

1301/311 1305/311
1304/311 1309/311
MATHEMATICS
June/July 2022
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;
This paper consists of EIGHT questions.
Answer FIVE questions.
All questions carry equal marks.
Maximum marks for each part of the 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.

1. (a) Solve the equations:

(i) $\log x^2 - 3 \log 4 = \log \left(\frac{1}{64} \right)$

(ii) $\log_2(5x + 2) - 1 = \log_2(x + 4)$

(8 marks)

(b) Solve the equation:

$$27^x (81^{x-3}) = 9^x (3^{3x+3})$$

(4 marks)

(c) Simplify

$$\frac{28}{5} \left[\frac{7 - \frac{5}{2} \times \frac{6}{4}}{\frac{7}{5} \times \frac{2}{5} \text{ of } \frac{7}{5}} \right]$$

leaving the answer in fraction.

(4 marks)

(d) Evaluate without using mathematical tables or calculator

$$\frac{4 \log_3 81 + 5 \log_4 256 + 7 \log_5 625}{3 \log_9 81 + 3 \log_8 64}$$

(4 marks)

2. (a) Use the completing the square method to solve the equation

$$2x^2 + 7x + 4 = 0$$

(6 marks)

(b) In a certain week a contractor bought 3 helmets and 4 dust coats at Ksh 6,600. The next week he went to the same shop and found that the prices had not been changed and he bought 2 helmets and 5 dust coats at Ksh 7,200. Determine the cost of a helmet and a dust coat using the elimination method. (5 marks)

(c) (i) Draw the graph $y = (2 - 3x)(x - 1)$ in the interval $-6 \leq x \leq 3$.

(ii) Hence solve the equation:

$$-3x^2 + 8x - 4 = 0.$$

(9 marks)

(a) A frustrum of a cone has a base radius of 4 cm and height 7.2 cm. If the original height of the cone was 12.0 cm. Calculate the:

(i) curved surface area;

(ii) radius of the top of the frustrum.

(6 marks)

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Handwritten notes: $4 \times \frac{3}{4} = 3$, $6 \times \frac{5}{5} = 6$, 6600 , 7200

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Handwritten work for (c)(i): $(2-3x)(x-1)$
 $2x - 2 - 3x^2 - 3x$



Handwritten notes: $\frac{2 \times 3}{5} = \frac{6}{5}$, $\frac{168}{20} = 8.4$

(b) Determine the volume of a pyramid with a rectangular base of $6\text{ cm} \times 4\text{ cm}$ and height of a 9 cm from the apex to the centre of the base. (4 marks)

(c) The third term of an arithmetic progression is 18 and the seventh term is 46. Find:

- (i) the first term;
- (ii) the sum of the first thirty terms.

(6 marks)

(d) A concrete block is made of three materials cement, sand and ballast in the ratio 3:6:12. If a sample block has a mass of 5.6 kg . Find the mass of each material in grams.

(4 marks)

4. (a) Given that $\cos 50^\circ = 0.64$, determine without using tables or calculator $\tan 230^\circ$.

(5 marks)

(b) $\sin \alpha = \frac{5}{13}$ and $\sin \beta = \frac{40}{41}$. Find without using table or calculators:

- (i) $\sin(\alpha - \beta)$;
- (ii) $\cos(\alpha - \beta)$.

(8 marks)

(c) Solve the trigonometric equation:

$$8 \sin^2 \theta + 3 \cos^2 \theta + 3 \cos \theta - 6 = 0.$$

(7 marks)

5. (a) Given the data;

5, 1, 7, 9, 4, 8, 4, 3, 4, 2,
2, 6, 8, 7, 5, 6, 4, 9, 1, 3

Determine the:

- (i) mean;
- (ii) mode;
- (iii) median.

(6 marks)

- (b) **Table 1** below shows the number of customers visiting a carpentry shop in 43 working days.

Table 1

No. of customers	0 - 9	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59
Frequency	2	5	10	15	9	2

- (i) Determine the mean no. of customers visiting the shop.
(ii) Calculate the standard deviation.
(iii) Determine the class which the median lies.

(14 marks)

(6) (a) If $A = \begin{pmatrix} 3 & 2 \\ 2 & 3 \end{pmatrix}$, $B = \begin{pmatrix} 6 & 4 \\ 10 & 9 \end{pmatrix}$ and $C = \begin{pmatrix} -7 & 4 \\ 1 & 8 \end{pmatrix}$.

Find:

- (i) $A + B - 5C$
(ii) the inverse of C
(iii) ABC

(9 marks)

(b) Given that $\begin{pmatrix} 1 & x-3 \\ x-2 & 0 \end{pmatrix}$ is a singular matrix, Find the value of x .

(5 marks)

- (c) Two sites pay their workers the same rate. In the first site 6 masons and 7 carpenters working for 6 days are paid Ksh 60,600 while in the second site 4 masons and 3 carpenters working for 6 days are paid Ksh 32,400. Find a day's wage for a mason and that for a carpenter. Use the inverse method of matrices.

(6 marks)

7. (a) A construction consultant does consultation for four companies owned by a Kenyan, Japanese, a Briton and American. In each company the consultant is paid the currencies according to the owner. In a particular month he was paid Ksh 100,000, JY 50,000, £ 1,000 and US \$ 1200 from the four companies respectively. He pays tax as follows Kenya company 30%, Japanese company 25%, British company 15% and the American company 20%. Calculate his net pay in Kenyan shilling using **table 2** below.

Table 2

100 JY	=	Ksh 93.87
1 £	=	Ksh 128.02
1 £	=	US \$ 1.26

Handwritten calculations:
 $26464 + 2311 + 924$

 9702
 $\frac{847}{462}$

(9 marks)

Handwritten calculation:
 $\frac{60600}{7} = 8657.14$

Handwritten calculation:
 $\frac{26464}{7} = 3780.57$

- (b) A Kenyan civil servant earns monthly basic salary of Ksh 51,000, house allowance of Ksh 22,000 and commuter allowance of Ksh 6,000. The following are deducted from his pay; Sacco loan Ksh 13,650, NHIF Ksh 1300 and CWF calculated at 2% of his basic salary. He is entitled to tax relief of Ksh 1,390. Calculate using table 3 the:

- (i) PAYE monthly;
(ii) Net pay for the month.

Table 3

Ksh	Tax rate
0 - 12,298	10%
12,299 - 23,885	15%
23,886 - 35,472	20%
35,473 - 47,059	25%
47,060 and above	30%

(11 marks)

8. (a) A bag contains 5 white, 7 black and 11 green balls. Three balls are picked one at a time without replacement. Represent the above in a tree diagram. (7 marks)
- (b) Using the information in (a) above, determine the probability that:
- (i) all balls are white;
(ii) two black and one green in that order.

(4 marks)

- (c) Figure 1 represents a system of four vectors acting on a particle. By calculation, determine the magnitude and direction of the resultant vector. (9 marks)

