

2705/201
2707/201
2709/201
2710/201
MATHEMATICS II AND
SURVEYING II
June/July 2023
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING TECHNOLOGY
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;*
- Drawing instruments;*
- Scientific calculator;*
- Mathematical table.*

This paper consists of EIGHT questions in TWO sections; A and B.

Answer FIVE questions choosing at least TWO questions from section A and B and ONE other question from either 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 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.

$\frac{4-1^2}{9-1^2}$

SECTION A: MATHEMATICS II

Answer at least TWO questions from this section.

1. (a) Find the values of $\frac{2-i}{3+i} + \frac{2+i}{3-i}$ (5 marks)
- (b) Given that $z_1 = 4 - 3i$ and $z_2 = 2 + i$, evaluate x and y given that $x + iy = \frac{1}{z_1 - z_2} + \frac{1}{z_1 z_2}$ (9 marks)
- (c) Solve the equation $3 \cosh 2x = 3 + \sinh 2x$ correct to three decimal places. (6 marks)
2. (a) Given that $z = x \tan^{-1}(\frac{y}{x})$, determine at the point (1, 1) the values of:
(i) $\frac{\partial z}{\partial x}$
(ii) $\frac{\partial z}{\partial y}$ (8 marks)
- (b) If $z = 3x^4 \sin y$, use partial differentiation to determine the rate of change in z , if x increases by 3 units/s and y decreases by 1 unit/s at the instant when $x =$ units and $y = \frac{\pi}{6}$ radius. (5 marks)
3. (c) Given that $y = 2e^{4x} \cos 5x$; find
(i) $\frac{dy}{dx}$
(ii) $\frac{d^2y}{dx^2}$
(iii) Hence show that $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 41y = 0$ (7 marks)
3. (a) Find:
(i) $\int x^2 \ln 2x \, dx$
(ii) $\int \frac{t^2 - 4}{3t^3 + 4t^2 - 4t} \, dt$ (9 marks)
- (b) Evaluate $\int_0^1 5x^2 e^{5x} \, dx$ (5 marks)

- (c) The curve $y = 6x - x^2$ is rotated 360° about the $x =$ axis, $x = 0$ and $x = 6$. Find the volume of the solid of revolution produced. (6 marks)

4. (a) Solve the differential equation

$$x^2 \frac{dy}{dx} = x^2 + xy - y^2 \quad (7 \text{ marks})$$

- (b) Find the particular solution to the differential equation.

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 4e^{-2x}$$

- and that $x = 0, y = 0$ and $\frac{dy}{dx} = -1$. (13 marks)

SECTION B: SURVEYING II

Answer at least TWO questions from this section.

- √5. (a) With the aid of sketches describe the following types of curves:

- (i) invert curve;
- (ii) overt curve;
- (iii) compound curve;
- (iv) reverse curve.

(4 marks)

- (b) In a curve ranging exercise, two straights are joined by a curve of radius 200 m with a deflection angle of 70° . If sub chords of 20 m are used in setting out, then determine:

- (i) tangent angle;
- (ii) tangent length;
- (iii) curve length;
- (iv) length of long chord;
- (v) deflection angle for the 20 m chord;
- (vi) deflection angle for the last sub-chord.

(16 marks)

6. (a) The bearing OA and included angle from OA are as shown in table below:

Bearing OA	318°	16"	18°	26"	168°	11"	238°	54"
Angle AOB	331°	14"	194°	25"	212°	14"	116°	12"

Determine the bearing OB in each case.

(8 marks)

- (b) Given below are the co-ordinates of points A and B.

$$\begin{aligned} E_A &= 31178 \\ N_A &= 41612 \\ E_B &= 24560 \\ N_B &= 42190 \end{aligned}$$

Determine the bearing of AB and the distance apart.

(8 marks)

- (c) Convert the following reduced bearings to whole circle bearings

- (i) S20° 30' E
- (ii) N18° 10' W
- (iii) N80° 50' W
- (iv) S27° 20' W

(4 marks)

- ✓7. (a) State **five** factors to be considered when selecting a traverse route.

(5 marks)

- (b) The observed internal angles in a closed traverse of six sides are given in column 2 of the table below:

Angle	Observed value
A	122° 14' 20"
B	136° 13' 10"
C	121° 54' 30"
D	129° 45' 40"
E	129° 47' 10"
F	77° 05' 12"

Adjust and give the values of the observations

(12 marks)

(c) From the given bearings determine the back bearings:

- (i) 67°
- (ii) 131°
- (iii) 348°

(3 marks)

8. (a) Distinguish between the following terms as used in compass traversing:

- (i) open traverse and closed traverse
- (ii) face left reading and face right reading

(6 marks)

(b) With the aid of a sketch, explain how obstruction to sight when setting out a curve from one tangent point using a single theodolite is overcome.

(14 marks)

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