

1704/202
MATHEMATICS II
June/July 2019
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 pages are printed as indicated and that no questions are missing.

1. ✓ (a) The probability that all staff of three construction sites visited by NCA officers are registered was found to be $\frac{2}{7}$, $\frac{3}{5}$ and $\frac{5}{9}$.

- (i) Represent the above in a tree diagram.
 (ii) Find the probability that all sites visited have not registered staff.

(10 marks)

- (b) The prices of 50 kg bag of cement in Ksh from 36 hardwares are given in the data below.

700 ✓ 770 × 720 ✓ 815 ✓ 850 ✓ 775 ✓
 750 ✓ 745 ✓ 715 ✓ 820 ✓ 765 ✓ 770 ✓
 825 ✓ 835 ✓ 770 × 760 × 750 ✓ 770 ✓
 710 ✓ 765 ✓ 825 ✓ 850 ✓ 820 ✓ 825 ✓
 705 ✓ 825 ✓ 735 ✓ 755 ✓ 750 ✓ 760 ✓
 755 ✓ 715 ✓ 785 ✓ 805 ✓ 840 ✓ 790 ✓



Starting from 700 and using class interval of Ksh 50 enter the data on a frequency distribution table hence:

- (i) calculate the mean;
 (ii) state the modal class.

(10 marks)

2. ✓ (a) The weekly pay in K£ for 80 sampled Mason's is tabulated in the **table 1**.

Table 1

Weekly pay in K£	150-151	152-153	154-155	156-157	158-159	160-161	162-163
No. of means	4	12	27	18	10	7	2

Calculate using assumed mean of 156.5:

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

(8 marks)

- (b) A concrete mixer was imported by a contractor from the United States of America at US\$ 500. The contractor paid 16% import duty at the port of Mombasa. The mixer depreciates at 14% p.a.

Taking 1US\$ = 100 Ksh, calculate in Ksh the:

- (i) value of the concrete mixer after 5 years;
 (ii) number of years when the value will be Ksh 10,000 or less.

(6 marks)

- (c) The cost of materials to complete a maisonette is Ksh. 4,500,000. The cost of labour is 30% of the materials. The contractor needs a 20% profit of the total cost. He is paid in three instalments, 1st instalment is 50%, 2nd instalment is 40% and finally 10%. Calculate the amount in each instalment. (6 marks)

3. (a) Prove the identity:

$$1 + \cot^2 \theta = \operatorname{cosec}^2 \theta \quad (4 \text{ marks})$$

- (b) Transform the expression $12 \sin \theta + 5 \cos \theta$ into the form $R \sin(\theta + \alpha)$ where α is acute angle. Hence solve the equation:

$$12 \sin \theta + 5 \cos \theta = 7 \quad (10 \text{ marks})$$

- (c) **Figure 1** shows a mass C hanged from a junction of two ropes suspended on a beam.

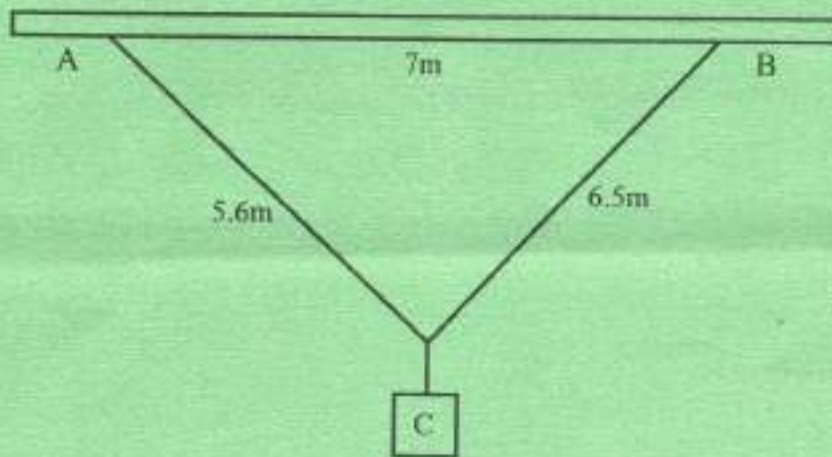


Fig. 1

Calculate the:

- (i) angle between the ropes;
 (ii) depth of the point of suspension of mass C below the beam AB. (6 marks)



