



STUDENT NUMBER:

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SURNAME:
(FAMILY NAME)

OTHER NAMES:

**This paper and all materials issued must be returned at the end of the examination.
They are not to be removed from the exam centre.**

Examination Conditions:

It is your responsibility to fill out and complete your details in the space provided on all the examination material provided to you. Use the time before your examination to do so as you will not be allowed any extra time once the exam has ended.

You are **not** permitted to have on your desk or on your person any **unauthorised material**. This includes but not limited to:

- Mobile phones
- Smart watches
- Electronic devices
- Draft paper (unless provided)
- Textbooks (unless specified)
- Notes (unless specified)

You are **not** permitted to obtain assistance by improper means or ask for help from or give help to any other person.

You are **not** permitted to leave your seat (including to use the toilet):

- Until 90 mins has elapsed
- During the final 15 mins

During the examination **you must first seek permission** (by raising your hand) from a supervisor before:

- Leaving early (after 90 mins)
- Using the toilet
- Accessing your bag

Disciplinary action will be taken against you if you infringe university rules.

48320 Surveying

Friday, 13 June 2014.

Time Allowed: 3 hours and 10 mins

Includes 10 minutes of reading time.

Reading time is for reading only. You are not permitted to write, calculate or mark your paper in any way during reading time.

This is a Closed Book exam

Please refer to the permitted materials below:

Permitted materials for this exam:

- Calculators (non-programmable only)
- Drawing instruments
i.e. Rulers, Set Squares and Compasses
-

Materials provided for this exam:

- This examination paper

Students please note:

- Questions are NOT of equal value
- Answer the questions on the examination paper in the spaces provided

Do not turn over or open your exam paper until instructed.

Rough work space

Do not write your answers on this page.

QUESTION 1 (23 Marks)

At station 1, a horizontal angle and a sloped distance was measured to point D.

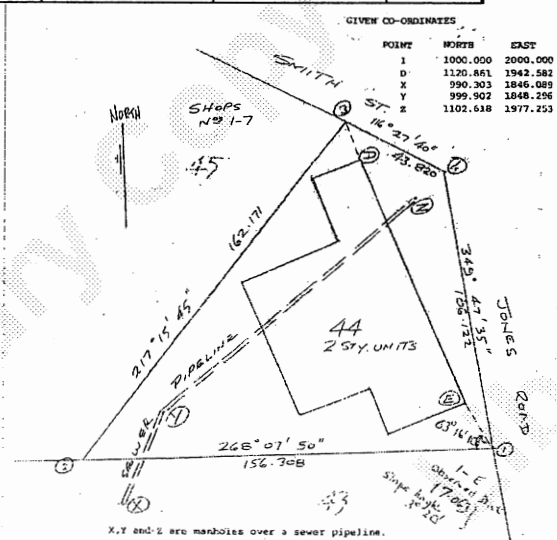
Using the table of coordinates and the information shown in the diagram below calculate:

- a) (10 Marks) the linear misclose and proportional accuracy of the boundary lines 1-2, 2-3, 3-4 and 4-1;
- b) (3 Marks) the coordinates of stations 2, 3 and 4;
- c) (3 Marks) the bearing and distance of the pipeline from Z to Y and
- d) (7 Marks) the length of the wall DE

A larger diagram of the traverse with extra working space is shown on the next page.

