Cover Type B

University of Technology, Sydney

TO BE RETURNED AT THE END OF THE EXAMINATION.
THIS PAPER MUST NOT BE REMOVED FROM THE EXAM CENTRE.

SURNAME: _____

FIRST NAME: _____

STUDENT NUMBER: _____

COURSE: _____

SPRING SEMESTER, 2003

SUBJECT NAME: SURVEYING

SUBJECT NO.: 48320

DAY/DATE: SATURDAY 15 NOVEMBER 2002

TIME ALLOWED: TWO Hours plus TEN Mins reading time

START/END TIME: 2:00 pm - 4:10 pm

NOTES/INSTRUCTIONS TO CANDIDATES:

Attempt ALL questions.
Write the answers in the spaces provided.
The questions are NOT of equal value. Marks for each part are shown adjacent to that part of a question.
THIS IS A CLOSED BOOK EXAM.
Calculators and drawing instruments are allowed.
Formulae are provided at the end of the examination paper.
If not enough room for working has been provided, please use the back of adjacent pages.

QUESTION 1 (14 Marks)
A traverse was run as shown in the traverse table below.

Calculate the misclose of the traverse. **(6 Marks)**
It is <u>not required</u> that you calculate the coordinates of the points unless you wish to do so.
It was suspected that one of the distances had an error of exactly 1m when it was recorded. Determine the most likely line to be suffering this error and state the length that the line should be after the 1m correction has been made. **(2 Marks)**

Having made the correction calculate the misclose of the traverse and its proportional accuracy. **(6 Marks)**

LINE	Bearing	Horiz. Dist	Δ E		Δ N		CO-ORD INATES		PT.
			E (+)	W (-)	N (+)	S(-)	E	N	
							750.000	2340.500	A
A - B	62° 30'	155.76							B
B – C	147° 52'	250.37							C
C – D	213° 02'	148.98							D
D – A	324° 11'	325.775							A

ANSWERS
Original Traverse Misclose .....

Line suffering the error ..... Its length after correction applied.....

Final Traverse Misclose ..... Proportional Accuracy .....

P.T.O.

QUESTION 2 (18Marks)

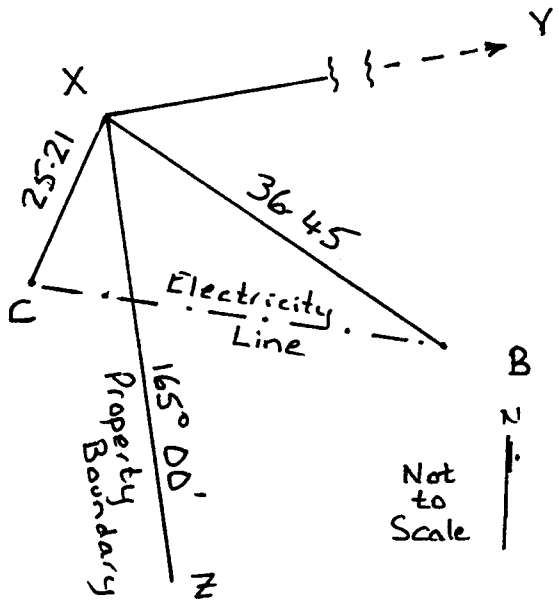
Given the coordinates listed below, calculate the bearing of the line XY. **(2 Marks)**

Cooordinates

Point	East	North
X	3102.300	1245.600
Y	3606.719	1451.963

This line was used as an azimuth for some radiations to electricity poles B and C, as tabulated in the booking sheet below. Calculate the bearing for each line XB and XC. **(4 Marks)**

The horizontal distances XB and XC were observed as noted on the diagram at right.



Theodolite set up at X

Target	Face Left	Face Right	Mean
Y	0° 00' 00"	180° 00" 00"	
B	45° 20' 40"	225° 22" 10"	
C	143° 55' 10"	323° 57" 00"	

Calculate the coordinates of B and C and the bearing of the line BC. Place your answers in the boxed cells in the table below. **(4 Marks)**

LINE	Bearing	Horiz. Dist	Δ E		Δ N		CO-ORD INATES		PT.
			E (+)	W (-)	N (+)	S(-)	E	N	
							3102.300	1245.600	X
X -B		36·45							B
							3102.300	1245.600	X
X -C		25·21							C
B - C									

ANSWER

Bearing of XY .....

