1301/311 1305/311
1304/311 1309/311
MATHEMATICS
June/July 2019
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN CARPENTRY AND JOINERY
CRAFT CERTIFICATE IN MASONRY
CRAFT CERTIFICATE IN PLUMBING
CRAFT CERTIFICATE IN ROAD CONSTRUCTION

MATHEMATICS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
- *Answer booklet;*
- *Mathematical tables/scientific calculator;*
- *Drawing instruments.*

*This paper consists of **EIGHT** questions.*
*Answer **FIVE** questions.*
All questions carry equal marks.
Maximum marks for each part of a question are indicated.
Candidates should answer the questions in English.

This paper consists of 5 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

1. (a) Solve the equations:

(i) $9^{x+3} - 81^{3-x} = 0$;

(ii) $Log_3(x+4) + Log_2 9 = 6$. (8 marks)

(b) Convert:

(i) 97_{10} to a binary number;

(ii) 10111011_2 to a denary number. (6 marks)

(c) Solve the equation $3^{3-x} = 5^{2x+5}$. (6 marks)

2. (a) The fourth and the seventh terms of an arithmetical progression are 29 and 44 respectively. Determine the:

(i) common difference;

(ii) first term;

(iii) sum of the first fifteen terms. (8 marks)

(b) The third term and the sixth terms of a geometrical progression are 4 and $\frac{-1}{2}$ respectively. Determine the:

(i) common ratio;

(ii) first term;

(iii) sum of the first seven terms. (8 marks)

(c) Solve the equation:

$4x^2 + 11x - 3 = 0$, by factorization. (4 marks)

3. Given the matrices:

$A = \begin{pmatrix} 2 & -3 \\ 1 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 3 \\ -2 & 3 \end{pmatrix}$. Determine:

(i) A^2;

(ii) AB;

(iii) A(A + B). (6 marks)

(b) The cost of five saws and eight hammers is Ksh 24,600 while four saws and six hammers cost Ksh 19,200. Use the inverse matrix method to find the cost of each item. (8 marks)

(c) A piece of timber of length 2.5 metres is cut into three smaller pieces in the ratio 1:3:4. Determine the length of each piece. (6 marks)

4. (a) (i) Draw the graph of the curve:

$y = 2x^2 - 4x - 6$ for values of x between $x = -2$ and $x = 4$.

(ii) Hence solve the equation $-2x^2 + 6x + 4 = 0$. (14 marks)

(b) Solve the following simultaneous equations by elimination method:

$$\begin{cases} 3x + 4y = 5 \\ 2x + 3y = 4 \end{cases}$$

(6 marks)

5. The ultimate tensile stress in kN/m^2 of steel rods in a store were recorded as in Table 1.

Table 1

Ultimate Tensile Stress kN/m^2	Number of rods
5 - 9	17
10 - 14	32
15 - 19	38
20 - 24	53
25 - 29	27
30 - 34	23
35 - 39	20

Calculate the:

(a) mean; (5 marks)

(b) standard deviation; (4 marks)

(c) mode; (3 marks)

(d) median; (4 marks)

(e) upper quartile. (4 marks)

6. (a) **Figure 1** shows the cross-sectional area of a rivet.

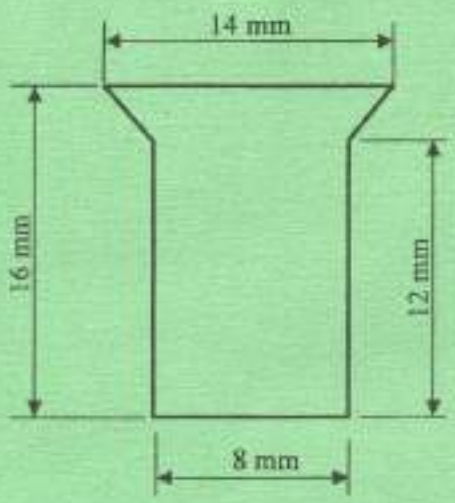

Fig. 1

Determine the volume of the rivet. (10 marks)

(b) A segment is bounded by a chord of length 14 cm and an arc of radius 25 cm. Determine the:

(i) area;

(ii) perimeter of the segment. (10 marks)

7. (a) (i) Make x the subject of the formula:

$x = \sqrt{Vd - g x^3}$ and;

(ii) hence determine the possible values of x when V = 22, d = 5 and g = 10 to three decimal places. (7 marks)

(b) Solve the equations:

(i) $4\sin x - 3\operatorname{cosec} x = 0$;

(ii) $3\cos^2 x - 7\cos x + 2 = 0$.

For values of x between 0° and 360° inclusive. (13 marks)

8. (a) The exchange rates on a certain day were:

1 American Dollar (US $) = Ksh 74.75
1 Swiss Franc (Fr) = 55.60

Calculate the Swiss Franc equivalent of US $ 831,220. (4 marks)

(b) A man invests Ksh 400,000 in a bank which pays a compound interest of 12% per annum, four years. Calculate the interest earned to the nearest shilling. (5 marks)

(c) Given the vectors $\underset{\sim}{a} = \begin{pmatrix} 6 \\ -4 \end{pmatrix}$ and $\underset{\sim}{b} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}$, determine:

$|3\underset{\sim}{a} + 2\underset{\sim}{b}|$. (5 marks)

(d) Three screws out of twenty in a box are over-size. Two screws are picked out of the box one after the other without replacement. Determine the probability that:

(i) both are oversize;

(ii) none is oversize;

(iii) only **one** is oversize. (6 marks)

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