

1301/311 1305/311
1304/311 1309/311
MATHEMATICS
June/July 2018
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.

1. (a) (i) Simplify $\frac{\left(\frac{3}{8}\right)^5 - \left(\frac{16}{3}\right)^{-5}}{\left(\frac{4}{3}\right)^{-4}}$ giving the answer in fraction form. (5 marks)

(ii) Without using tables evaluate:

$$\left(\frac{1}{2} \log_4 36 \times \log_6 64\right). \quad (8 \text{ marks})$$

(b) Solve the equation $5^{2x} - 10(5^x) + 24 = 0$. (7 marks)

2. (a) (i) A man deposits his money in a savings account on a monthly basis. Each deposit exceeds the previous one by Ksh 750. If he started by depositing Ksh 1,500, how much will he have deposited in 12 months? (4 marks)

(ii) The second and fifth terms of a geometric progression are 16 and 2 respectively. Determine the common ratio and the first term. (4 marks)

(b) Make P the subject of the formula $\frac{D^2}{d} = \sqrt{\frac{f^2 + P}{f - P}}$. (4 marks)

(c) A cone of base radius 20 cm and height 30 cm is held upside down and filled with water. Half of this water is then poured into a rectangular glass tank with a square base of side 10 cm. Determine to two decimal places the depth of water in the tank. (8 marks)



3. (a) Solve graphically the simultaneous equations:

$$y = x^2 + 3x - 4.$$

$$y = 2x + 4.$$

(6 marks)

(b) Draw the graph of the function $y = 2x^2 + 6x - 5$ by taking the integral values of x in $-4 \leq x \leq 3$. Use the graph to solve the following equations:

(i) $2x^2 + 6x - 5 = 0$;

(ii) $2x^2 - x - 6 = 0$.

(10 marks)

(c) The simultaneous equations below are satisfied when $x = 1$ and $y = p$.

$$-3x + 4y = 5$$

$$qx^2 - 5xy + y^2 = 0$$

Find the values of p and q .

(4 marks)

3.7.1

- (a) Given the matrices:

$$A = \begin{pmatrix} 4 & 1 \\ -3 & 0 \end{pmatrix} \quad B = \begin{pmatrix} 2 & 2 \\ -1 & 3 \end{pmatrix};$$

Determine:

(i) $A + B$;

(ii) AB ;

(iii) $(A + B)^{-1}$. (10 marks)

- (b) Given that $N = \begin{pmatrix} 4-x & 1 \\ 3 & x \end{pmatrix}$ is a singular matrix, determine the possible values of x .

Hence write down the **two** possible matrices. (6 marks)

- (c) In a certain week, a contractor bought 36 spades and 32 wheelbarrows for a total of Ksh 227,280. In the following week, he bought 28 spades and 24 wheelbarrows for a total of Ksh 174,960. Using matrix method, find the price of each spade and each wheelbarrow. (4 marks)

5. (a) Given that $\cos \theta = \frac{-3}{7}$ and θ is obtuse, find without using tables the value of $\tan^2 \theta$. Hence find the value of $\sec^2 \theta$. (6 marks)

$$\begin{pmatrix} 1 & c \\ c & 1 \end{pmatrix}$$

- (b) Prove the identity:

$$\frac{2}{1 + \sin \theta} + \frac{2}{1 - \sin \theta} = 4 \sec^2 \theta. \quad (4 \text{ marks})$$

- (c) A, B and C are three marked points on a level building site. A and B are 120 m apart. Angles \hat{CAB} and \hat{CBA} are 80° and 40° respectively. If concrete is to be laid on the site, calculate the area to be concreted. (6 marks)

- (d) Solve the equations:

$$4 \sin^2 \theta + 4 \cos \theta = 5 \text{ for } 0^\circ \leq \theta \leq 360^\circ. \quad (4 \text{ marks})$$

6. (a) In a triangle OAB, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. A point P divides \overrightarrow{OA} in the ratio 3:1 and a point Q divides AB in the ratio 2:5. If OQ meets BP at M, determine:

- (i) the ratio OM:MQ;

- (ii) the ratio BM:MP.

$$\begin{pmatrix} 36 & 32 \\ 28 & 24 \end{pmatrix}$$

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(10 marks)

(b) If $\mathbf{a} = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -2 \\ 2 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$, find:

(i) $\frac{2}{3}(\mathbf{a} + \mathbf{b})$;

(ii) $3\mathbf{a} - 3\mathbf{b} + 2\mathbf{c}$.

(4 marks)

(c) **Figure 1** shows a system of forces acting on a particle A.

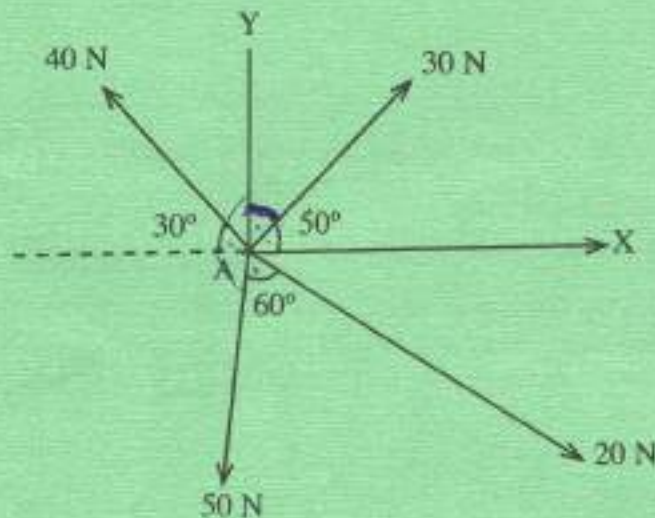


Fig. 1

Use resolution of forces to determine the magnitude of the resultant force. (6 marks)

7.

(a) A bag contains four green balls, four black balls and two white balls. Determine the probability of:

(i) picking two green balls without replacement;

(ii) picking a green ball and a white ball without replacement;

(iii) picking a white ball in the first draw and a green ball in the second draw with replacement;

(iv) drawing no white ball if two balls are drawn without replacement. (8 marks)



- (b) Find:
- the mean;
 - standard deviation;
 - modal class of the data given in table 1.
- (12 marks)

Table 1

Class	0 - 9	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59
Frequency	1	3	8	12	9	2

8. (a) The initial cost of a ranch is Ksh 10,000. At the end of each year, the land value increases by 2%. What will be the value of the ranch at the end of 3 years? (4 marks)
- (b) Mr Peterson wants to buy a residential house valued at Ksh 10,000,000. A housing finance company advances him 90% of this amount which he has to repay by equal monthly instalments of Ksh 40,000 for 20 years. Calculate the amount of interest that he has to pay. (4 marks)
- (c) Mr. Kubasu imports into the country 1,000 television sets which cost him Ksh 20,000 each. If an import duty of 100% is imposed and then a sales tax of 15% levied, calculate:
- the selling price of each set;
 - the amount of money that the government gets as tax from the sale of these sets. (6 marks)
- (d) Mr. Kirui is a junior civil servant, is married and lives in a government house for which he pays a rent of Ksh 2,000 per month. If his salary is £ 6,200 p.a. calculate how much P.A.Y.E he pays every month. Use graduated tax rates given below:

Income (£ per annum)	Rates (Sh per pound)
1 - 1980	2
1981 - 3960	3
3961 - 5940	5
5941 - 7920	7
7921 - 9900	9
9901 - Over	10

$$\left(\frac{102}{100} \times 10000 \right)^3$$

HINT: Take family relief to be Ksh 500 per month. (6 marks)

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