1. Given that $\log 2 = 0.3$ and $\log 5 = 0.7$, find, without using tables or calculator, the value of:
   (i) $\log 2.5$;
   (ii) $\log_{16} 5$.   (05 marks)

2. Events A and B are independent such that $P(A) = \frac{1}{4}$ and $P(B) = \frac{3}{4}$.
   Find:
   (i) $P(A \cap B)$;
   (ii) $P(A \cup B)$.   (05 marks)

3. Evaluate: $\int_1^4 x^2(x^2 - 4)\, dx$ (05 marks)

4. The data given below represent the marks obtained by 50 senior six candidates in a subsidiary mathematics test:

Class	20-30	30-40	40-50	50-60	60-70	70-80
Number of candidates	7	10	15	10	5	3

   Use the table above to draw the histogram and estimate the modal mark.   (05 marks)

5. Solve the equation $7 - 6\cos^2\Theta = 5\sin\Theta$ for $0^\circ \le \Theta \le 360^\circ$ (05 marks)

6. A random variable X has a distribution:

X	1	2	3	4
$P(X = x)$	$\frac{2}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$

   Find the standard deviation of X   (05 marks)

7. Given the matrix $N = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$, find the values of the scalar λ such that $(N - \lambda I)$ is singular, where I is a 2x2 identity matrix.   (05 marks)

8. The table below shows the number of vehicles bought by a certain company from 2021 to 2023

YEAR	QUARTER			
	1st	2nd	3rd	4th
2021	50	70	57	75
2022	61	82	60	86
2023	70	84	68	92

Calculate the four-point moving average for the data   *(05 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). The third term of an Arithmetic Progression (A.P) is 12 and the seventh term is 32. Find the first term and the common difference of an A.P.   *(05 marks)*

    (b) The length of seven rods are in a Geometric progression (G.P).

    The total length of the first two rods is 9cm. The total length of the first three rods is 21cm. Determine the:

    (i)   length of the shortest rod;
    (ii) total length of all the seven rods.   *(10 marks)*

10. A mathematics class in a certain school wishes to take students to Kitende SS for a mathematics seminar. The club has hired a mini-bus and a bus to take the students. Each trip for the bus is Shs.500,000 and that of a mini-bus Shs.300,000. The bus has a capacity of 54 students and the mini-bus 18 students. The maximum number of students allowed to go for the seminar is 216. The number of trips the bus makes do not have to exceed those made by the mini-bus. The club has mobilized as much as Shs.3,000,000 for transportation of the students.

If x and y represent the number of trips made by the bus and the mini-bus respectively.

(i)   Write down five inequalities representing the above information;

(ii) Plot these inequalities on the same axes;

(iii) By shading the unwanted region, show the region satisfying all the above inequalities
(iv) List the possible number of trips each vehicle made
(v) State the greatest number of students who went for the seminar (15 marks)

11. Given the vectors $a = 3i + 4j$, $b = 12i + 5j$ and $c = 8i - 6j$
    (a) Express the following in terms of i and j (03 marks)
       (i) $3a - 2b$ (03 marks)
       (ii) $4b + c$ (06 marks)
    (b) Find the angle between the vectors a and b (03 marks)
    (c) Show that the vectors a and c are perpendicular

12. The rate of increase of a population of certain animals is proportional to the number in the population present at that time. Initially, the number in the population was 24,000. After 60 years the population was 40,000. Find the:
    (a) number of animals in the population after 72 years;
    (b) time when the population doubles the initial number. (15 marks)

PART TWO: STATISTICS

13. A random variable X has a probability density function given by
$$f(x) = \begin{cases} k(x + 4); & 0 \le x \le 3 \\ 0 & ; \text{ else where} \end{cases}$$

    (a) (i) Find the value of k. (03 marks)

       (ii) Sketch the graph of the probability distribution. (02 marks)

    (b) Determine the:
       (i) $P(X \le 2)$; (03 marks)

       (ii) expectation of X; (03 marks)

       (iii) variance of X. (04 marks)

14. A man's chance of hitting a target with each of his shots is $\frac{1}{5}$.
    (a) If he has to fire 5 shots, calculate the probability that:
       (i) exactly 3 shots hit the target;

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(ii) at least 2 shots hit the target;
(iii) less than 2 shots hit the target. **(10 marks)**

(b) Given that he has 20 shots to fire, determine the mean number and the variance of his shots at the target. **(05 marks)**

15. The table below shows marks scored by ten candidates A-J in mathematics and physics examinations.

Candidates	A	B	C		D	E	F	G	H	I	J
Mathematics (x)	50	84	70		60	65	90	80	72	76	92
Physics (y)	30	80	76		60	70	84	75	73	75	92

(a) (i) Represent the data on a scatter diagram **(04 marks)**

(ii) Draw the line of best fit and use it to estimate x when $y = 65$ **(03 marks)**

(b) (i) Calculate the rank correlation coefficient for the data **(08 marks)**

(ii) Comment on your result

16. The prices (per kilogram) of beans, meat, millet and posho in the years 2022 and 2023 are shown in the table below.

ITEM	PRICE		WEIGHT
	2022	2023	
Beans	2500	3000	10
Meat	12000	15000	5
Millet	3500	4500	3
Posho	4000	3000	1

Taking 2022 as the base year, calculate for 2023 the:

(a) Price index for each item; **(04 marks)**

(b) Simple average price index; **(03 marks)**

(c) Simple aggregate price index; **(03 marks)**

(d) Weighted aggregate price index. **(05 marks)**

END

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