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.

Turn over

1. (a) Define each of the following terms as used in contouring:

    (i)   contour interval;
    (ii)   horizontal equivalent;
    (iii) contour line;
    (iv)   gradient;
    (v)   spot height.

                                                                    (5 marks)

    (b) The following staff readings were taken on a construction site at 20 m intervals along
         a continuously rising ground:

         3.726, 3.268, 2.326, 1.747, 1.168, 0.558, 3,576,
         2.753, 2.021 (BM RL = 950.635 m),
         1.442, 0.619

         (i)   Rule out a page of a level note book and enter the readings.

         (ii)   Reduce the levels by height of collimation method applying the
                necessary arithmetic checks;

         (iii) Calculate the gradient of the levelled line from the second point to second last
                point.

                                                                    (15 marks)

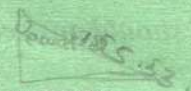2. (a) Outline **three** advantages and **four** disadvantages of plane table surveying.

                                                                    (14 marks)

    (b) (i)   Determine the horizontal length of a line measured as 125.53 m on a sloping
                ground of -03° 30' 15".

         (ii)   The reduced levels of two points A and B, 55 m apart are 1650.00 m
                and 1651.56 m respectively, evaluate the horizontal distance between them.

                                                                    (6 marks)

3. **Figure 1** shows a circular curve to be set out using 30 m standard chords on a through chainage
    basis between two straights deflecting at an angle of 28° 30' 30".

    Using the information on the figure, calculate:

    (i)   radius of the curve, R;
    (ii)   chainage of the first tangent point, T_1;
    (iii) Sub-chord lengths;
    (iv)   deflection angles for the first sub chord, standard chord and last sub chord.

                                                                    (20 marks)

Ch·T₁ Ch·I - Tan length.

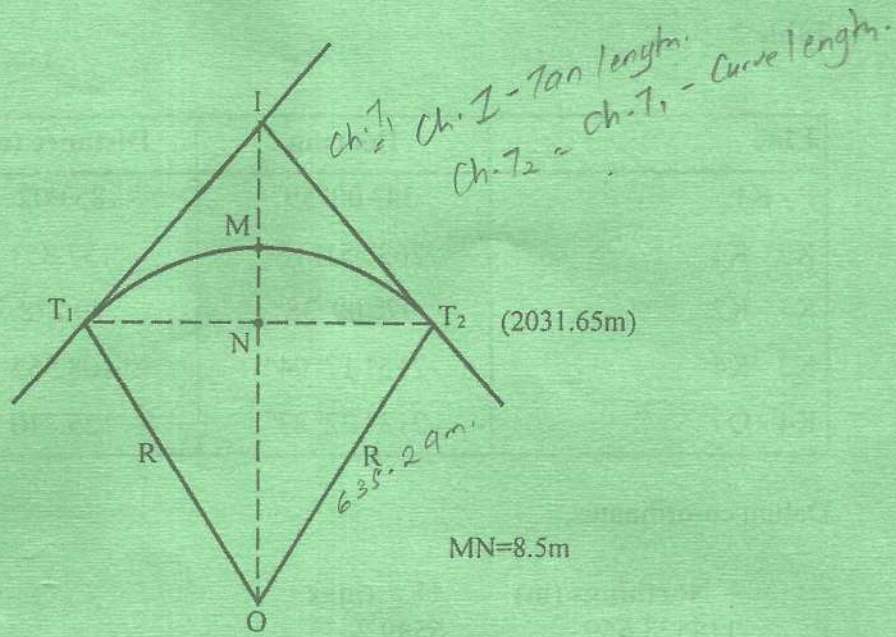Ch·T₂ = Ch·T₁ - Curve length.

T₂ (2031.65m)

R 635·29m

MN=8.5m

Fig. 1

4. A section of a proposed road is to run through a cutting from chainage 90 m to 490 m, the formation level falling at 1 in 250 from chainage 90 m. The formation width is to be 16 m and the side slope are to be 1 in 3.

The original ground surface is inclined uniformly at right angles to the centre-line at 1 in 20.

From the information given in **table 1**, calculate the volume of excavation, using end area formula.

