

2306/302
SURVEYING
June/ July 2019
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,
drawing instruments,
scientific calculator.

Answer 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.

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Turn over

1. (a) With the aid of a sketch, show four elements of a curve. (4 marks)
- (b) A circular curve is to be set out with pegs at every 30 m intervals between two straights intersecting at chainage 2638.57 m. If the deflection angle of the curve is $52^{\circ}30'00''$ and the minimum distance of the curve from the intersection point of the two straights is 35 m, calculate the:
- (i) radius;
 - (ii) chainages at the beginning and end of the curve;
 - (iii) deflection angles for the first and last subchords.
- (16 marks)

2. (a) With the aid of a sketch outline the process of determining tacheometric constants. (6 marks)
- (b) **Table 1** shows tacheometric headings to a vertical staff held at points M and N, from a tacheometer with anallactic lens set up at R. If the reduced level of M is 525.35 m, determine the:
- (i) reduced level of N;
 - (ii) horizontal distance of M and N from the instrument station.
- (14 marks)

Point	Vertical angle	Readings on vertical staff
M	$-7^{\circ}36'$	2.605, 1.920, 1.235
N	$-4^{\circ}25'$	1.955, 1.075, 0.195

3. (a) State three sources of error in levelling. (3 marks)
- (b) **Table 2** show staff readings from a field level book. Determine the reduced levels of the points by the rise and fall method applying the necessary arithmetic checks. (17 marks)

Backsight	Intermediate Sight	Foresight	Remarks
1.653	2.936		
	1.998		
	2.143		
3.777	3.260	2.575	BM(RL = 205.75 m)
	2.208		
		1.636	



4. (a) Define each of the following terms as used in mass haul diagrams:

- (i) free haul;
- (ii) lead;
- (iii) haul distance;
- (iv) lift.

$K = 2w$
 $m = 2$
 $b = 10$ (6 marks)
 $h = 3.5$

(b) A proposed embankment on a ground sloping at 1 in 20 has side slopes of 1 in 2. If the formation width is 10 m and the formation height is 3.5 m, determine the:

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



$$w_1 = \left(\frac{b}{2} + hm\right) \left(\frac{K}{K+m}\right)$$
 (10 marks)

$$w_2 = \left(\frac{b}{2} + hm\right) \left(\frac{K}{K-m}\right)$$
 (4 marks)

(c) Outline four characteristics of a mass haul diagram.

5. (a) Using the field notes and datum bearings shown in table 3 (a) and (b). Compute the adjusted bearings for the traverse. (8 marks)

$$A = \frac{1}{2} m \int (w_1 + w_2) \left(\frac{1}{2} + hm\right)$$

Table 3(a)

Station	Observed bearings
At S F.N.P.	
Y	105° 58' 45"
Tri	15° 57' 03"
At Tri	
S	195° 56' 54"
P	65° 15' 53"
At P	
Tri	245° 15' 49"
Q	287° 33' 39"

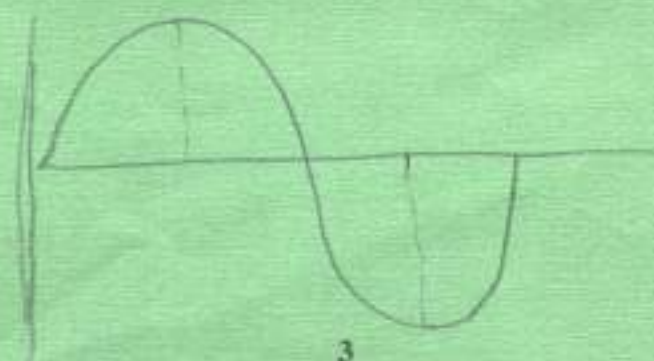


Table 3(b)

LINE	Datum bearings
S - Y	125° 58' 55"
P - Q	287° 33' 34"



$w_1 = 10.110$
 $w_2 = 13.333$



- (b) A point Q lies half-way between R and S. Determine the bearing and distance between Q and T given the following datum co-ordinates.

Point	Northings (m)	Eastings
R:	+ 5266.95	- 4495.83
S:	+ 5303.56	- 3028.95
T:	+ 4340.65	- 2873.57

(12 marks)

6. (a) Define each of the following terms as used in a theodolite:

- (i) changing face;
- (ii) centering;
- (iii) swinging;
- (iv) transiting.

handwritten notes:
level
level
level

handwritten note:
three following

(6 marks)

- (b) Outline **three** permanent adjustments for a theodolite.

(3 marks)

- (c) With the aid of a sketch, outline the procedure of setting out a culvert perpendicular to the centreline of a road.

(11 marks)

7. (a) Outline **two** classes of obstacles in chain surveying stating **one** example for each.

(4½ marks)

- (b) Explain the **three** classes of error encountered in chain surveying giving **one** example in each case.

(7½ marks)

- (c) (i) A 50 metre tape was used to measure a distance of 398.685 m. If the tape was later calibrated and found to be 49.845 m, calculate the correct length.

- (ii) If the height difference between two points 150 m apart on a slopping ground is 1.865 m, calculate the horizontal distance between them.

(5 marks)

- (d) Explain each of the following types of survey:

- (i) aerial survey;
- (ii) cadastral survey.

(3 marks)

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obstacul



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

- (i) $78^{\circ} 32' 15''$
- (ii) $141^{\circ} 14' 28''$
- (iii) $273^{\circ} 45' 26''$
- (iv) $234^{\circ} 38' 15''$

(4 marks)

(b) In order to fix sight rails for a sewer line excavation, levelling was carried out and booking done as shown in table 4.

- (i) reduce the levels by height of collimation method;
- (ii) if a 3.50 m boning rod was to be used, determine the height of sight rails at A and B.

(16 marks)

Table 4

BS	IS	FS	Remarks
2.59			BM (RL = 207.88 m)
	2.45		Ground level at A
	2.85		Invert level at A
1.95		1.18	Change point
	1.67		Ground level at B
		2.87	Invert level at B

*BS - RL = HI
 HI - IS = RL*

Handwritten calculations:

BS	IS	FS	Height of Instrument (HI)	RL	Remarks
2.59			210.47	207.88	BM
	2.45			208.02	208.02
	2.85			207.62	213.32
1.95		1.18	211.24	209.29	
	1.67			209.57	209.52
		2.87		208.37	

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Handwritten calculations:

$4.54 - 4.05 = 208.37 - 207.88$

$0.49 \quad 0.49$

