THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN WATER TECHNOLOGY
(WATER SUPPLY OPTION)
(WASTE WATER OPTION)

SURVEYING

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
  Answer booklet;
  Scientific calculator.
Answer ***FIVE*** *of the following* ***EIGHT*** *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 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. (a) With the aid of a sketch, describe the use of sight rails in the control of excavations in sewer construction. (5 marks)

(b) A sewer is to be laid between two points A and B and the data for profile levelling is given in **table 1**. The invert level at A is 112.250 m and the gradient of AB is to be 1 in 150, B being at lower level than A. At the setting out stage the level was set up close to its previous position and a back sight of 0.698 m was recorded on the staff held at the B.M. Determine:

(i) length of the traveller;
(ii) the height of rails above ground level at A and B;
(iii) the staff reading required for fixing of sight rails at A and B.

(15 marks)

Table 1

Point	B.S.	I.S.	F.S.	H.I.	Distance (m)	R.L.	Remarks
1	0.744			117.064	-	116.320	B.M. = 116.320 m
2		3.036			0		A
3		2.808			30		
4		2.671			60		
5		3.026			90		
6		3.131			120		B
7			0.744				B.M.

2. (a) (i) State **six** parts of a planimeter, *polar arm, Pole block*

(ii) Explain **two** ways in which a polar planimeter may be used. *arm outside, arm inside* (11 marks)

(b) (i) **Figure 1** shows an embankment on a level surface. Derive an equation for the area of the cross section.

(ii) The embankment shown in **figure 1** has a formation width of 10 m and side slopes are 1:1 (H:V), and the ground surface is level. Using the prismoidal formula, determine the volume of excavation between two cross-section 100 m apart. Take vertical depths at the end cross-sections as 3 m and 5 m respectively. (9 marks)
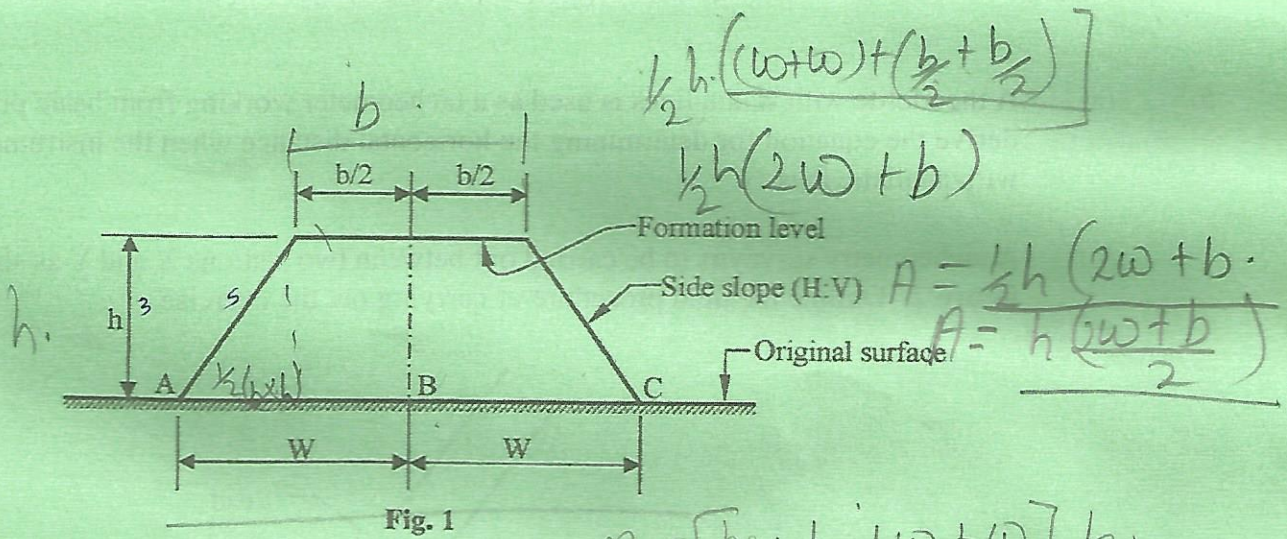
Fig. 1

Handwritten annotations around figure:
$$\tfrac{1}{2}h\left[(\omega+\omega)+\left(\tfrac{b}{2}+\tfrac{b}{2}\right)\right]$$
$$\tfrac{1}{2}h(2\omega+b)$$
$$A=\tfrac{1}{2}h(2\omega+b)$$
$$A=\frac{h(2\omega+b)}{2}$$
$$A=\left[\tfrac{b}{2}+\tfrac{b}{2}+\omega+\omega\right]h$$
$$=(b+2\omega)h$$
$$2\omega$$

3. (a) Explain the following methods of contouring:

    (i) direct method of contouring;

    (ii) indirect method of contouring.

    (10 marks)

    (b) State the following with reference to contours in surveying:

    (i) **five** characteristics of contours;

    (ii) **three** differences between contour interval and horizontal equivalent;

    (iii) **two** factors governing the selection of contour interval.

    (10 marks)

4. (a) State **three** advantages and **three** disadvantages of chain surveying. (6 marks)

    (b) Explain **three** types of errors in chain surveying. (7 marks)

    (c) Sketch symbols for the following in chain surveying:

    (i) unfenced road;
    (ii) footpaths;
    (iii) marsh;
    (iv) building;
    (v) bridge.

