

S475/1

SUBSIDIARY MATHEMATICS

PAPER 1

$2\frac{2}{3}$  HOURS

PRE – REGISTRATION EXAMINATIONS 2025

S6 SUBSIDIARY MATHEMATICS

TIME: 2 HOURS 40 MINUTES

INSTRUCTIONS:

- Attempt **ALL** questions in Section A and any 4 from Section B **with at least one question from each part.**

SECTION A: (40MRKS)

1. Express  $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$  in the form  $a + b\sqrt{c}$ . Hence find the values of a, b, and c (05 marks)
2. Find  $AB + 3I$  when  $A = \begin{pmatrix} -3 & 1 \\ 2 & 3 \end{pmatrix}$ ,  $B = \begin{pmatrix} 7 & 0 \\ 8 & -6 \end{pmatrix}$  and I is a  $2 \times 2$  identity matrix. (05 marks)
3. The mean of eight numbers 13, 5, 6, 10, **k**, 11,8, and 7 is 9 . Find the value of **k** hence the standard deviation. (05 marks)
4. 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. (05 marks)
5. A random variable  $X$  has a probability distribution function given in the table below;

$x$	0	2	3	4
$p(X = x)$	$\frac{1}{10}$	$\frac{3}{10}$	$m$	$\frac{2}{5}$

- Find the; (i) value of  $m$   
(ii) the expectation,  $E(x)$  (05 marks)

6. Given the vectors  $\mathbf{a} = 2\mathbf{i} - 4\mathbf{j}$  and  $\mathbf{b} = 3\mathbf{i} + 5\mathbf{j}$ . Find the magnitude of  $5\mathbf{a} + 2\mathbf{b}$ . (05marks)

7. The price in shillings of commodities A, B and C in 2012 and 2013 are given in the table below:-

Commodity	Price in 2012	Price in 2013
A	500	750
B	1,500	2100
C	1,000	1200

Using 2021 as the base year, find the;

(a) Price relative for each commodity

(b) Simple aggregate price index.

(05 marks)

8. Given that  $y = 2t^2 - 5t$ . Find  $2 \frac{d^2y}{dx^2}$

(05marks)

## SECTION B:(60MRKS)

### 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 atleast 665 men available to offer labour.

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

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

(b) Draw the inequalities above by shading the unwanted regions, using a scale of 1cm to represent 5units 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. (15marks)

10. Given that the point  $\mathbf{P}$  has position vector  $7\mathbf{i} - 3\mathbf{j}$ , point  $\mathbf{Q}$  has position vector  $5\mathbf{i} + 5\mathbf{j}$ , and point  $\mathbf{R}$  has position vector  $6\mathbf{i} + \mathbf{j}$ . Find

(i)  $\mathbf{PQ}$

(ii)  $\mathbf{PR}$

(iii) The angle between **PQ** and **QR**

(15marks)

11. A curve is defined by the equation  $y = x^2 - 5x + 6$

(a) Determine the:

(i) coordinates and nature of the stationary point of the curve.

(5mrks)

(ii) X and Y - intercepts

(6mrks)

(b) Sketch the curve

(4mrks)

12. (a) Solve the equation  $2x^2 - x - 10 = 0$ .

(5marks)

(b) Form a quadratic equation whose roots are  $\frac{3}{5}$  and  $-3$ .

(3 marks)

(c) The roots of a quadratic equation  $2x^2 - x - 10 = 0$  are  $\alpha$  and  $\beta$ . Form a quadratic equation with integral coefficients whose roots are  $(\alpha - 2)$  and  $(\beta - 2)$ .

(7 marks)

### PART TWO: STATISTICS

13. A farm manager claimed existence of a relationship between certain fertilizers called Mbolea and his agricultural output per hectare. The table below shows data on usage of different quantities of Mbolea fertilizer on a sample of 10 hectare.

Amount of fertilizer(X)	18	16	16	14	13	12	10	7	5	3
Output in units (Y)	15	16	14	12	12	13	8	6	3	2

(a) Draw a scatter diagram for the data and use it to comment on the farm manager's claim.

(b) Draw a line of best fit and use it to estimate the output when 8kg of Mbolea fertilizer is applied. (8marks)

(c) Calculate the spearman's rank correlation coefficient between X and Y and comment on your result. (7marks)

14(a) A group consists of 4 boys and 7 girls. In how many ways can a team of 5 be selected if it is to be with: (i) 2 boys and 3 girls

(ii) at least 3 boys

(7marks)

(b) The discrete random variable X has probability density function

$$f(x) = \begin{cases} \frac{k}{x} ; x = 1,2 \\ kx ; 3,4,5 \\ 0, otherwise \end{cases}$$

Find ; (i) The value of constant K

(ii) Mode

(iii) Mean of x

(8marks)

15. The table below shows the marks scored by S4 candidates of a certain school in a Mock 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 mark

(6mrks)

(ii) Modal mark

(3mrks)

(b)(i) Draw a cumulative frequency curve and use it to estimate the median mark.

(4mrks)

(ii) 60<sup>th</sup> percentile.

(2mrks)

16. The table shows the of motor cycles sold by a certain company from 2017 to 2019.

YEAR	QUARTERS			
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
2017	65	82	67	84
2018	67	84	71	90
2019	73	90	75	96

(a) Calculate the four – point moving averages for the data.

(4marks)

(b) (i) On the same axes, draw the graph of original data and moving averages.

(6marks)

(ii) Comment on the trend of the number of motorcycles sold over 3 – year period.

(1mark)

(c) Use your graph to estimate the number of motorcycles that were sold in the first quarter of 2020.

(4marks)

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