(Please work to three decimal places)

LINE	Adjusted Bearing	Horiz. Dist	Δ E		Δ N		CO-ORD INATES		PT.
			E (+)	W (-)	N (+)	S(-)	E	N	
							1000.000	1000.000	1
1-2									2
2-3									3
3-4									4
4-1									1
									Z
Z-Y									Y
							1000.000	1000.000	1
1-E									E
									D
D-E									E

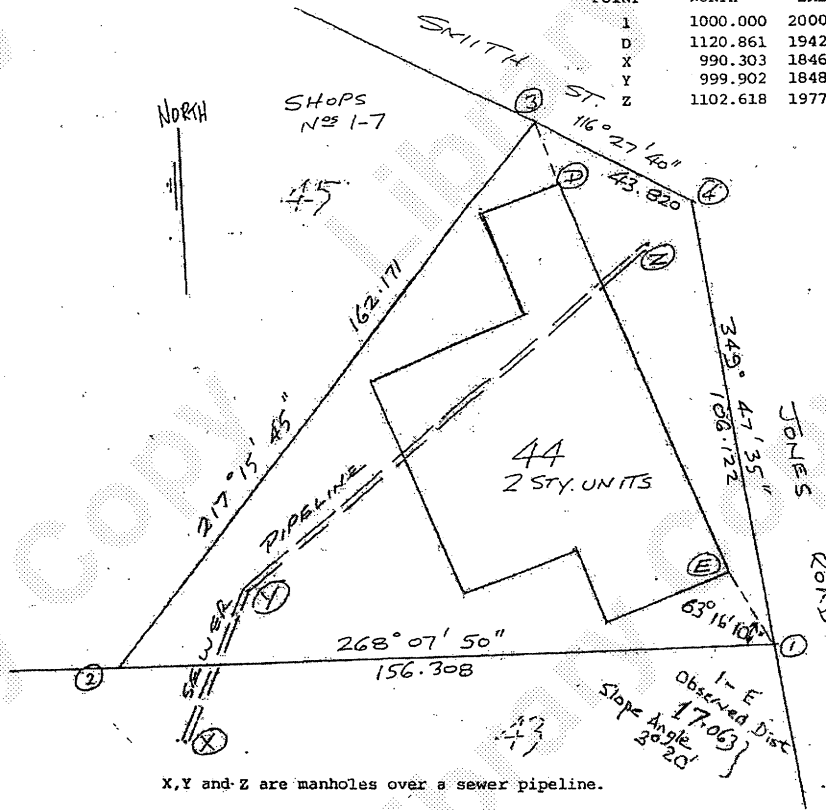


Linear Misclose Proportional Accuracy
 Show coordinates of 2, 3, and 4 in the traverse table.
 Bearing and distance of pipeline Z-Y
 Length of wall DE

WORKING SPACE and larger diagram for QUESTION 1
 (Please write your answers in the spaces provided on the previous page.)

GIVEN CO-ORDINATES

POINT	NORTH	EAST
I	1000.000	2000.000
D	1120.861	1942.582
X	990.303	1846.089
Y	999.902	1848.296
Z	1102.618	1977.253



QUESTION 2 (20 Marks)

A builder is required to construct a circular driveway as shown to join the tangent line XA to the existing garage. Points A and B are the tangent points on the curve and O is the centre.

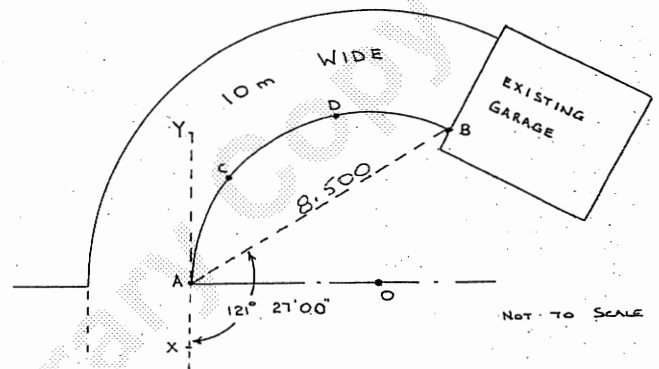
A theodolite was set up at point 'A' and the angle XAB and the distance AB measured as shown

TWO (2) pegs are to be placed at **equal distances** along the arc AB at points C and D.
Calculate the following set out information:

a) (6 Marks) the exact radius for the given data;

For all further calculations use a radius of 5.000m regardless of your answer to a)

- b) (2 Marks) the arc length AB;
- c) (2 Marks) the arc length CD;
- d) (4 Marks) the angles BAC and BAD;
- e) (2 Marks) the chord distance CD;
- f) (4 Marks) the distance along, and the offset from, the chord AB, to points C and D.



a) the exact radius calculated from the given data

Using a radius of 5.000m

b) the arc length AB

c) the arc length CD

d) the angles BAC and BAD

e) the chord distance CD

f) the distance along the chord AB for point C the offset for C.....

