

2306/302
SURVEYING
Oct./Nov. 2017
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.

This paper consists of EIGHT questions.

Answer any FIVE questions in the answer booklet provided.

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 6 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. Two straights TI and UI intersect at point I. The bearings of the straights are $28^{\circ} 29' 31''$ and $268^{\circ} 50' 52''$ respectively. The straights are joined by a circular curve which must pass through point P situated 150 m on a bearing of $202^{\circ} 10' 20''$ from I. Determine:
- the radius of the curve;
 - the tangent length;
 - the length of the first sub chord and last sub chord if the chainage of U is 2313.46 m;
 - the deflection angles of the first sub chord the standard chord and the last sub chord if the standard is 25 m.
- (20 marks)
2. ✓ Table 1 shows the bearings and distances from a traverse between datum points S and P. Use the datum co-ordinates given in table 2 to compute the adjusted co-ordinates of the new points by the Bowditch method. (20 marks)

Table 1

LINE	BEARING	DISTANCE (m)
S-MI	$40^{\circ} 27' 10''$	3721.42
$M_1 - M_2$	$38^{\circ} 37' 10''$	2973.20
$M_2 - M_3$	$357^{\circ} 21' 20''$	2714.24
$M_3 - M_4$	$27^{\circ} 37' 35''$	4003.70
$M_4 - M_5$	$153^{\circ} 17' 20''$	2573.40
M5 - P	$150^{\circ} 17' 20''$	2974.78

Table 2

LINE	NORTHING	EASTING
S	-317374.70	- 427013.20
P	-310843.18	-418380.37

3. (a) With the aid of a sketch, show that in vertical staff tacheometry;
- $H = KS \cos^2 \theta + C \cos \theta$
 - $V = \frac{1}{2}KS \sin 2\theta + C \sin \theta$

Where; C and K are constants
 S = Staff intercept
 θ = Vertical angle
 V = Vertical component
 H = Horizontal distance

(8 marks)

- (b) Table 3 shows readings of a tachometric exercise with the instrument set at station A.

Table 3

Staff Station	Staff Readings		Horizontal circle reading	Vertical circle reading
	Middle	Lower		
B	2.540	1.830	315° 20' 15"	82° 33"
C	3.364	2.914	139° 53' 17"	95° 18"

If the instrument has an anallatic lens, calculate:

- (i) horizontal distances, AB, AC and BC;
- (ii) difference in height between B and C.

(12 marks)

4. (a) Define each of the given terms as used in levelling:

- (i) height of instrument;
- (ii) back sight;
- (iii) benchmark;
- (iv) intermediate sight;
- (v) line of collimation.



(5 marks)

- (b) State four characteristics of contours.

(4 marks)

- (c) With the aid of a sketch, show that the correction for curvature of the earth in levelling is given by:

$$X = \frac{(\text{measured distance})^2}{\text{diameter of the earth}} \quad (6 \text{ marks})$$

- (d) Table 4 shows staff reading from a reciprocal levelling exercise across a wide river. Determine the:

- (i) True difference in level between Y and X.
- (ii) Reduced level of point Y if the reduced level of point x is 98.74 m above datum.

(5 marks)

Table 4

Instrument Station	Staff Station	Staff Readings (m)
P	x ₁	1.5842
P	y ₁	0.8514
Q	x ₂	1.2227
Q	y ₂	0.4911

5. (a) Figure 1 shows a parcel of land with an irregular boundary. Lengths of offsets from PQ to the irregular boundary are recorded in table 5. Determine the area of the parcel using Simpson's rule. (11 marks)

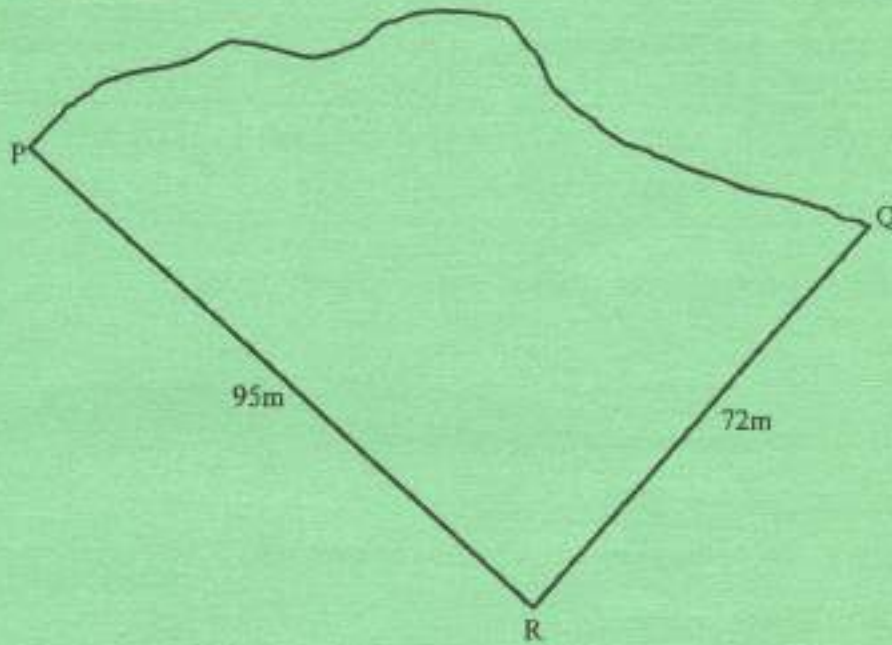


Fig. 1

Table 5

Chainage (m)	0	10	20	30	40	50	60	70	80	90	100	110
Offset (m)	0	6.5	7.4	8.3	8.9	9.2	7.7	5.9	4.0	1.5	1.0	0

- (b) Figure 2 shows the plan of a building site to be excavated vertically to a uniform reduced level of 60 m. The reduced levels at the corners are as indicated. Determine the volume of excavation by prismoidal formula. (9 marks)



Fig. 2

6. (a) Point M was fixed from two datum points K and L. Horizontal circle readings observed from L were as follows:

Horizontal circle reading to K = $179^{\circ} 16' 33''$

Horizontal circle readings to M = $102^{\circ} 45' 57''$

The coordinates of L and K are as shown in **table 6**.

If the distance from L to M is 1217.63 m, determine the coordinates of M.

(12 marks)

Table 6

Point	Northings (m)	Eastings (m)
L	6956.57	31052.99
K	3976.31	27542.49

- (b) Outline the procedure of carrying out each of the following adjustments on an optical reading theodolite:

(i) centering;

(ii) levelling.

(8 marks)

7. ✓ (a) Explain the **three** classes of errors encountered in chain surveying and state **two** examples in each case. (9 marks)

- (b) Two points A and B are on a sloping ground. The elevations of A and B are 175.5 m and 170 m respectively and the distance along the ground is 225.60. Calculate the horizontal distance AB. (4 marks)

- (c) With the aid of a sketch, explain **two** indirect methods of determining horizontal distances on a sloping ground. (7 marks)

8. (a) Distinguish between plane surveying and 'geodetic surveying'. (4 marks)
- (b) In order to fix sight rails for a sewer line excavation, levelling was done and readings recorded as in table 7. Determine the:
- (i) Reduced levels of A and B by rise and fall method;
- (ii) Height of sight rail at A and B if a 2.75 m boning rod is to be used. (16 marks)

Table 7

BS	IS	FS	Remarks
2.39			BM (RL = 122.00 m)
	1.81		Ground level at A
	1.51		Invert level at A
1.61		0.88	Change point
	1.32		Ground level at B
		2.52	Invert level at B

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