P.T.O.

Q. 2 (Continued)

The line XZ is a property boundary and the client wishes to know how far along the boundary line from X, the electricity line BC crosses the boundary.
Calculate the distance from X to this point. **(8 Marks)**

(Working Space for Q2)

ANSWER

Distance from X to line BC .....

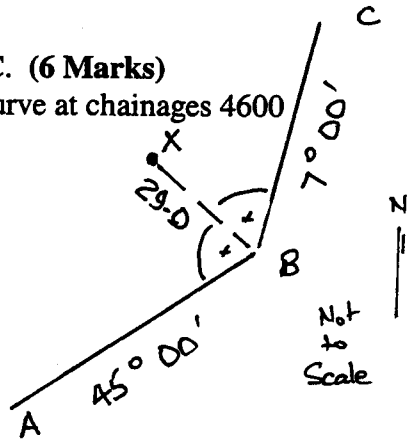
QUESTION 3 (16 Marks)

Two straights AB and BC with bearings 45° 00' and 7° 00' respectively are to be connected by a circular curve. In order to avoid a local historical monument the curve must pass through a point X which lies on the bisector of the angle ABC at a distance of 29.0m from B.

Calculate the exact radius needed to achieve this. **(6 Marks)**

For safety reasons, it was decided to adopt a radius of 500.0m for the circular curve. The "chainage" of the Intersection Point (B) is 4715.00.

Calculate the running chainages of the tangent points on AB and BC. **(6 Marks)**
Calculate the deflection angles and chords to set out points on the curve at chainages 4600 and 4700. **(4 Marks)**



ANSWERS

Exact radius .....

Chainage of TP on AB ....., Chainage of TP on BC .....

To set 4600: Deflection Angle ....., Chord .....

To set 4700: Deflection Angle ....., Chord .....

P.T.O.

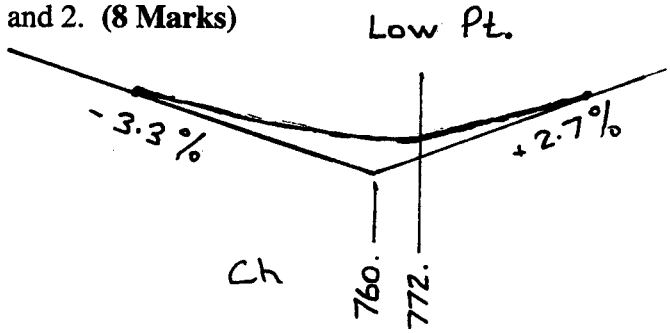
QUESTION 4 (17 Marks)

A vertical curve is to be designed on a road, to join a falling grade of 3.3 % to a rising grade of 2.7%. The Low Point on the curve MUST OCCUR at chainage 772.00 and the Intersection Point is fixed at chainage 760.0m and an R.L. of 43.500m.

a) Calculate the EXACT length of the vertical curve to meet the above requirements. **(7 Marks).** Round your answer to the nearest metre, for the further calculations.
If you can not find the length asked for in part a), please adopt 260m and continue.

b) Calculate the chainages of T.P.1 and T.P. 2 and place them into the table below. **(2 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 2. **(8 Marks)**



ANSWERS

a) Exact length of vertical curve .....

b) Enter chainages of T.P.1 and T.P. 2 into the table.

c) Complete other values in the table.

CHAINAGE	GRADE	GRADE LEVEL	ORDINATE	DESIGN LEVEL
T.P.1( )				
660				
690				
I.P. 760		43.500		
790				
T.P.2 ( )				

P.T.O.

