

Name _____ Index No. _____

2705/201
2707/201
2709/201

Candidate's Signature _____

Date _____

**MATHEMATICS II AND
SURVEYING II**
Oct./Nov 2013
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

- Write your name and index number in the spaces provided above.*
- Sign and write the date of examination in the spaces provided above.*
- You should have a scientific calculator for this examination.*
- This paper consists of **EIGHT** questions in **TWO** sections; **A** and **B**.*
- Answer **FIVE** questions, choosing **TWO** questions from section **A**, **TWO** questions from section **B** and **ONE** question from either section in the spaces provided in this question paper.*
- All questions carry equal marks.*
- Maximum marks for each part of a question are as shown.*
- Candidates should answer the questions in English.*

For Examiner's Use Only

Section	Question	Maximum Score	Candidate's Score
A		20	
		20	
		20	
B		20	
		20	
		20	
TOTAL SCORE			

This paper consists of 20 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) Using Maclaurin's series show that:

$$\sqrt{\frac{1+x}{1-x}} = 1 + x + \frac{x^2}{2}$$

(10 marks)

- (b) Expand $\sin(x+h)$ using Taylor's series up to the term h^3 . Hence find $\sin 30^\circ 21'$ correct to five decimal places. (10 marks)

2. (a) If $f(x) = \cos 2x$

find $f'(x)$, $f''(x)$ and $f'''(x)$

(3 marks)

- (b) If $y = \frac{\sin x}{x^2}$, find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$,

then find $x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + (x^2 + 2)y$.

(17 marks)

3. (a) If $z = 3x^2 + 3y - 5xy^2$, find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$. (2 marks)

- (b) If $p = \ln(x+y)$, find $\frac{\partial^2 p}{\partial x^2} + \frac{\partial^2 p}{\partial y^2}$ (8 marks)

- (c) The deflection y at the centre of a circular plate suspended at the edge and uniformly loaded is given by $y = \frac{kwd^4}{t^3}$ where:

w is total load;

d is diameter of plate;

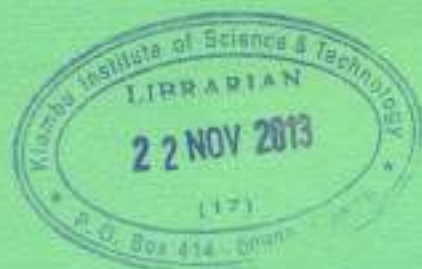
t is thickness and;

k is a constant.

Calculate the approximate percentage change in y if w is decreased by 5%, d is increased by 2% and t is decreased by 3%. (10 marks)

4. (a) Show that $\tanh^{-1} x = \frac{1}{2} \ln \left(\frac{1+x}{1-x} \right)$. (6 marks)

- (b) Express $\cosh 2x$ and $\sinh 2x$ in exponential form and hence solve for real values of x , if $2 \cosh 2x - \sinh 2x = 4$. (14 marks)



SECTION B: SURVEYING II

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

5. (a) Distinguish between the following terms:
- (i) open and closed traverses;
 - (ii) polar and rectangular co-ordinates;
 - (iii) whole circle and reduced bearings.
- (6 marks)
- (b) Outline the purpose of the following parts of a theodolite:
- (i) telescope;
 - (ii) horizontal circle;
 - (iii) vertical circle;
 - (iv) spirit level.
- (8 marks)
- (c) Outline the **three** classes of errors encountered in traversing. (6 marks)
6. Table 2 shows data for a traverse run between datum stations TEK and YOT. Given the datum co-ordinates Table 1:

Table 1

STATION	N(m)	E(m)
TEK	+11619.20	+9877.41
YOT	+9774.73	+8372.97

Table 2

Line	Bearing	Distance (m)
TEK-PT1	236°15'55"	473.05
PT1-PT2	223°37'15"	393.10
PT2-PT3	219°31'06"	432.41
PT3-PT4	219°28'05"	716.28
PT4-YOT	194°57'00"	425.00

Compute the final adjusted co-ordinates of the new points PT1, PT2, PT3 and PT4. (20 marks)

7. The centre line of a road consists of two straights joined by a curve of radius 600 m. The deflection angle between the two straights is 18°24'. If the curve is to be set out using the angle of deflection method on chords of 20 m interval. Tabulate the data required to set out the curve, given the chainage of the intersection point as 2140.00 m. (20 marks)





8. (a) With the aid of diagrams:

(i) Distinguish between a transition and a vertical curve as used in curve ranging.

(ii) Outline the elements of a simple circular curve.

(14 marks)

(b) Outline the **two** purposes of a transition curve.

(6 marks)

