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MATHEMATICS II
AND SURVEYING II
June/July 2019
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING CONSTRUCTION
DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN ARCHITECTURE

MODULE II

MATHEMATICS II AND SURVEYING II

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
    Answer booklet;
    Non-programmable electronic calculator;
    Drawing instruments.
*This paper consists of **EIGHT** questions in **TWO** sections: A and B.*
*Answer **FIVE** questions choosing at least **TWO** questions from each section.*
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 4 printed pages.

Candidates should check the question paper to ascertain that all
the pages are printed as indicated and that no questions are missing.

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SECTION A: MATHEMATICS II

*Answer at least **TWO** questions from this section.*

1.   (a)   Prove the following hyperbolic identities:

         (i) $Cosh^2x - Sinh^2x = 1$ (4 marks)

         (ii) $Sinh^{-1}x = \ln\{x + \sqrt{1 + x^2}\}$ (7 marks)

   (b)   Find the area under the curve defined parametrically by $x = 6(\theta - Sin\theta)$ and $y = 6(1 - Cos\theta)$ between $\theta = 0$ and $\theta = 2\pi$.   (9 marks)

2.   (a)   Use Taylor's Theorem to expand $f(x) = 2x^{\frac{3}{2}} - 1$ in ascending powers of $x - 1$ up to the term in $(x-1)^5$, hence evaluate $f(1.5)$ correct to four decimal places.   (10 marks)

   (b)   If $Z^3 = 4 - 3j$ find Z in the form $a + jb$.   (10 marks)

3.   (a)   Given that $x^2y - x^3y^3 + 2 = 0$, evaluate $\frac{dy}{dx}$ at point $p(1, 2)$.   (6 marks)

   (b)   Use the Maclaurin series to expand the function $f(x) = xe^{2x}$ up to the term in x^4, hence evaluate:

$$\int_0^1 xf(x)\,dx \text{ correct to four decimal places.} \qquad \text{(14 marks)}$$

4.   (a)   Solve the differential equation: $\frac{dy}{dx} + 8y = e^x$ given that $y = 4$ when $x = 0$.   (6 marks)

   (b)   Find the coordinates of the centroid of the area bounded by the curve $y = 3x^2$ and $x = 0$ and $x = 4$.   (6 marks)

   (c)   Solve the hyperbolic equation:

         $2\,Coshx + Sinx = 2$.   (8 marks)

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SECTION B: SURVEYING II

Answer at least **TWO** *questions from this section.*

5.   (a)   Using illustrations explain each of the following:

       (i)   **three** types of traverse;
       (ii) horizontal angles.

                                                                    (18 marks)

   (b)   List the quantities measured during traversing.   (2 marks)

6.   **Figure 1** represents a playing field ABCD and **table 1** contains the coordinates of the corners. Using the information provided compute:

   (a)   the bearings and distances of the sides of the playing field hence, the perimeter.

   (b)   the area of the playing field in hectares.

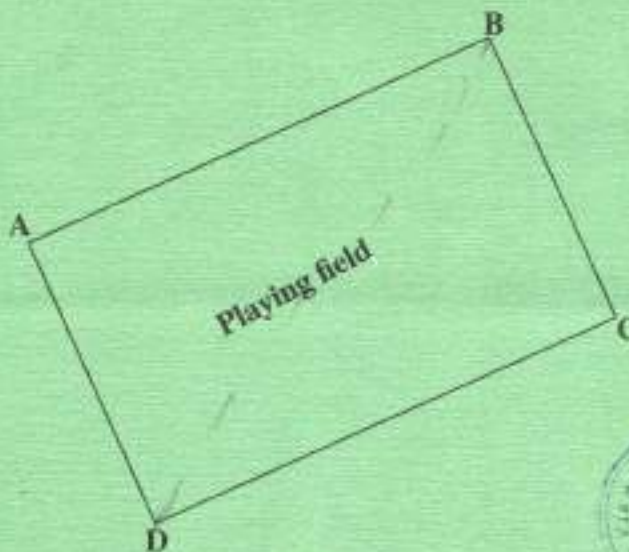   (20 marks)

Fig. 1

Table 1

Point	Northing (m)	Easting (m)
A	13909.45	25993.99
B	14644.78	27276.12
C	14211.05	27524.87
D	13475.72	26242.74

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7. The following observations were obtained during traversing. The traverse started at F_3 through T_1, T_2, T_3 closing at M_3. Prepare a bearing sheet given the datum bearings in **table 2**.

(20 marks)

@F₃
F₂	321°	37'	36"
T₁	25°	45'	33"
F₁	232°	10'	32"

@T₁
F₃	205°	44'	53"
T₂	112°	07'	39"

@T₂
T₁	292°	08'	32"
T₃	168°	48'	41"

@T₃
T₂	348°	48'	49"
M₃	54°	50'	31"

@M₃
T₃	234°	49'	57"
M₁	292°	33'	43"
H	354°	49'	17"

Observed Station	Observed bearing	Correction	Corrected bearing	Final correction	Final/adjusted correction

Table 2: Datum bearings

Line	Bearings		
F3 - F2	321°	38'	19"
F3 - F1	232°	09'	49"
M3 - M1	292°	34'	20"
M3 - H	354°	48'	16"

8. **Table 3** shows values reduced from a traverse observations. Compute the final coordinates of point P1, P2, P3 and P4 given the coordinates of point T is 9372.98 m (N), 3854. 28 m (E). Use Bodwitch method to adjust the coordinates. (20 marks)

Table 3

Line	Distances (m)	Bearings		
T - P₁	155.00	100°	15'	20"
P₁ - P₂	200.00	40°	41'	20"
P₂ - P₃	249.00	10°	15'	20"
P₃ - P₄	190.00	285°	57'	20"
P₄ - T	445.40	198°	56'	30"

0.02 × 155.00

12 39.40

Line bearing distance	Partial co-ordinates		Correction	Adjusted co-ordinates	Station
	ΔE (long)	ΔN (lat)	ΔE	ΔE (m)	ΔN (m)	

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