Table 1

Chainage (m)	Formation level (m)	Ground level at centre line (m)
90	185.86	192.72
190		192.45
340		192.57
490		192.70

5. Table 2 shows an extract of reduced bearings and distances for traverse run between two datum stations P and Q. Use the information in the table and the datum co-ordinates to compute and adjust the traverse by Bowditch's method and evaluate its accuracy.

(20 marks)

P	ΔE	ΔN
K₁	47·155	74·561
K₂	-134·626	-9·276
K₃	89·870	
K₄	-47·255	
K₂	-51·378	
Q		

Table 2

Line	Bearing	Distance (m)
P - K1	34° 00' 59"	85.002
K2 - K1	263° 51' 16"	157.853
K3 - K2	97° 09' 38"	79.278
K3 - K4	215° 17' 04"	108.555
K4 - Q	213° 22' 27"	125.710

Datum co-ordinates.

	- Northings (m)	+Eastings
P:	114523.669	6589.243
Q:	114619.850	6584.005

6. **Table 3,** shows observations made using a tacheometer fitted with an anallactic lens. If the staff was held normal to the line of sight. Calculate:

(i)   the distance PQ;
(ii)   the reduced levels of P and Q.

(20 marks)

Table 3

Instrument station	Staff station	Bearing	Vertical circle reading	Hair readings	
				Mid	Bottom
N	P	20° 30'	96° 12'	1.513	0.965
	Q	85° 30'	82° 55'	1.349	0.898

7.   **Figure 2** shows a closed traverse with exterior angles. If the bearing of M to N is 269° 45' 30", determine the bearings of ML, LK, KJ, JH and HN.
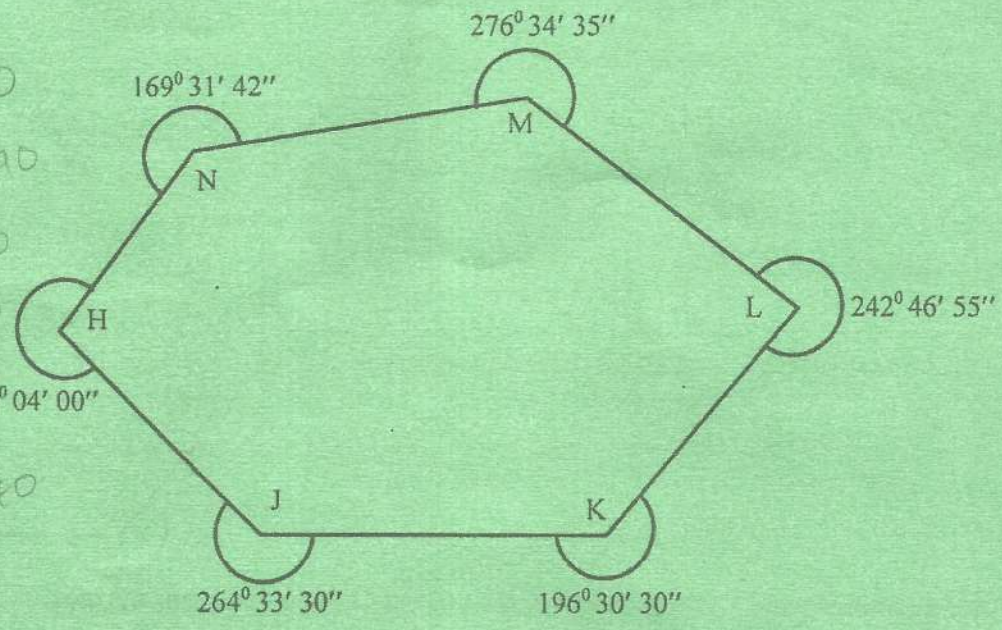
(20 marks)

Fig. 2

8. (a) Explain the procedures of setting up a theodolite in readiness for taking observations.
(12 marks)

(b) A bench mark of reduced level 2001.50 exists close to the site to be contoured. Explain how contour lines 1998.50 and 2003.50 will be obtained directly if the staff reading to the bench mark is 3.56 m. (8 marks)

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