Cover Type B

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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: _____

AUTUMN SEMESTER, 2005

SUBJECT NAME: SURVEYING

SUBJECT NO.: 48320

DAY/DATE: SATURDAY 18 JUNE 2005

TIME ALLOWED: TWO Hours plus TEN Mins reading time

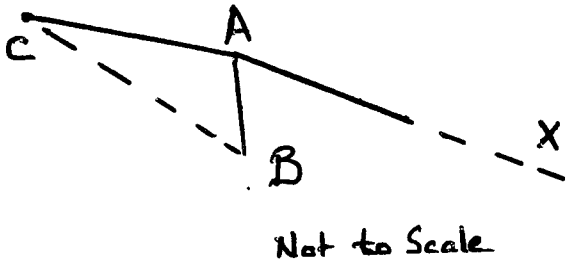
START/END TIME: 2:00 pm - 4:10 pm

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.
All of the diagrams are sketches for illustrative purposes and are not to scale.
If not enough room for working has been provided, please use the back of adjacent pages.

QUESTION 1 (18 Marks)
A theodolite was set up on point A and sighted to point X as azimuth.

Coordinates of Station A: 2560.320 m E, 2893.450 m N
Coordinates of Station X: 2628.042 m E, 2841.013 m N



This sighting was used as an azimuth for some radiations to electricity poles B and C, as tabulated in the booking sheet below.

Theodolite set up at A

Target	Face Left	Face Right	Mean	Horiz. Distance
X	0° 00' 00"	180° 00" 00"		
B	55° 30' 50"	235° 32" 20"		27.45
C	173° 25' 30"	353° 27" 50"		58.36

Calculate:
a) **(4 Marks)** The bearing from A to X.
b) **(4 Marks)** The bearings of the radiations from A to each of B and C
c) **(6 Marks)** The Co-ordinates of Points B and C.
d) **(4 Marks)** The bearing and distance from B to C

ANSWERS
a) Bearing from A to X .....

b) Bearing AB ....., Bearing AC .....

c) Coordinates of B ....., ...

Coordinates of C....., ...

d) Bearing and Distance B to C

P.T.O.

QUESTION 2 (12 Marks)

A closed traverse was run from A via B, C and D and back to A. The adjusted bearings and horizontal distances are shown in the traverse close below.

Calculate the misclose of the traverse. There is no need to find the coordinates of the points What is the proportional accuracy of the traverse close?

LINE	Adjusted Bearing	Dist	Δ E		Δ N		CO-ORD INATES		PT.
			E (+)	W (-)	N (+)	S(-)	E	N	
									A
A-B	314° 27' 00"	87.630							B
B-C	226° 01'00"	86.925							C
C-D	166° 11'20"	33.025							D
D-A	75° 10' 00"	121.265							A

ANSWERS

Misclose ..... Proportional Accuracy .....

P.T.O.

QUESTION 3 (20 Marks)
The I.P. of a falling grade of 3.3% and a rising grade of 4.7% lies at Chainage 405.0 and an R.L. of 22.41. A point 'A', at chainage 255.0, has an R.L. of 27.36, lies on the existing road and must not be altered when a new Vertical Curve is designed.

The new vertical curve should pass exactly through an R.L. of 23.71 at a chainage 150m on from Point 'A'.

a) (6 Marks) Calculate the length of vertical curve needed to exactly meet this criterion. For design simplicity it was rounded off to the nearest metre for further calculations. If you can not find the length needed, adopt L = 150m and continue with the calculations.

b) (10 Marks) Complete the table below, calculating and showing the TP chainages, grade levels, ordinates and Design Levels for the nominated Points.

c) (4 Marks) Also calculate the chainage and R.L. of the Low Point of the Curve.

Chainage	Grade	Grade Level	x	Ordinate	Design Level
'A' 255.0	|	27.36			27.36
TP	-3.3%				
370.0	|				
(IP) 405.0	✕	22.41			
420	|				
TP	4.7%				

LP					

ANSWER
Exact length of VC needed .....

QUESTION 4 (20 Marks)

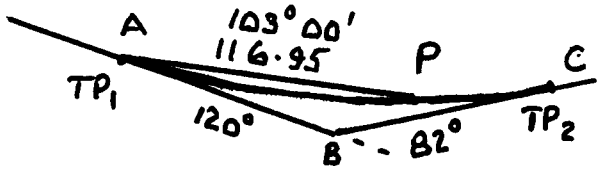
A horizontal curve has to join 2 straights AB and BC, whose bearings are 120° and 82° respectively, as indicated in the diagram. A and C are tangent points
The curve must pass through point P exactly. To locate P, a bearing and a distance was measured from A to P as shown.

a) (6 Marks) Calculate the exact radius for the curve to pass through P. (2 decimal places). If you can not find a radius, please use 210.0m for the remainder of the question.

b) (6 Marks) If the "chainage" of B is 872.3668, calculate the chainages of A and C.

c) (4 Marks) Calculate the chord length from P to C.

d) (4 Marks) Calculate the deflection angle and chord to set a mark at chainage 870.0



ANSWERS

a) Exact Radius to pass through P .....

b) Chainage of A, ...Chainage of C .....

c) Chord PC .....