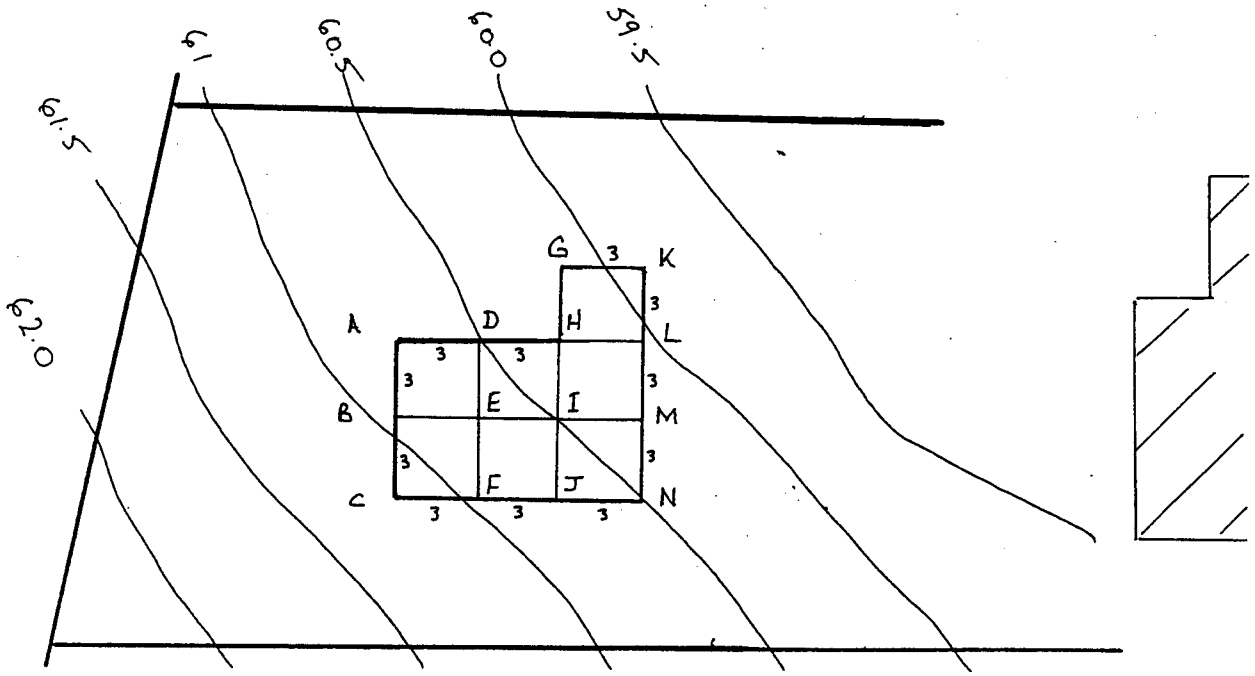
QUESTION 5 (14 Marks)

The contour plan below of the backyard of a house shows the proposed site of a swimming pool. The pool is to be 9m long with the width as shown. A 3m grid has been marked on the plan inside the pool area to assist with estimating the volume of material to be excavated.

At line KN, the bottom of the excavation is to be at R.L. 59.0. From this line the bottom of the pool slopes downwards at 10% towards the other end (line AC).

a) Using the contour plan, estimate and enter into the table below, the natural surface R.L.s at each grid point. (Please work to 1 decimal place). **(3 Marks)**
b) Calculate the R.L.s of the bottom of the pool at each grid point and enter them into the table, **(3 Marks)**
c) Calculate the volume of material to be excavated from the site. **(8 Marks)**

Point	Natural Surface R.L.	Bottom of Pool R.L.	Depth		
A					
B					
C					
D					
E					
F					
G					
H					
I					
J					
K					
L					
M					
N					