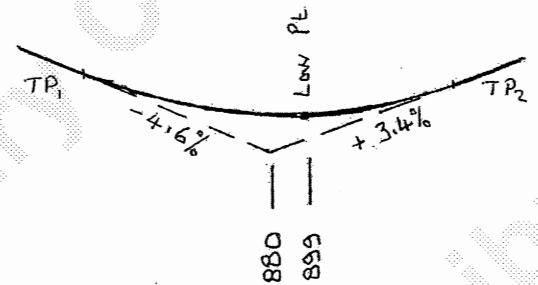
the distance along the chord AB for point D the offset for D.....

QUESTION 3 (18 Marks)

A vertical curve is to be designed on a road, to join a falling grade of 4.6 % to a rising grade of 3.4%. The Low Point on the curve needs to be close to chainage 899.0 and the Intersection Point is fixed at chainage 880.0m and an R.L. of 56.500m.

- a) Calculate the EXACT length of a vertical curve to place the low point exactly at chainage 899.0. (8 Marks). For the rest of the calculations please adopt a vertical curve length of 260.0m and continue.
- b) Calculate the chainages and R.L.s of T.P.1 and T.P. 2 and place them into the table below. (4 Marks)
- c) Complete the table below calculating the grade levels, ordinates and design levels at ALL the points nominated on the table, including T.P.1 and T.P. 2. (6 Marks)

Chainage	Grade	Grade Level	Ordinate	Design Level
T.P.1	-4.6%			
800	↓			
I.P. 880.0	▼	56.500		
930	↑			
T.P. 2	+3.4%			



ANSWERS

- a) Exact length of vertical curve
- b) Enter chainages and R.L.s of T.P.1 and T.P. 2 into the table.
- c) Complete other values in the table.

QUESTION 4 (22 Marks)

a) (8 marks)

A pathway is to be constructed across a culvert between points "A" and "B" as shown on the sketch below.

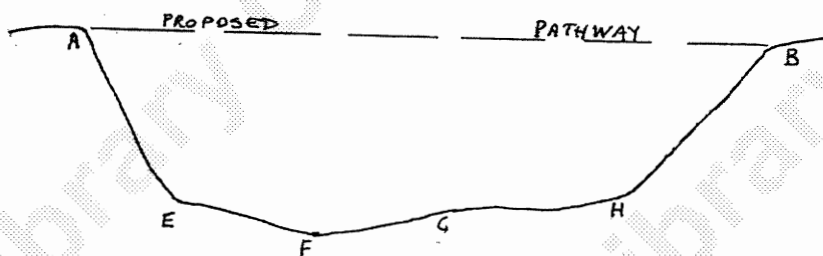
The pathway is to be of constant grade between "A" and "B".

Levels have been taken along the ground below the proposed pathway at the chainages as shown. The space between the pathway and the ground below is to be filled.

The new pathway is to be 3 metres wide and have vertical sides.

Calculate the volume of earth to fill the area between the path and the existing ground below the path.

