a *and* b *(05 marks)*

2. The mean of numbers $50,60,55,a,45,55,42$ *is* 52. Find the standard deviation of the set of numbers. *(05 marks)*

3. Solve for θ in the equation 3tanθ=4 sin θ for $\theta^o < \theta < 360^o$. *(05 marks)*

4. A committee of 4 students is to be formed from a group of 8 girls and 9 boys. What is the probability that there are only 3 boys on the committee? *(05 marks)*

5. A curve has an equation y = $4x^3 - 6x^2 + 5$, find the values of x such that $\frac{dy}{dx} = 24$. *(05 marks)*

6. Events A and B are independent such that P(A) = $\frac{1}{4}$ and P(A∩B) = $\frac{1}{6}$. Find *(05 marks)*
   (i) P(B)
   (ii) P$\left({}^{A}/_{B}\right)$

7. Given that $A = \begin{pmatrix} 1 & 3 & 1 \\ 4 & 2 & 5 \end{pmatrix}$ *and* $B = \begin{pmatrix} 0 & 1 \\ 3 & 2 \\ 5 & -1 \end{pmatrix}$ *and* $P = AB$, find P^{-1}. *(05 marks)*

8. Given that X~$B[10, 0.8]$, find:
   (i) P(X= 8) *(02 marks)*
   (ii) P(X< 8) *(03 marks)*

SECTION B (60 MARKS)

Answer only four questions from this section.

PART I: PURE MATHEMATICS

9. Express $2x^2 + x - 10$ in the form of $a(x+b)^2 + c$ where a, b *and* c are constants to be found, hence: *(03 marks)*

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(a) State the:

(i) minimum value of the function and value of x within which it occurs; (02 marks)

(ii) minimum point; (01 mark)

(iii) intercepts. (03 marks)

(b) sketch the curve $y = 2x^2 + x - 10$. (03 marks)

(c) find the area enclosed by the curve and $x - axis$. (03 marks)

10. A radioactive substance decays so that the rate of decrease of mass at any time is proportional to the mass, x, present at that time, t. Initially there are x_o grammes of mass. After 30days the mass is reduced to $\frac{4}{5}$ of the initial value.

(a) Form a differential equation for the rate of decrease of mass (02 marks)

(b) Solve the differential equation formed in (a) above. (10 marks)

(c) Calculate the time required for the mass to be reduced to half its Initial value. (03 marks)

11. Given the vectors $\boldsymbol{a} = 3\boldsymbol{i} + 4\mathbf{j}$, $\boldsymbol{b} = -\boldsymbol{i} + 2\mathbf{j}$ and$\boldsymbol{c} = 5\boldsymbol{i} - 7\mathbf{j}$, find:

(i) $(\mathbf{a} + \mathbf{b}).(\mathbf{a} - \mathbf{c})$ (06 marks)

(ii) $|\mathbf{a} + \mathbf{b}|$ (03 marks)

(i) $|\mathbf{a} - \mathbf{c}|$ (03 marks)

(iv) angle between $(\mathbf{a} + \mathbf{b})$ and $(\mathbf{a} - \mathbf{c})$ (03 marks)

12. To start a bus company, the business association needed at least five "Taata"- buses and ten "Mini"-buses, and not more than 30 vehicles were needed altogether. Suppose that a Taata-bus required 3 units of parking space; while a mini-bus required 1 unit, and only 54 units of parking space were available at the proposed site. If x and y represent the number of Taata-buses and Mini-buses respectively;

let the taata buses be x

$+5 \leq 30 = 54$ $x = 30$ $x + y =$

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(i) Write down four inequalities representing the given information.

(ii) Draw a graph showing the region representing the given inequalities in (i) above.

(iii) Find the maximum number of vehicles that can be bought.

(15 marks)

PART II: STATISTICS AND PROBABILITY

13. The table below shows the prices (Ug.sh) of some food items and their corresponding weights.

Item(kg)	Price (in Ug sh.)		Weight
	2010	2015	
Rice	2000	2500	2
Millet	1200	1500	4
Soya	1000	1200	1
Irish	500	1000	3

Taking 2010 as a base year;calculate the:

(i) simple average price index for 2015. S A P I *(07 marks)*
Comment on your result.

(ii) weighted aggregate price index fx *(04 marks)*

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

14. The table below shows the marks obtained by 100 students in a mathematics test.

Marks	$20 < x < 30$	$30 < x < 40$	$40 < x < 50$	$50 < x < 60$	$60 < x < 70$	$70 < x < 80$	$80 < x < 90$	$90 < x < 1$
Student no.	7	10	15	20	16	14	10	8

(a) Construct a cumulative frequency table and a cummulative frequency curve.

(05 marks)

570

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(b) Use your curve in (a) above to estimate the

(i) median mark *(02 marks)*

(ii) interquartile range *(04 marks)*

(iii) the number of students who scored more than 60%; *(02 marks)*

(iv) 20th percentile *(02 marks)*

15. A salt factory sells salt in bags of mean weight $50kg$ and variance$6.25kg$.

Given that the weights of the bags are normally distributed, find the;

(a) probability that the weight of any bag selected at random lies between $51.5kg$ and $53kg$. *(04 marks)*

(b) percentage of bags whose weights;

(i) exceeds $54kg$

(ii) lies between $46.58kg$ and $55.58kg$. *(07 marks)*

(iii) number of bags that will be rejected out of $1000\ bags$ purchased for weighing below $45kg$. *(04 marks)*

16. A random variable X has a probability density function f given by:

$$f(x) = \begin{cases} kx(5-x) & ; 0 \le x \le 5 \\ 0 & ; else\ where. \end{cases}$$

Find:

(i) the value of k; *(03 marks)*

(ii) $E(X)$; *(04 marks)*

(iii) $E(X^2)$; *(04 marks)*

(iv) $E(X^2 + 2X)$; *(02 marks)*

(v) $Var\ (X)$. *(02 marks)*

END

$L_1 + \left(\frac{\frac{N}{2} - cf_b}{f_m}\right.$

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