    (5 marks)

    (d) A line was measured with a chain believed to be 20 m long, which gave a length of 420.6 m. On checking the chain, it was found to be 20.05 m. Determine the actual length of the line. (2 marks)

5.　(a)　A theodolite with stadia lines is used as a tacheometer working from basic principles, derive the equation for determining the horizontal distance when the instrument is fitted with anallatic lens.　(12 marks)

　　(b)　A tacheometry survey is to be carried out between two stations X and Y as shown in **figure 2**. Outline the field procedure of carrying out the exercise.　(8 marks)
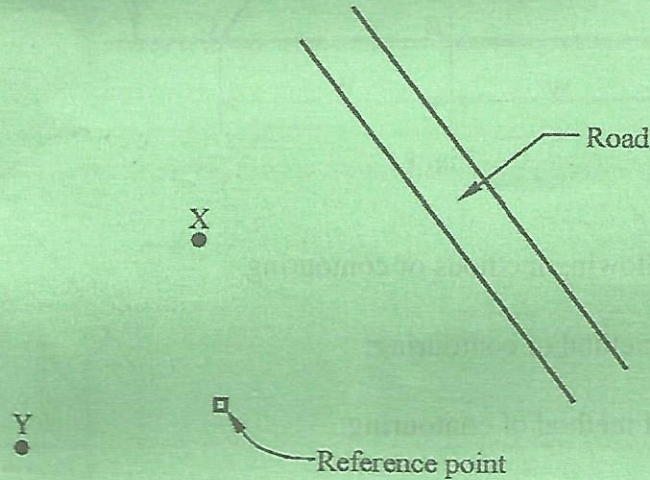

Fig. 2

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

　　　(i)　magnetic meridian;
　　　(ii)　whole circle bearing;
　　　(iii)　forward bearing;
　　　(iv)　secular variations;
　　　(v)　diurnal variations;
　　　(vi)　local attraction. – Caused by

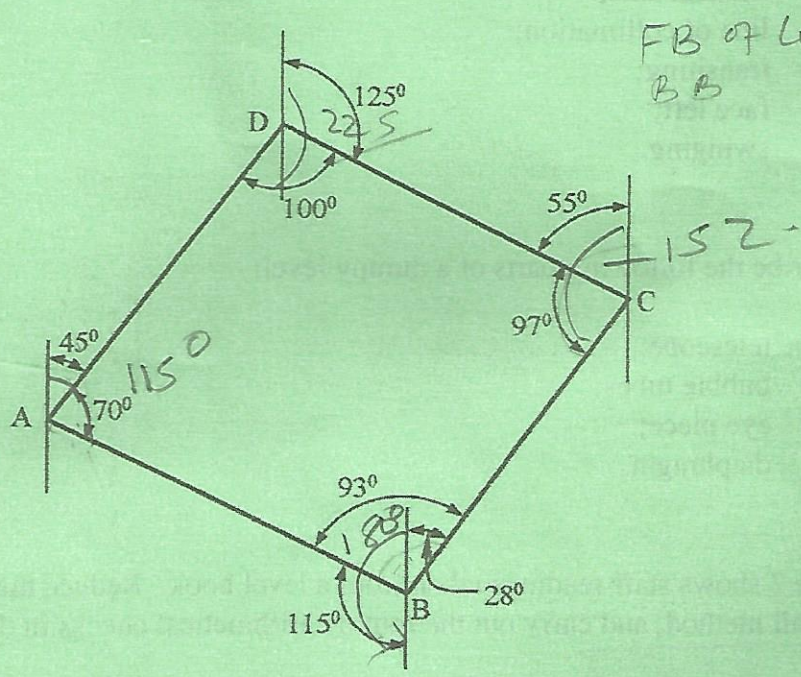　　　　　　　　　　　　　　　　　　　　　　　　(6 marks)

　　(b)　Describe the following types of traverse:

　　　(i)　closed traverse; end at the same point/opp.
　　　(ii)　open traverse;
　　　(iii)　compass traversing.

　　　　　　　　　　　　　　　　　　　　　　　　(6 marks)

(c) **Figure 3** shows a closed traverse. Determine the forward bearing and backward bearing for each of the lines of the traverse. (8 marks)

FB of Line AB = 185°.
BB   AB = 180

Fig. 3

AB = FB AB =

7. (a) (i) State **four** differences between an aerial photograph and a map;

(ii) State **three** uses of a contoured map.

(7 marks)

(b) Explain each of the following characteristics in aerial photo interpretation:

(i) shape and size;
(ii) colour tone;
(iii) shadow;
(iv) pattern.

(10 marks)

(c) Vertical photographs at a scale of 1:20,000 are to be taken for an area whose mean ground level is 600 m above mean level. Determine the flying height above mean sea level if the focal length of the camera is:

(i) 210 mm;
(ii) 152 mm.

(3 marks)

1:20,000 = 6000M

$(2h-4)90$
@ 90
-4

1:20 000
216:

8. (a) Define the following terms used in theodolite surveying:

    (i)   vertical axis;
    (ii)   line of collimation;
    (iii) transiting;
    (iv) face left;
    (v)   swinging.

(5 marks)

(b) Describe the following parts of a dumpy level:

    (i)   telescope;
    (ii)   bubble tubes;
    (iii) eye piece;
    (iv) diaphragm.

(6 marks)

(c) **Table 2** shows staff readings taken from a level book. Reduce the levels using the rise and fall method, and carry out the routine arithmetical checks in the completed entries.

(9 marks)

Table 2

B.S.	I.S.	F.S.	Remarks
1.32			Peg A
	2.43		B
	1.15		C
	1.72		D
5.06		0.22	E
	4.79		F
	4.47		G
	3.25		H
		1.84	Datum of R. L. 30.00

$\Sigma BS - \Sigma FS = Last - Fig RL : Rise - Fall$

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lens