

1301/311
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MATHEMATICS
June/July 2009
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL
CARPENTRY AND JOINERY CRAFT CERTIFICATE
MASONRY CRAFT CERTIFICATE
PLUMBING CRAFT CERTIFICATE
ROAD CONSTRUCTION CRAFT CERTIFICATE

MATHEMATICS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

*Answer booklet
Mathematical tables/electronic calculator*

*Answer any FIVE of the following EIGHT questions.
All questions carry equal marks.
Maximum marks for each party of a question are shown.*

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) Given that x is positive and $\log_4^{6-x} = \log_2 x$
determine the value of $\log_4(8x)$

(ii) Without using tables evaluate:

$$\frac{1}{2}(\log_2 36) \times (\log_6 64) \quad (13 \text{ marks})$$

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

2. (a) Plot the graph of $y = 2 - 2x - x^2$ for values of x from $x = -4$ to $x = 3$.
Use the graph to solve the equations:

(i) $2 - 2x - x^2 = 0$

(ii) $1 - 3x - x^2 = 0$ (14 marks)

- (b) On the same axes of the graph in (a) above plot the graph of $2y = -4x + 1$.
Hence find the equation whose roots are the intersection of the two graphs. (6 marks)

3. (a) Given that $M = \begin{pmatrix} 3-x & 1 \\ 2 & x \end{pmatrix}$ is a singular matrix, determine the possible values of x . Hence write down the two possible matrices. (6 marks)

(b) Given the matrices:

$$A = \begin{pmatrix} 2 & -1 \\ 1 & 3 \end{pmatrix}, \quad B = \begin{pmatrix} 3 & -2 \\ 1 & -3 \end{pmatrix}, \quad C = \begin{pmatrix} 1 & -2 \\ 1 & -1 \end{pmatrix}$$

determine:

(i) ABC

(ii) $B^T(A + C^T)$ (6 marks)

(c) Use inverse matrix method to solve the equations:

$$\begin{aligned} 3x + 5y &= 4 \\ 2x - 3y &= -10 \end{aligned} \quad (8 \text{ marks})$$

4. (a) Given that $\cos \theta = \frac{-3}{7}$ and θ is obtuse find without using table the value of $\tan^2 \theta$.

Hence find the value of $\sec^2 \theta$. (7 marks)

- (b) Prove the identity $\frac{2}{1 + \sin \theta} + \frac{2}{1 - \sin \theta} = 4 \sec^2 \theta$ (4 marks)

- (c) Solve the trigonometric equation.

$$7 \tan^2 \theta + \sec \theta = 4 \quad \text{for } 0^\circ \leq \theta \leq 360^\circ. \quad (9 \text{ marks})$$

5. (a) Given the vectors $\mathbf{m} = \mathbf{j} + 2\mathbf{k}$, $\mathbf{n} = 3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ and $\mathbf{p} = 2\mathbf{i} + 4\mathbf{j} - \mathbf{k}$. Find a unit vector parallel to the resultant of the vectors. (4 marks)

- (b) The position vectors of the points A and B are given by

$$\mathbf{a} = \mathbf{i} - 2\mathbf{j} + 4\mathbf{k} \quad \text{and} \quad \mathbf{b} = 3\mathbf{i} - 4\mathbf{j} + 6\mathbf{k} \quad \text{respectively}$$

- (i) Find \overline{AB} .

- (ii) Find the coordinates of the point M which divides \overline{AB} in the ratio 2:3. (6 marks)

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

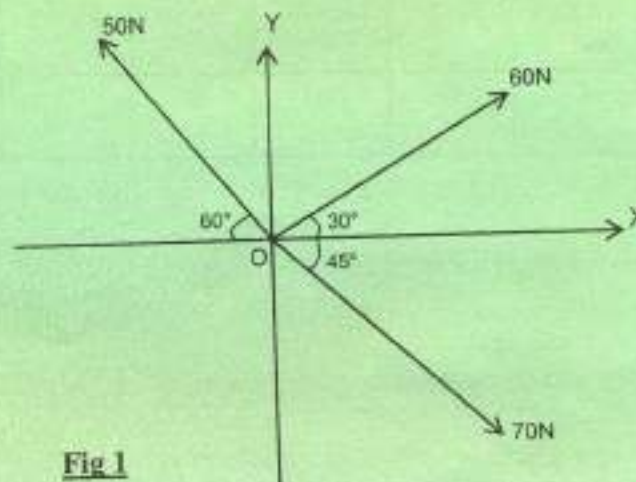


Fig 1

Use resolution of forces to determine the magnitude of the resultant force.

(10 marks)

6. (a) Make L the subject in the formula

$$f = \frac{1}{2\pi\sqrt{LC}}$$

(3 marks)

- (b) The second term of a G.P is -8 while the fifth term is 1 . Determine the sum of the first 20 terms of the series correct to 2 decimal places. (7 marks)

- (c) A right pyramid stands on a rectangular base of sides, $8\text{cm} \times 6\text{cm}$. The slant side of the pyramid is 15cm . Calculate:

- (i) the height of the pyramid;
 (ii) the total surface area. (10 marks)

7. (a) The probability that a technician attends an apprentice workshop is $\frac{1}{5}$.

If he attends this workshop, the probability that he will be promoted is $\frac{1}{2}$.

If he does not attend the workshop the probability that he will be promoted

is $\frac{1}{6}$. Find the probability that:

- (i) he attends the workshop and will be promoted;
 (ii) he will be promoted. (7 marks)

- (b) Table 1 shows the wages earned by the workers in a factory per week.

Wages (in K£)	30-39	40-49	50-59	60-69	70-79	80-89
Number of workers	6	10	9	7	5	3

Table 1

Taking an assumed mean of 54.5 calculate:

- (i) the mean age;
 (ii) the standard deviation of the wage. (13 marks)

8. (a) The cost of a machine from a manufacturer is US \$7,200. The machine was later sold to a firm at a profit of 15% . If the machine depreciates at the rate of 2% from the time it is acquired by the firm, calculate its value in sterling pounds after 8 years. Assume mean exchange rates:

1 US\$ = Ksh.79.23

1 GBP = Ksh.115.52

(7 marks)

- (b) A company employee earns a salary of Ksh.55,000 per month plus a house allowance of Ksh.35,000 per month. He is entitled to a family relief of Ksh.1,120 per month. Other deductions on his pay add up to Ksh12,400 per month.

Use table 2 to determine his net income per month in Ksh.

Table 2

Income slab (K£ p.m.)	Rate (sh. per pound)
1 - 484	2
485 - 940	3
941 - 1396	4
1397 - 1852	5
1853 and above	6

(13 marks)