THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN LAND SURVEYING

LAND SURVEYING THEORY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Scientific calculator;
Answer booklet;
This paper consists of EIGHT questions.
Answer FIVE questions.
All questions carry equal marks.
Maximum marks for each part of a question are as shown.
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) Define each of the following terms as used in levelling:

   (i)   level surface;
   (ii) datum; → the reference with known elevation :-
   (iii) forecast;
   (iv) change point; → it where the foresight and backsight reading are observed ;
   (v)   reduced level → This is the point given as the bench mark

(5 marks)

   (b) Table 1 shows an extract of a levelling field note-book. If some figures have become obliterated from the booking use the information in the table to:

   (i)   deduce the missing entries and carry out usual arithmetic checks.
   (ii) Calculate the gradient from Q to R.

(15 marks)

Table 1

Bs	Is	Rise / Fall	Rise	Fall	Reduced level (m)	Distance (m)	Remarks
2.92					219.235	0	A
	.571		1.349		220.584	20	B
	2.983			1.412	219.175	35	C
	1.317		1.666		220.838	50	D
0.038		2.921		1.604	219.234	65	E
	1.138			1.174	218.06	80	Q
	1.564			0.394	217.666	95	F
___		2.884		1.320	216.346	110	G
	2.214			1.802		125	H
		0.977		___		170	R

2. (a) State four methods of determining volumes of earth works.   (4 marks)

   (b) Table 2 shows measurement made from a survey line RS to an irregular boundary of a parcel as shown in figure 1. Lines RT and ST are 90 m and 74 m respectively. Compute the area in hectares of the whole parcel using Simpson's rule for the curvilinear.

(16 marks)

Table 2

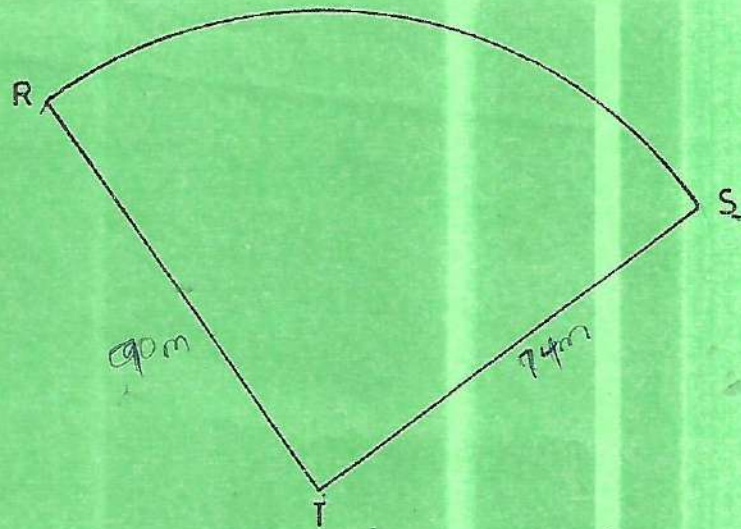| Change(m)	0	20	40	50	60	75	90	100	110
Offset(m)	4.5	5.4	6.3	6.9	7.2	5.7	3.9	2.0	0

Fig.1

3. The observations shown in **table 3** were taken with a theodolite fitted with an anallactic lens to a vertically held stuff. If the reduced level f A is 1895.613 m, calculate the gradient of BC. (20 marks)

Table 3

Instrument Station	Staff Station	Horizontal Angle	Vertical circle Reading	Stadia hair readings	
				Top	Mid
A	B	25° 30' 15"	274° 30' 30"	3.190	2.395
	C	75° 25' 30"	267° 25' 15"	3.880	3.340

4. (a) State the **five** corrections applied to linear measurements with chain in catenary. (5 marks)

   (b) With the aid of diagram(s) describe the procedure of traversing as a method of plane tabling. (15 marks)

select traverse station A B C
set up the table above the point over one station
select the point suitable
Mark it with a magnetic direction
with alidade touching sight B and draw away
Measure the distance AB and scale of ab that fixing

