SECTION A (40 marks)

Answer ALL the questions in this section.

1. Given that $\log 3 = a$ and $\log 5 = b$ express $\log 45$ in terms of a and b. (4 marks)

2. Given the matrices

$$P = \begin{pmatrix} 4 & 2 \\ -1 & 3 \end{pmatrix}, \quad Q = \begin{pmatrix} 1 & 3 \\ 5 & 4 \end{pmatrix} \text{ and } R = \begin{pmatrix} 7 & 1 \\ -3 & 2 \end{pmatrix}, \text{ determine the matrix } S = P(QR).$$

(4 marks)

3. Table 1 shows the marks scored by module I automotive class in a Mathematics examination.

Table 1

Marks	40	51	56	62	70	75	78
No. of students	2	1	3	5	4	3	2

Calculate the mean mark. (4 marks)

4. A technician borrowed Ksh. 84,000 from a bank at a compound interest of 13% per annum for 3 years. Determine the amount of interest paid. (4 marks)

5. Convert the decimal number 1.53 into a fraction. (4 marks)

6. Arrange the fractions $\frac{2}{3}$, $\frac{7}{8}$ and $\frac{5}{6}$ in descending order. (4 marks)

7. Convert:

(a) 111_{16} to a binary number;

(b) 110101_2 to a denary number.

(4 marks)

8. Two pipes, A and B can fill a tank in 2 hours and 6 hours respectively. Pipe C can empty the tank in 3 hours. Determine the time it would take to fill the tank when:

(a) pipe A and B are open and is C closed;

(b) all the pipes running.

(4 marks)

9. Given the series $6 + 8 + 10 + \_\_\_\_$ determine the 20^{th} term. (4 marks)

10. Solve the equation $4^{2x+1} = 8$. (4 marks)

1503/103
MATHEMATICS I
Oct./Nov. 2021
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN AUTOMOTIVE ENGINEERING

MODULE I

MATHEMATICS I

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
- *Answer booklet;*
- *Mathematical tables;*
- *Non programmable scientific calculator.*

This paper consists of ***FOURTEEN*** *questions in* ***TWO*** *sections: A and B.*
Answer ***ALL*** *questions in section A and any* ***THREE*** *questions from section B in the answer booklet provided.*
Each question in section A carries 4 marks while each question in section B carries 20 marks.
All necessary working must be clearly shown.
Maximum marks for each part of a question are as shown.
Candidates should answer the questions in English.

This paper consists of 4 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

Turn over

SECTION B (60 marks)

*Answer any **THREE** questions from this section.*

11. (a) Given a singular matrix $B = \begin{vmatrix} \lambda - 4 & 4 \\ 5 & \lambda - 3 \end{vmatrix}$ determine the values of λ. (6 marks)

(b) Given the matrices

$A = \begin{bmatrix} 4 & 2 \\ 1 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 1 \\ 2 & -3 \end{bmatrix}$ determine $(A^2B^2)^T$. (5 marks)

(c) The power in a mechanical device is given by $P = aN + \frac{b}{N}$ where a and b are constants. Use Cramer's rule to determine the values of a and b if $P = 13$ when $N = 3$ and $P = 12$ when $N = 2$. (9 marks)

12. (a) A technician bought 90 litres of locally made coolant at Ksh. 35 per litre and 140 litres of imported coolant at Ksh. 45 per litre. He mixed the two types of coolant and sold the mixture at Ksh. 50 per litre. Determine the percentage profit realized. (6 marks)

(b) Table 2 shows the lengths of bolts produced by a lathe machine in centimetres.

Table 2

Length in cm	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44
Total number of bolts	2	3	5	4	3	2	1	2	3

Determine the

(i) mean;
(ii) median;
(iii) variance;
(iv) standard deviation.

(14 marks)

13. (a) The 8th term of an arithmetic progression is 22 and the 15th term is 43. Determine the:

(i) first term;

(ii) common difference;

(iii) sum of the first 20 terms.

(6 marks)

(b) Given the series: $\log x + \log x^3 + \log x^5 + \ldots$ determine the:

(i) 8^{th} term;

(ii) sum of the first 5 terms.

(8 marks)

(c) Ksh. 8,000 was deposited in a bank that paid compound interest at 5% per annum for 3 years. Calculate the amount accrued if the interest was paid:

(i) half yearly;

(ii) quarterly.

(6 marks)

14. (a) Solve the equations:

(i) $2^{2x+1} - 12(2^x) + 16 = 0$;

(ii) $\log_3 x - 4\log_x 3 + 3 = 0$.

(15 marks)

(b) Given the numbers 12, 16, 24, determine the:

(i) LCM;

(ii) HCF.

(5 marks)

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