4. (a) Figure 2 below shows a circumcircle passing through the vertices of a triangle:

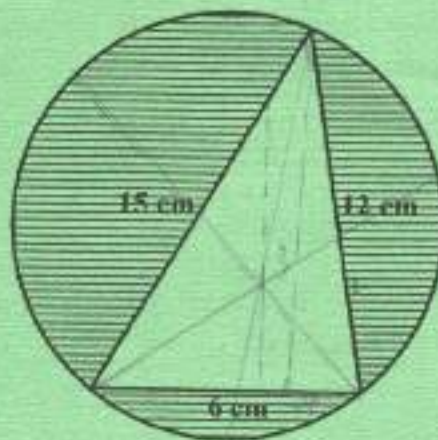


Fig. 2



- (i) Calculate the radius of the circle.
- (ii) Area of the shaded region. (9 marks)
- (b) Solve the equation $6 \cos^2 \theta - \sin \theta = 4$ for values of θ from 0° to 360° inclusive. (6 marks)
- (c) If $\sin A = \frac{3}{5}$ and $\tan B = \frac{5}{12}$ and A and B being obtuse and acute angles respectively. Determine the value of $\cos(A+B)$. (5 marks)

5. (a) Given that matrices:

$$A = \begin{bmatrix} 4 & -7 \\ 3 & 6 \end{bmatrix} \quad B = \begin{bmatrix} 9 & 5 \\ 7 & 6 \end{bmatrix} \quad \text{and} \quad C = \begin{bmatrix} 5 & 4 \\ 3 & 6 \end{bmatrix}$$

Find:

- (i) $A(B+C)$;
- (ii) $AB+AC$;
- (iii) What can be concluded from (i) and (ii) above? (7 marks)
- (b) Solve the simultaneous equation by inverse matrix method:

$$7x + 13y = 86$$

$$4x - 10y = -38$$

(5 marks)

- (c) A contractor has two sites. In the first site, there are 5 masons and 3 hands men. While in the second site, there are 8 masons and 5 hands men. In each site, payments are done weekly, 6 working days. In a particular week, the contractor paid to a total of Ksh 30,600 in the first site and Ksh 49,500 in the second site. Use Cramer's Rule to determine how much a mason and a handman is paid per day. (8 marks)

6. ✓ (a) Given that $a = 5i + 4j$, $b = 3i - 2j$ and $c = 2i + j$. Evaluate $|a + 3b - 4c|$ (6 marks)

- (b) Four forces 10 N, 15 N, 25 N and 40 N are acting at the following directions 0° , 210° , 75° and 330° respectively. Find the resultant force of these forces. (8 marks)

- (c) Given acceleration $a_1 = 20 \text{ m/s}^2$ and $a_2 = 35 \text{ m/s}^2$ both act from a point. If a_1 is acting at 50° and a_2 at 150° . Use scale diagram to find: *resultant force* $\rightarrow \leftarrow$

(i) $a_1 + a_2$;

(ii) $a_1 - a_2$. (6 marks)

7. (a) The displacement x of a body in time t is given by:

$$x = 5t^3 + 6t^2 - 32t + 125$$

Find the:

(i) velocity when $t = 5 \text{ sec}$;

(ii) acceleration when $t = 0$. (6 marks)

- (b) The cost c of constructing a classroom is related to the main material used to construct the classroom as follows:

$$c = \frac{x^3}{2} - \frac{5}{4}x^2 - 6x + 1$$

Determine the maximum and minimum cost of the classroom. (8 marks)

- (c) Surface area of a cone is given by $s = \pi r^2 + \pi r l$ where r is radius and l is the slant height. Use partial differentiation to determine the approximate change in surface area if the radius increases from 4.5 cm to 5 cm and the slant height decreases from 7 cm to 6.8 cm. (6 marks)



8. (a) Determine:

(i) $\int 2x(x^2+1)dx;$

(ii) $\int (4x^2 + e^{4x})dx.$ (6 marks)

(b) Find the area bounded by the curve $y = 2x^2 + 6x - 3$, the x-axis and the ordinates $x = 1$ and $x = 3$. (6 marks)

(c) The velocity (v) of a body, t seconds after certain instant is $(9t^2 + 5)$ m/s. Find its displacement x , given that when $t = 2$, $x = 28$. Hence the displacement made in the fifth second. (8 marks)

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