5. **Figure 2** shows a traverse run between two control points N and K. Using measured bearing from the figure and datum bearings in **table 4**, determine the final bearing of the traverse lines.
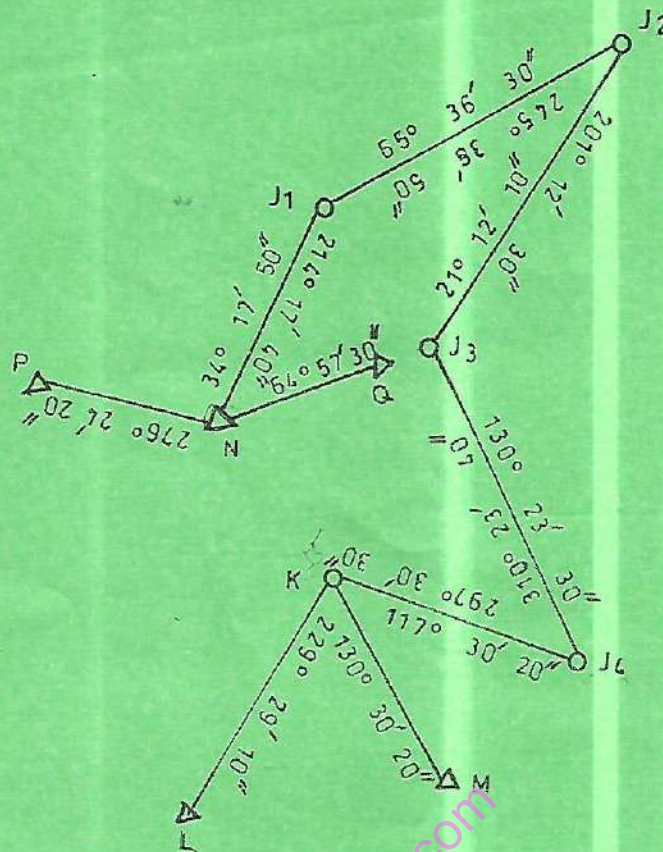
(20 marks)

Fig. 2

Table 4

Line	Datum Bearing
N - P	276° 24' 30"
N - Q	64° 57' 22"
K - L	229° 29' 20"
K - M	130° 30' 16"

6. **Table 5**, shows values of partial co-ordinates of a traverse calculated from field observation. If the traverse was run between R1 and R2 whose datum co-ordinates are given as:

	N	(m)	E
R1:	1835.68		1266.29
R2:	1946.05		1373.44

(i) Determine the relative accuracy of the traverse.

(ii) Calculate the adjusted co-ordinates of K1, K2, K3 and K4 using Bowditch's method of adjustment.

(20 marks)

Table 5

Line	Distance (m)	△N	△E
R1 - KI	104.55	+101.23	+26.40
K1 - K2	208.99	+158.32	+136.45
K2 - K3	212.47	−59.76	+203.84
K3 - K4	215.88	−158.57	−146.52
K4 - R2	131.08	+68.21	−112.09

7.　(a)　The following horizontal circle readings were observed at traverse station P to other traverse stations. Reduce the observations in readings for bearing sheet preparation.

@P

T1	T2	T3	T4
53° 25' 30"	76° 28' 10"	88° 30' 48"	255° 30' 04"
278° 36' 04"	301° 38' 20"	313° 41' 18"	120° 40' 40"

(6 marks)

(b)　Describe the **three** temporary adjustments performed on a theodolite before making observations.

(14 marks)

8.　A sewer line, 180 m long is to be laid with a fall gradient of 1: 150 from A to B The ground levels at A and B are 2127.310 and 2127.450 m respectively. If the invert level of B is 2125.460 m and the length of sight rail above the ground at B is 1.65 m; determine:

(i)　length of the boning rod;
(ii)　height of fixing sight rail at A;
(iii)　the invert level at A.

(20 marks)

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