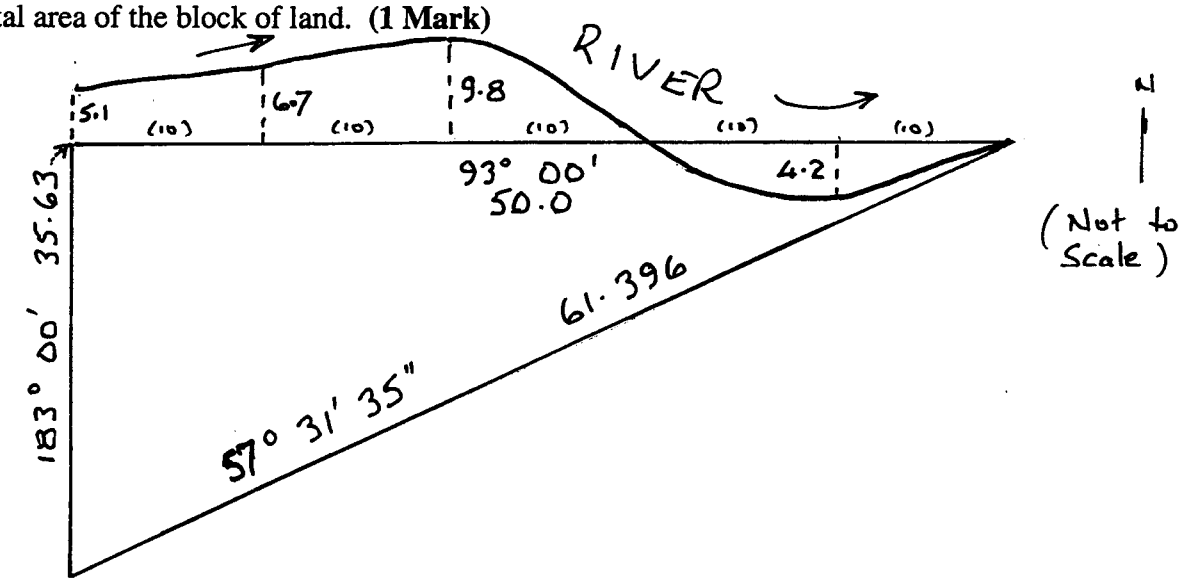
ANSWER

Volume to be removed from the site .....

P.T.O.

QUESTION 6 (9 Marks)

The plan below shows a block of land, of which has one of its boundaries is a river.
Using the dimensions for the (straight) traverse lines calculate the area within the traverse. **(3 Marks)**
Calculate the offset area between the traverse line and river boundary using the offsets shown, **(5 Marks)**, and
the total area of the block of land. **(1 Mark)**



ANSWERS

Area within the traverse lines .....

Offset area ..... Total Area of Block .....

P.T.O.

QUESTION 7 (12 Marks)

a) (3 Marks)

When using a computer package, such as Landmark, to prepare a contour plan it is often necessary to adjust and reshape the triangles that the package prepares. Explain why it is necessary to do this.

b) (2 Marks)

Registered Surveyors are the only people permitted by law to undertake Cadastral Surveys. What are cadastral surveys?

c) (4 Marks)
Surveyors use G.P.S. to locate the positions of control points for highway surveys. Briefly explain how they typically undertake such surveys to make sure they avoid errors that might be introduced into the system because of the G.P.S signals travelling through the atmosphere to reach the receiver/s.

d) (3 Marks)
Laser levels are now very commonly found in the construction industry. Briefly describe how a laser level typically works and list two areas where it might suitably be used.

$$C_{slope} = -L \times \left(1 - \cos\beta\right)$$

$$C_{slope} = -\left[\frac{\Delta h^2}{2L_m} + \frac{\Delta h^4}{8L_m^3}\right]$$

$$C_{temp} = \pm L \times \alpha \times (\Delta t)$$

$$\alpha_{steel} = 11.2 \times 10^{-6}/^0C$$

$$C_{sag} = -\frac{w^2 \times L^3}{24 \times T^2} \times \cos\beta$$

$$Grade = \frac{\Delta h}{HorDist.} \times 100$$

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

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

$$PQ = \left(\frac{G_2 - G_1}{200L}\right) \times x^2$$

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

$$H = 100 \times s \times \cos^2\theta$$

$$V = 100 \times s \times \sin\theta \times \cos\theta$$

$$RL_S = RL_T + HI + V - m$$

$$Tangent\ Dist. = R\tan\frac{\Delta}{2}$$

$$Secant\ Dist. = R\sec\frac{\Delta}{2}$$

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

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

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

$$Arc = R\theta^{rad.}$$

$$Arc = R\theta^{deg} \times \frac{\pi}{180}$$

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

$$Chord = 2R\sin\delta$$

$$y_0 = R - \sqrt{R^2 - \left(\frac{C}{2}\right)^2}$$

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

$$Area = \pi R^2$$

$$Sector = \frac{1}{2}R^2\theta$$

$$Segment = \frac{1}{2}R^2\left(\theta - \sin\theta\right)$$

$$2 \times Area = \left(N_1E_2 + N_2E_3 + \cdots N_NE_1\right) - \left(E_1N_2 + E_2N_3 + \cdots E_NN_1\right)$$

$$Volume = \frac{w}{2}\left(A_1 + 2A_2 + 2A_3 + \ldots..2A_{n-1} + A_n\right)$$

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