

1704/202
MATHEMATICS II
June/July 2021
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
CRAFT CERTIFICATE IN BUILDING TECHNOLOGY

MODULE II

MATHEMATICS II

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Non-programmable Scientific calculator;

Mathematical tables;

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 as indicated.

Candidates should answer the questions in English.

This paper consists of 6 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) Given the matrices

$$M = \begin{pmatrix} 6 & 3 \\ -1 & 2 \end{pmatrix} \text{ and } N = \begin{pmatrix} 5 & 5 \\ 2 & 6 \end{pmatrix}$$

Determine:

- (i) MN ;
- (ii) $(MN)^{-1}$.
- (iii) Use the results in (ii) to solve the equation.

$$36x + 48y = 216$$

$$-x + 7y = 19$$

(10 marks)

(b) Given that $\begin{vmatrix} x+4 & -1 \\ 3 & x \end{vmatrix} = 0$. Determine the possible values of x .

(4 marks)

(c) A contractor has two sites; A and B. He uses similar materials in the two sites. If for site A he bought 12 packets of tiles and 8 pieces of ceiling boards at Ksh 17,200 and for site B he bought 24 packets of tiles and 14 pieces of ceiling boards at Ksh 32,800. Using determinant method of matrices determine the cost of each packet of tiles and each piece of ceiling board.

$$12t + 8c = 17200$$

$$24t + 14c = 32800$$

(6 marks)

2.

(a) The Table 1 below shows the distribution of length of bricks to the nearest mm.

Table 1

Length in (mm)	155-159	160-164	165-169	170-174	175-179	180-184	185-189
No. of Nails	2	5	16	9	5	2	1

Calculate:

- (i) the median length;
- (ii) lower quartile;
- (iii) upper quartile;
- (iv) 80th percentile.

$$\begin{pmatrix} 12 & 8 \\ 24 & 14 \end{pmatrix} \begin{pmatrix} t \\ c \end{pmatrix} = \begin{pmatrix} 17200 \\ 32800 \end{pmatrix}$$

(10 marks)

$$L + \frac{(n-c)}{f} \cdot i$$

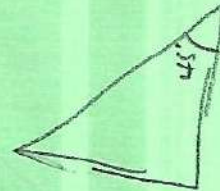
- (b) The frequency distribution for the mass of 48 soil samples in grams is as shown in table 2 below.

Table 2

Mass in grams	30.5 - 30.9	31.0 - 31.4	31.5-31.9	32.0-32.4	32.5-32.9	33.0-33.4
Frequency	3	10	11	13	9	2

Calculate:

- (i) mean;
 (ii) variance;
 (iii) standard deviation.



(10 marks)

3. (a) Solve the equations for values of θ from 0° to 360° ;

(i) $\tan(3\theta - 45^\circ) = \frac{1}{2}$;

$\cos^2\theta + \sin^2\theta = 1$
 $\cos^2\theta = 1 - \sin^2\theta$

(ii) $3 - 3\cos^2\theta = 4\sin^2\theta$.

$= 3 - 1 - \sin^2\theta = 4\sin^2\theta$

3

(10 marks)

- (b) If $\tan\theta = \frac{7}{24}$ and θ is reflex. Find without using tables or calculators, the values of

- (i) $\sin\theta$.
 (ii) $\sec\theta$.

(4 marks)

- (c) Two points P and Q on a straight highway, are 2 km apart. Q being due East of P. If tower T is observed on bearing 127° and 150° from points P and Q respectively. What is the distance of the tower to the highway.

(6 marks)

4. (a) Figure 1 shows a system of four forces acting from a point.

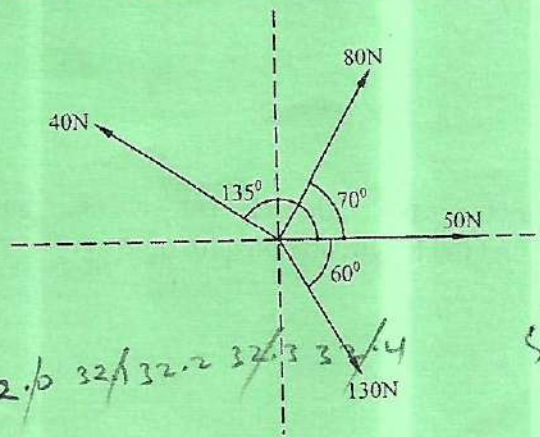


Fig. 1

Calculate the magnitude and direction of the resultant force.

