

2306/302  
SURVEYING  
Oct./Nov. 2022  
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN QUANTITY SURVEYING

SURVEYING

3 hours

INSTRUCTIONS TO CANDIDATES

*You should have the following for this examination:*

*Answer booklet;*

*Scientific calculator;*

*Answer any FIVE of the following EIGHT 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 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.**



1. (a) With the aid of a sketch show that external distance of a simple circular curve is given by the expression  $R(\sec \frac{\Delta}{2} - 1)$ . (5 marks)
- (b) A simple circular curve is to be set out with pegs at every 30 m continuous chainage 2745.95 m. If the deflection angle of the curve is  $45^{\circ}30'35''$  and the minimum distance of the curve from the intersection of the two straights is 35 m, calculate:
- the radius of the curve;
  - the chainages at the beginning and end of the curve;
  - the deflection angles of first, subchord, standard chord and last sub chord. (15 marks)
2. The following are bearing observations extracted from a traverse field book.

@ Q

R:  $346^{\circ}30'25''$ S:  $256^{\circ}33'20''$ K1:  $107^{\circ}10'13''$ 

@ K1

Q:  $287^{\circ}10'38''$ K2:  $109^{\circ}10'57''$ 

@ K2

K1:  $289^{\circ}11'10''$ K3:  $91^{\circ}58'52''$ 

@ K3

K2:  $271^{\circ}58'42''$ V:  $92^{\circ}33'47''$ 

@ V

K3:  $272^{\circ}33'55''$ X:  $81^{\circ}57'33''$ Y:  $130^{\circ}28'15''$ 

## Datum bearings

Q - R:  $346^{\circ}30'35''$ S - Q:  $76^{\circ}33'28''$ V - X:  $81^{\circ}57'30''$ Y - V:  $310^{\circ}28'23''$ 

Prepare a traverse bearing sheet.

(20 marks)



3. **Table 1** shows observations made using a tacheometer fitted with an anallactic lens, calculate:
- the distance PQ;
  - the reduced levels of P and Q.

(20 marks)

**Table 1**

Instrument Station	Staff Station	Horizontal Circle reading	Vertical Circle Reading	Stadia hair readings	
				Mid	Bottom
R	P	135°48'30"	86°30'15"	0.855	0.255
	Q	179°28'13"	92°12'18"	1.750	1.000

4. (a) Define each of the following terms as used in levelling:
- datum surface;
  - vertical line;
  - foresight;
  - reduced level.
- (6 marks)
- (b) State **four** characteristics of contours. (4 marks)
- (c) During a two-peg -test with a dumpy level, , the readings 1.860 m and 1.615 m were read on R and S respectively with the instrument set mid-way on a line 100 m long. If readings 1.725 m and 1.610 m were taken over R and S respectively with the instrument 10 m from S on line R - S produced, determine the correct reading on R and S. (10 marks)

5. (a) Differentiate between the following terms used in theodolite surveying:
- temporary and permanent adjustments;
  - face left and face right readings.
- (8 marks)
- (b) A sewer line is to be constructed to run 100 m at a falling gradient of 1:80 from manhole K to manhole L. Using the data in **table 2**, calculate:
- staff reading of intermediate sights at K and L if a backsight taken on benchmark is 2.685 m.



- (ii) the height of the sight rails at K and L if the boring rod is 3.75 m.

(12 marks)

**Table 2**

	Reduced levels (m)
Bench mark	134.920
Ground level at L	132.533
Ground level at K	132.628
Invert level at K	130.850

6. (a) State **four** characteristics of a mass-haul diagram. (4 marks)

- (b) A proposed embankment on a ground sloping at 1 in 25 has side slopes of 1 in 2.5. If the width of the embankment is 14 m and its formation height is 3.5 m above the ground, determine:

- (i) the side widths;  
 (ii) the area of the cross-section.

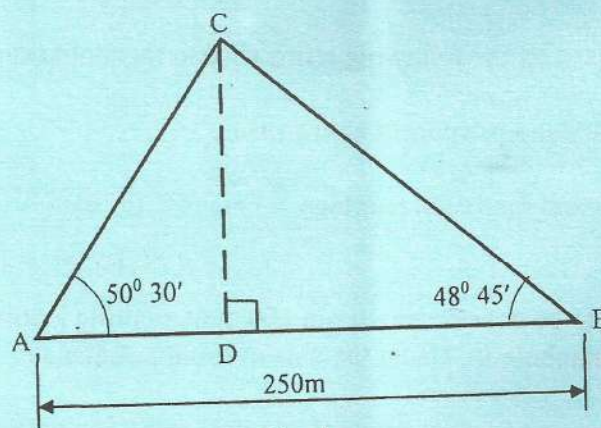
(16 marks)

- 183 7. (a) Distinguish between geodetic surveying and plane surveying. (4 marks)

- (b) Explain the **three** classes of errors in chain surveying stating **two** examples in each case. (9 marks)

- (c) A 50 m tape was used to measure a baseline and a distance of 487.365 m was recorded. If the tape was later calibrated and found to be 49.857 m, calculate the correct length of the baseline. (3 marks)

- (d) Calculate the distance CD shown in **figure 1**. (4 marks)

**Fig. 1**

8. (a) Convert the following whole circle bearings to quadrantal bearings:

(i)  $65^{\circ}35'32''$ ;

(ii)  $125^{\circ}28'19''$ ;

(iii)  $254^{\circ}20'25''$ ;

(iv)  $310^{\circ}32'15''$ .

(4 marks)

(b) Compute join PR, given the coordinates of P and R:

	EASTINGS (m)	NORTHINGS (m)
P	-6498.95	+5276.82
R	-4893.78	+4360.46

(6 marks)

(c) With the aid of a sketch outline the procedure of setting out a rectangular building using a theodolite and a tape. (10 marks)

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