1503/103
MATHEMATICS I
June/July 2022
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.
All questions carry equal marks.
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

Answer any THREE questions from this section.

11. (a) Table 1 shows the number of engineering students per option in a college.

Table 1

Option	Number of students
Plant	50
Production	40
Automotive	30
Refrigeration	20

Represent this information in a pie-chart.

(8 marks)

(b) Table 2 shows the diameters of 20 pipes in centimetres produced by automotive engineering students.

Table 2

Diameter of pipe	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39
Number of pipes	1	3	2	a	4	b	1	2

(i) Determine the values of a and b given that the mean is 18.75.

(ii) Hence calculate the variance.

(12 marks)

12. (a) Given the matrix $A = \begin{bmatrix} 2 & 3 \\ 4 & 1 \end{bmatrix}$, determine $A^2 - 3A - 10I$, where I is an identity matrix.

(7 marks)

(b) Given matrices $B = \begin{bmatrix} 4 & 3 \\ 5 & 9 \end{bmatrix}$ and $C = \begin{bmatrix} 5 & 9 \\ 2 & 3 \end{bmatrix}$, determine $2B + 3C^T$.

(4 marks)

(c) 3 litres of diesel and 4 litres of petrol cost Ksh.766, while 5 litres of diesel and 7 litres of petrol cost Ksh.1,315.

Use the inverse matrix method to determine the cost of each fuel. (9 marks)

13. (a) Given the series $8 + 4 + 2 + \underline{\quad}$
determine the:

    (i) 10th term;
    (ii) sum of the first 15 terms;
    (iii) sum to infinity.

    (9 marks)

(b) The ninth term of an arithmetic progression exceeds three times the 4th term by 15. While the second term is twice the third term. Determine the

    (i) common difference;
    (ii) first term;
    (iii) sum of the first 20 terms of the progression.

    (11 marks)

14. (a) A college bought a milling machine on hire purchase. The cash value of the milling machine is Ksh.480,000. A deposit of Ksh.100,000 was made followed by 24 monthly instalments of Ksh.25,000 each. Determine the monthly rate at which the compound interest is charged per month. (8 marks)

(b) Simplify the expression:

$$\frac{2\log 125 + 3\log 25 + \frac{1}{4}\log 625}{\log 25^7 + \log 125^7 + \log 3125}$$

(5 marks)

(c) Determine the:

    (i) L.C.M;

    (ii) H.C.F of the numbers 36, 56 and 84.

    (7 marks)

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SECTION A (40 marks)

Answer ALL the questions from this section.

1. Evaluate $\dfrac{-8 \div 2 + 12 \times 3 - 4 \times 9}{42 \div 7 \times 3}$. Give your answer in the simplest fractional form. (4 marks)

2. Solve the equation $\log(x+5) = \log(7-x) + 1$ (4 marks)

3. Solve the equation $\begin{vmatrix} x-2 & 4-x \\ 3 & x \end{vmatrix} = 0$ (4 marks)

4. Given that -4 and 14 are the first and last terms of an arithmetic progression of four terms, determine the other terms. (4 marks)

5. Determine the variance of the distribution:

   $3, 4, 5, 7, 9, 10, 11$ (4 marks)

6. Convert:

   (i) 456_{10} to a binary number.

   (ii) 1111011_2 to a denary number. (4 marks)

7. 1 litre of a coolant A costing Ksh.98 is mixed with 1 litre of a coolant B costing Ksh.112. Determine the ratio of the mixture if it is to cost Ksh.108. (4 marks)

8. Given the numbers 72 and 180, determine the:

   (a) L.C.M.

   (b) G.C.D. (4 marks)

9. Solve the recurring decimal $1.46\dot{4}$ to a fraction. (4 marks)

10. Simplify, without using a calculator,

   $$\dfrac{1\frac{1}{5} \text{ of } \frac{25}{30} - 1\frac{2}{3} \times 48}{2\frac{1}{3} - \frac{1}{4} \text{ of } 12 \times \frac{2}{3}}$$ (4 marks)