Point	Chainage	Reduced Level
A	350	27.03
B	500	19.53
E	370	12.13
F	400	11.60
G	430	12.20
H	470	13.1

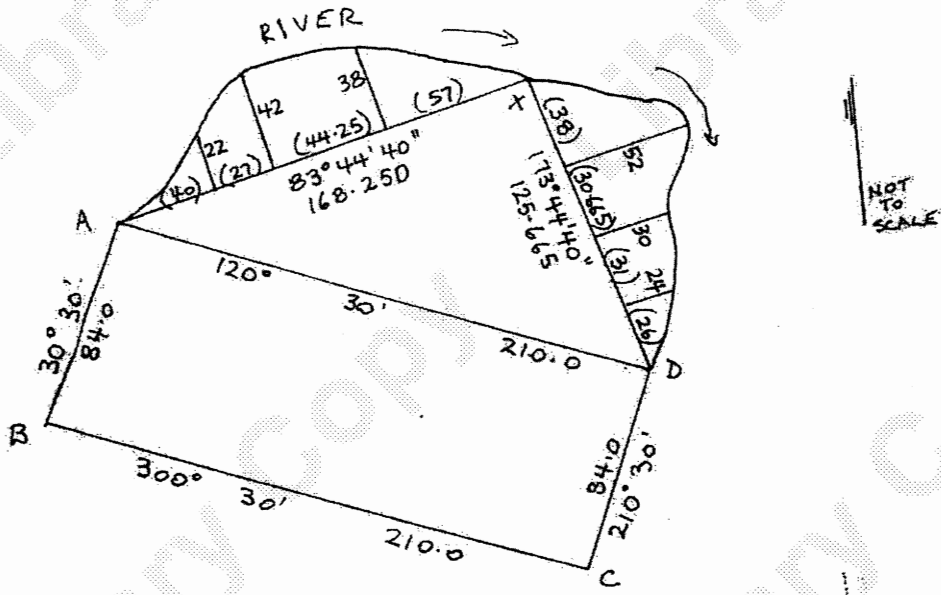


Volume required.....

QUESTION 4 (cont.)

b) (8 marks)

Calculate the area of the block of land in the figure shown below. The land includes the area bounded by A, B, C, D, the river bank between D and X and the river bank between X and A.



Area A, B, C, D..... Area AXD.....
 Offset area AX..... Offset Area XD.....

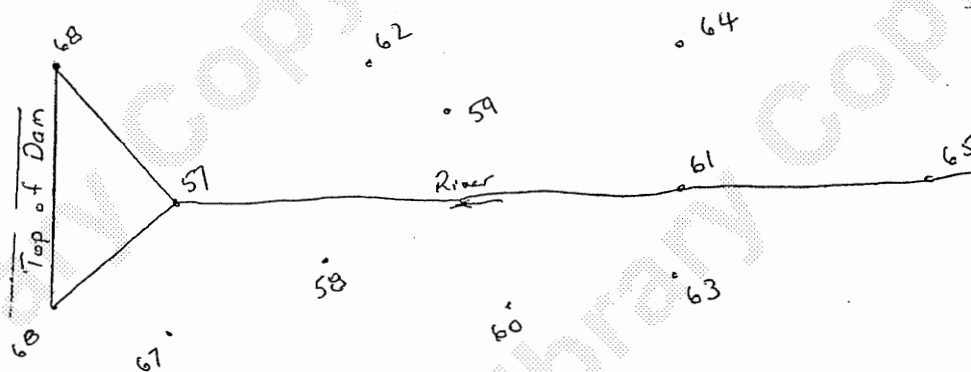
QUESTION 4 (cont.)

c) (6 marks)

An earth fill dam is to be built in a river valley. The face of the dam is to be of constant slope from a base level of R.L. 57 to a top level of R.L. 68 as sketched.

A few other spot levels are shown in the area. The river is of constant slope between the points labelled.

Sketch on the diagram contours at a 5m contour interval. LABEL EACH CONTOUR CLEARLY. Do not calculate the contour positions, but interpolate by eye.



QUESTION 5 (17 Marks)

In the following questions, circle the most correct answer (2 marks each)

When using a total station and computer package to prepare a detail survey:-

- a) A Registered Surveyor is require to take the measurements
- b) Data must be obtained from a Government Department
- c) Data can be stored and transferred to a computer witho0ut manually recording measurements
- d) Bar codes are used to obtain measurements
- e) The plan is drawn automatically without the need for any further input from the operator.