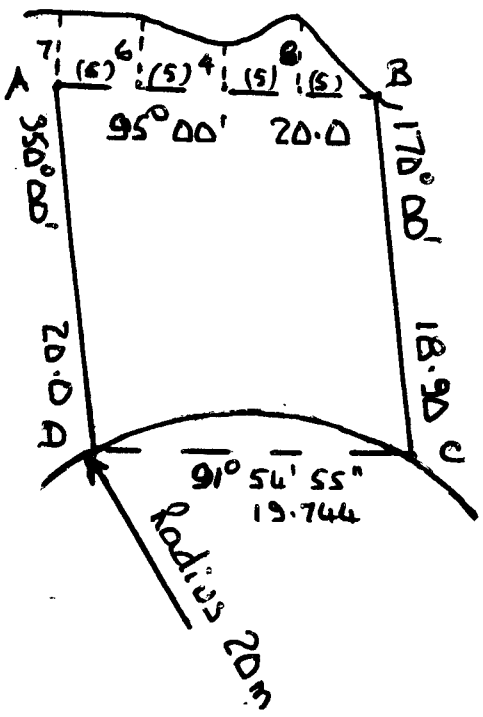
d) Deflection Angle for 870.0 ..... Chord .....

QUESTION 5 (10 Marks)

A block of land has its frontage onto a cul-de-sac whose radius is 20m. The rear boundary is an irregular river bank boundary close to which a traverse line has been run and offsets taken to the creek bank as shown in the diagram

Calculate the area of the block of land by calculating:

a) the area within the straight lines ABCD,
b) the area between line AB and the river using the offsets.
c) the area of the segment at the front of the block.



ANSWERS

a) Area inside lines ABCD ..... b) Offset area .....

c) Area of the segment .....d) Total area of land .....

P.T.O.

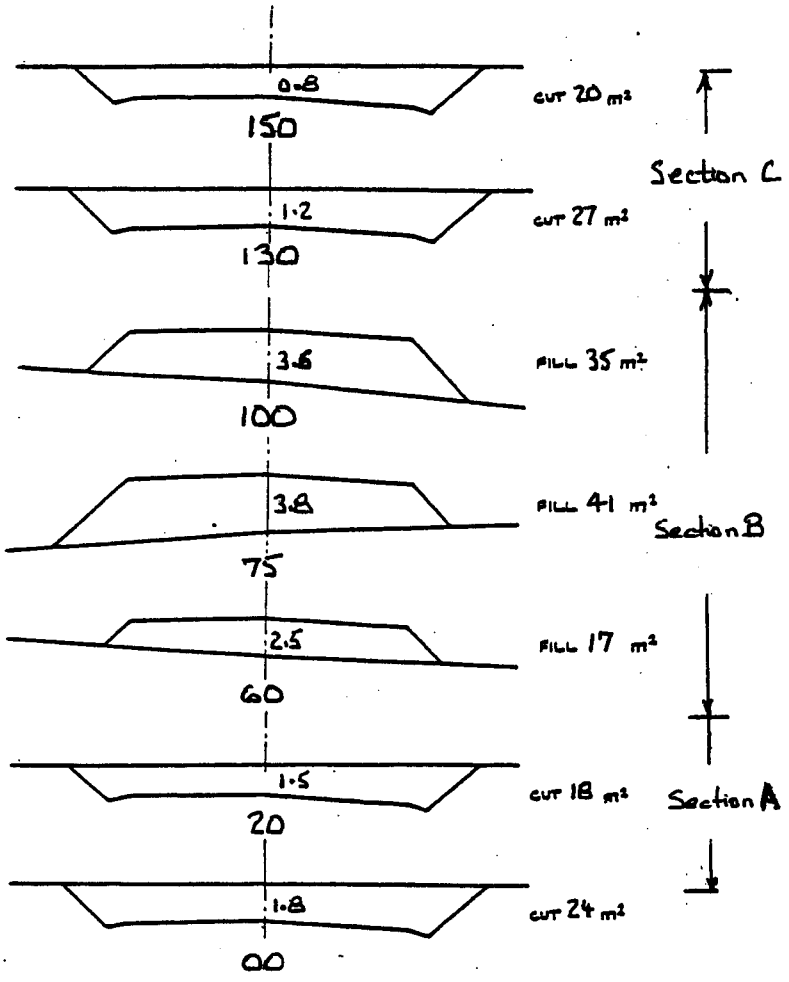
QUESTION 6 (10 Marks)
The cross section plan at right shows a series of cross sections taken at irregular chainages along a new road.

For each cross section, the area of cut or fill is shown as well as the chainage and the difference in height between the natural surface and the road on the centre line.

Calculate:

- the volume of cut in section A,
- the volume of fill in section B, and
- the volume of cut in section C.

List any assumptions you make and show your calculations.



Volume of cut in Section A .....

Volume of fill in section B .....

Volume of cut in Section C .....

P.T.O.

QUESTION 7 (10 Marks)

a) (3 Marks)

In Contouring packages such as Landmark, the operators sometimes need to "delete or adjust triangles". What are the triangles for, how are they created and why do they have to be deleted or adjusted

b) (2 Marks) Who are the only people allowed, by law, to undertake cadastral surveys and what are Cadastral Surveys?

P.T.O.

c) **(2 Marks)**
Digital levels read to a staff that looks like a bar code. Give one advantage that digital levels offer to a Surveyor or Engineer and one disadvantage that they have compared with normal levelling.

d) (3 Marks) Briefly explain how Surveyors use GPS readings to get very accurate coordinates (centimetre precision) for control surveys when the GPS readings, by themselves have numerous errors and may only give readings to the nearest metre.

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

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

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

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

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

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

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

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

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

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

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

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

$RL_S = RL_T + HI + V - m$

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

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

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

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

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

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

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

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

$Chord = 2R\sin\delta$

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

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

$Area = \pi R^2$

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

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

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

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

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