

2705/201 2709/201

2707/201 2710/201

MATHEMATICS II AND SURVEYING II

Oct./Nov. 2022

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.

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

Answer FIVE questions choosing at least TWO questions from section A, at least TWO questions from section B and ONE 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 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.**

SECTION A: MATHEMATICS II
Answer at least TWO questions from this section.

1. (a) Evaluate:

$$\int \frac{(3x+5)dx}{(x+2)(x-3)}$$

(6 marks)

- (b) (i) Sketch the graph of the area enclosed between $y^2 = 8x$, and the line $y = 2x$.

- (ii) Determine the centroid of the area in (i).

(14 marks)

2. (a) Given the function $y = (x+1)^2(x-2)^2$:

- (i) determine the stationary points and their nature;

- (ii) sketch the graph of the function.

(12 marks)

- (b) Determine the Maclaurin's series for the function $f(x) = \ln(1+x)$ upto the fourth term.

(8 marks)

3. (a) Solve the differential equation:

$$\frac{d^2x}{dt^2} - 6\frac{dx}{dt} + 9x = 2e^{5t} \text{ given that when: } t = 0, x = 0 \text{ and } \frac{dx}{dt} = 2.$$

(12 marks)

- (b) The rate of growth of a certain bacteria is directly proportional to the amount present. After 20 minutes, the amount present is 120% of the original amount. Determine how long it would take the bacteria to grow to three times its original value. (8 marks)

4. (a) Given that $z = \cos \theta + j \sin \theta$. Use De-moivre's theorem to prove the identity:

$$\sin 3\theta = 3 \cos^2 \theta \sin \theta - \sin^3 \theta.$$

(5 marks)

- (b) Given the complex numbers:

$$z_1 = -30 + j5$$

$$z_2 = -3 + j p \text{ and}$$

$$z_3 = q + j3$$

Where p and q are real numbers. Determine correct to 2 decimal places the values of p and q if $z_2 z_3 = z_1$. (8 marks)

- (c) Show that $\cosh^{-1} x = \ln \{ x + \sqrt{x^2 - 1} \}$ hence evaluate $\cosh^{-1} 2$.

(7 marks)

SECTION B: SURVEYING II

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

5. Two tangents intersecting at an angle of $150^{\circ}00'00''$ and at a chainage of 1250 m; are to be joined by a simple circular curve of radius 250 m. Given the standard chord of 20 m; compute the setting data for the curve by deflection angle method on a through chainage. (20 marks)
6. (a) Using a well labelled diagram, distinguish between the following terms:
(i) point of tangency and tangent distance;
(ii) intersecting angle and central angle;
(iii) point of curvature and long chord. (12 marks)
- (b) Describe the procedure for setting out a curve by two theodolite method. (8 marks)
7. Table 1 below shows the observed bearings of a closed traverse A, B, C, D, A.

Table 1

Line	Forward bearing
AB	$77^{\circ}30'$
BC	$110^{\circ}30'$
CD	$228^{\circ}00'$
DA	$309^{\circ}50'$

- (i) With the aid of a diagram, calculate the interior angles of the traverse.
(ii) Check on the sum of the resulting angles. (20 marks)
8. (a) Convert the following quadrantal bearings to whole circle bearings:
(i) $N 40^{\circ}15' W$;
(ii) $S 36^{\circ}30' W$;
(iii) $N 26^{\circ}45' E$;
(iv) $S 43^{\circ}30' E$. (4 marks)

(b) Define the following terms as used in compass surveying:

- (i) bearing;
- (ii) true meridian;
- (iii) magnetic meridian.

(8 marks)

(c) Using illustrations, distinguish between the following terms:

- (i) open traverse and closed traverse;
- (ii) departure and latitude.

(8 marks)

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