A motorised total station:

- a) Can be used by a single operator
- b) Is controlled remotely
- c) Can excavate to a pre-determined Reduced Level
- d) Can record measurements
- e) Can automatically set up over a point

To improve accuracy of GPS surveys:

- a) Readings are repeated over a number of weeks
- b) Readings from at least two satellites must be obtained
- c) Readings are taken simultaneously from a base station and remote unit
- d) Points must be visible from each other
- e) Points must be at the same Reduced Level

In a horizontal curve, the chainage of the second tangent point is:

- a) The chainage of the first tangent point plus the length of the long chord
- b) The chainage of the Intersection Point plus the tangent length
- c) The chainage of the first tangent point plus the long arc length
- d) The chainage of the first Tangent Point plus 2 x the tangent length
- e) The chainage of the first tangent point plus the external distance

Which of the following is NOT a Cadastral Survey:

- a) A subdivision
- b) An identification survey
- c) A detail and level survey
- d) A pegout survey
- e) An Easement survey

In the following questions BRIEFLY answer the question in the space provided.

(3 marks)

An owner has constructed a building which is partly on the neighbour's land. List three (3) ways which this can be legally rectified.

1)

2)

3)

(4 marks)

List two methods of setting out horizontal curves and for each give one example of a situation where that method would be suitable.

SURVEYING FORMULAE SHEET

$$OM = \frac{L(G_2 - G_1)}{800}$$

$$PQ = \frac{4.x^2.OM}{L^2}$$

$$d = \left(\frac{G_1}{G_1 - G_2} \right) L$$

$$\text{Tangent Distance} = R \cdot \tan \left(\frac{\Delta}{2} \right)$$

$$\text{Secant Distance} = R \cdot \sec \left(\frac{\Delta}{2} \right)$$

$$\text{External Distance} = R \left(\sec \frac{\Delta}{2} - 1 \right)$$

$$\text{Mid Ordinate} = R \left(1 - \cos \frac{\Delta}{2} \right)$$

$$\text{Chord} = 2 \cdot R \cdot \sin \frac{\Delta}{2}$$

$$\text{Arc} = R \cdot \Theta^{\text{rad}}$$

$$\text{Arc} = R \cdot \Theta^{\text{deg}} \cdot \frac{\pi}{180}$$

$$\delta = \frac{\text{arc}}{2 \cdot R} \times \frac{180}{\pi}$$

$$\text{Chord} = 2 \cdot R \cdot \sin \delta$$

$$y_0 = R - \sqrt{R^2 - (c/2)^2}$$

$$y_1 = y_0 - \left[R - \sqrt{R^2 - x^2} \right]$$

$$\text{Grade} = \frac{\Delta h}{\text{Hor. Dist.}} \times \frac{100}{1}$$

$$\text{Area} = \pi \cdot R^2$$

$$\text{Sector} = \frac{1}{2} \cdot R^2 \cdot \Theta$$

$$\text{Segment} = \frac{1}{2} \cdot R^2 (\Theta - \sin \Theta)$$

$$\text{Area} = \frac{1}{2} \cdot (N_1 \cdot E_2 + N_2 \cdot E_3 + \dots + N_N \cdot E_1) - (E_1 \cdot N_2 + E_2 \cdot N_3 + \dots + E_N \cdot N_1)$$

$$\text{Volume} = \frac{w}{2} \cdot (A_1 + 2 \cdot A_2 + 2 \cdot A_3 + \dots + 2 \cdot A_{n-1} + A_n)$$

$$\text{Volume} = \frac{\text{Area}}{4} \cdot \left(\sum d_1 + \sum 2 \cdot d_2 + \sum 3 \cdot d_3 + \sum 4 \cdot d_4 \right)$$