(8 marks)

- (b) In the figure 2 below $\vec{OS} = 3\vec{r}$ and $OQ = \frac{3}{2}\vec{p}$. Given that $\vec{QK} = m\vec{QR}$ and $\vec{PK} = n\vec{PS}$. Find the two distinct expressions in terms of \vec{p} and \vec{r} . m and n for \vec{OK} . By equating the two expressions. Find the values of m and n hence calculate the ratios $QK:KR$ and $PK:KS$.

(10 marks)

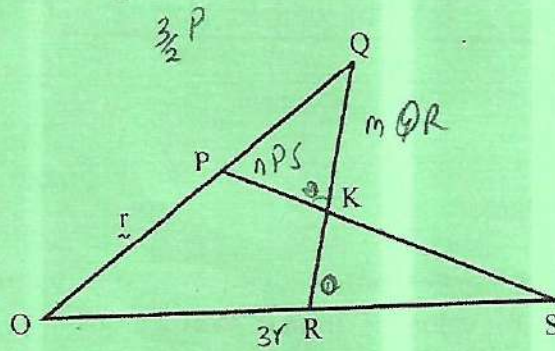


Fig. 2

- (c) Given that A (2,3) and B(7,15).

Find the magnitude and direction of vector \vec{AB} .

(4 marks)

5. (a) Differentiate the following:

(i) $y = \frac{3 \cos x}{5x^3}$.

(ii) $y = (3x^4 - 2x)^5$.

(iii) $y = x^3 \ln 2x$.

(12 marks)

- (b) Find the second differential coefficient of the function

$$y = (x - 5)^5$$

(3 marks)

- (c) A farmer has a 3600 m long chain link. He wants to enclose a rectangular area using the chain link. Find the length and breadth of the rectangle for maximum area enclosed.

(4 marks)

6. (a) Integrate the following with respect to x

(i) $3(e^x - e^{-x})$;

(ii) $\frac{3}{5x} + \sqrt{x^5}$.

(6 marks)

(b) Evaluate

$$\int_1^4 \frac{(3x+2)(x^2-4)}{x} dx$$

(4 marks)

(c) Find the area under the curve $y = 4x^2 + 6$ the x -axis and the ordinates $x = -1$ and $x = 3$. (4 marks)

(d) A particle has an acceleration of $a = 2t + 3$. The velocity of the particle is 36 m/s at the instance time $t = 5$ sec. Write the general formula for displacement of the particle. (6 marks)

7. (a) The value of a porke vibrator on purchase is Ksh 120,000. It is considered worthless when its value reaches 10,000. Find after how long it is declared worthless, if the depression is 12.5% per year. (6 marks)

(b) A water supply company charges water consumption as follows:

- Standing charge 200
- Ksh 12 for the first 50 units
- Ksh 15 for the next 100 units
- Ksh 18 for the next 150 units
- Ksh 21 for the remaining units

The consumer is subjected to 16% value added tax. If in a particular month a construction site was billed Ksh 6,287.2. Find the correct metre reading if the previous reading was 20436.

(8 marks)

(d) During a certain period the exchange rate was as follows:

$$1 \text{ sterling pound} = 1.8 \text{ US \$}$$

$$1 \text{ US \$} = \text{Ksh } 105.3$$

Mr. Katili ordered a machine from a dealer based in the United States who imports his machines from Britain. The dealer makes 15% profit. If the price of the machine in Britain is £1500. How much will Mr. Katili pay if he has to incur additional 25% in import duty and shipment.

(6 marks)

8. (a) Given that $\cos 36.87^\circ = 0.8$. find without using tables or calculators the value of $\tan 216.87^\circ$ (4 marks)

(b) The probability of contractors complying with construction laws in three towns A, B and C are:

$$\frac{2}{5}, \frac{5}{7} \text{ and } \frac{7}{9} \text{ respectively.}$$

(i) represent the probabilities in a tree diagram;

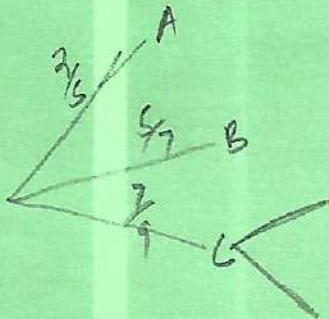
(ii) determine the probability of all sampled contractors complying with the rules.

(iii) Only one complying.

(12 marks)

(c) A fair die is tossed and also a fair coin is tossed. Find the probability of obtaining a 4 and a Head.

(4 marks)



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