



# **THE KENYA POLYTECHNIC**

## **SURVEYING & MAPPING DEPARTMENT**

### **HIGHER DIPLOMA IN LAND SURVEY**

#### **END OF YEAR I EXAMINATIONS**

**NOVEMBER 2006**

#### **SURVEY ADJUSTMENTS**

**3 HOURS**

#### **INSTRUCTIONS TO CANDIDATES:**

You should have the following for this examination:

Answer booklet

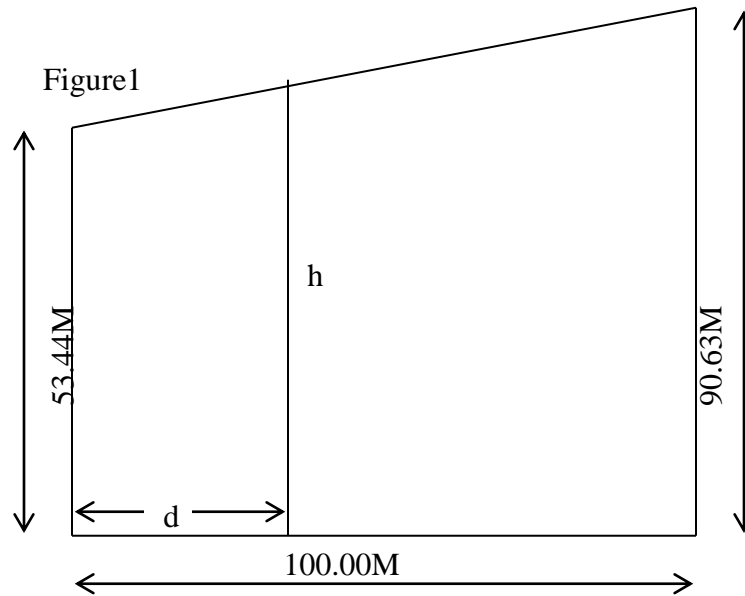
Calculator/Mathematical tables

Answer any FIVE of the following EIGHT questions.

All questions carry equal marks and the maximum marks for each part of a question are as shown.

This paper consists of 4 printed pages.

- Q1 (a) Explain the following as used in survey adjustment:-
- i. Error
  - ii. Precision
  - iii. Residual
  - iv. Accuracy
- (8 marks)
- (b) Figure 1 shows a parcel of land trapezoidal in shape. The measured distance  $d = 30.65\text{M}$  has an error of  $0.025\text{M}$ . Compute :-
- i. The ordinate  $h$
  - ii. The error in the computed value of  $h$
- (12 marks)



- Q2 (a) Explain the aim of adjustment of adjustment of survey measurements.
- (4 marks)
- (b) Discuss the types of errors in survey measurements.
- (16 marks)
- Q3 (a) Give reasons for linearizing equations in survey adjustments .
- (4 marks)
- (b) State the basis of linearization.
- (2 marks)
- (c) Linearize the function :-

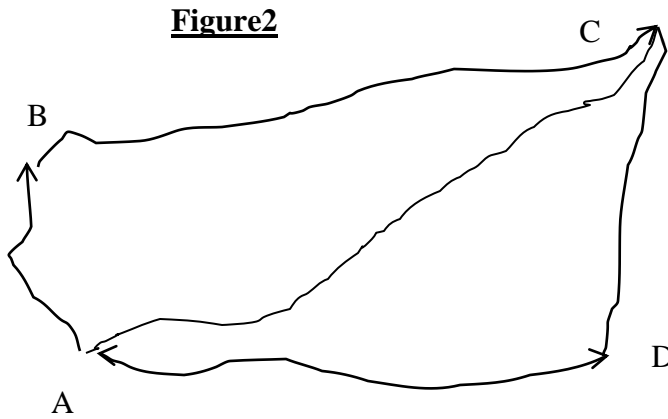
$$y = [(100)^2 + x^2 - 200x \cos \theta]^{1/2}$$

at  $x_0 = 80.00\text{M}$  and  $\theta = 40^\circ 00'$  according to basis in (b).

(14 marks)

Q4 Figure 2 shows leveling network run from a benchmark A whose elevation is 1214 880M through new points B,C and D Determine the most probable heights of the new points using least squares method if the observations are :-

Line	difference in height (m )
AB	+61.478
BC	+16.994
CD	-25.051
DA	-54.437
AC	+78.465



Q5 An observer measured an angle TEN times with the same theodolite under the same condition. The result of the observations agreed in degrees ( 40° ) and minutes ( 53' ) but differed in seconds as follows :-  
 25", 25", 29", 30", 23", 26", 30", 30", 36", 27", 19", 31", 21", 27", 22", 28",  
 32", 26", 28" and 27"

Find :-

- i. The most probable value
- ii. The standard deviation
- iii. The standard error of the mean ( 20 marks )

Q6 (a) Write a Jacobian matrix of a multivariate function. (4 marks)

(b) Given :

$$A_1 = \frac{1}{2}y_1y_3 + \frac{1}{2}y_2y_3$$

and  $A_2 = \frac{\pi}{8}y_3^2 + \frac{1}{2}y_1y_3$

- i. Evaluate the jacobian matrix  $y_1 = 50$  ,  $y_2 = 20m$  ,  $y_3 = 30m$
- ii. If errors in  $y_1$  ,  $y_2$  ,and  $y_3$  are 0.2, -0.04 ,and 0.03 respectively evaluate errors in  $A_1$  and  $A_2$ . (16 marks)

Q7 (a) Define the term REDUNDANCY. (2 marks)

(b) State the basis of least squares method of adjustment. (3 marks)

(c) Explain error propagation as used in survey adjustments. (5 marks)

(d) Distinguish between DIRECT and INDIRECT methods of least square adjustment. (10 marks)

Q8 Figure3 shows angles observed at point O.Using the results in table 1,compute the most probable values of the angles  $\hat{A}OB$  ,  $\hat{B}OC$  , and  $\hat{C}OD$ .

Angle	Observed value
$\hat{A}OB$	25° 18' 30"
$\hat{B}OC$	40 20 25
$\hat{C}OD$	30 30 35
$\hat{A}OC$	65 38 52
$\hat{B}OD$	70 51 02
$\hat{A}OD$	96 09 31

