



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:** \_\_\_\_\_

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**AUTUMN SEMESTER, 2008**

**SUBJECT NAME: SURVEYING**

**SUBJECT NO.: 48320**

**DAY/DATE: THURSDAY 19 JUNE 2008**

**TIME ALLOWED: TWO Hours plus TEN Mins reading time**

**START/END TIME: 9:30 pm - 11:40 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.

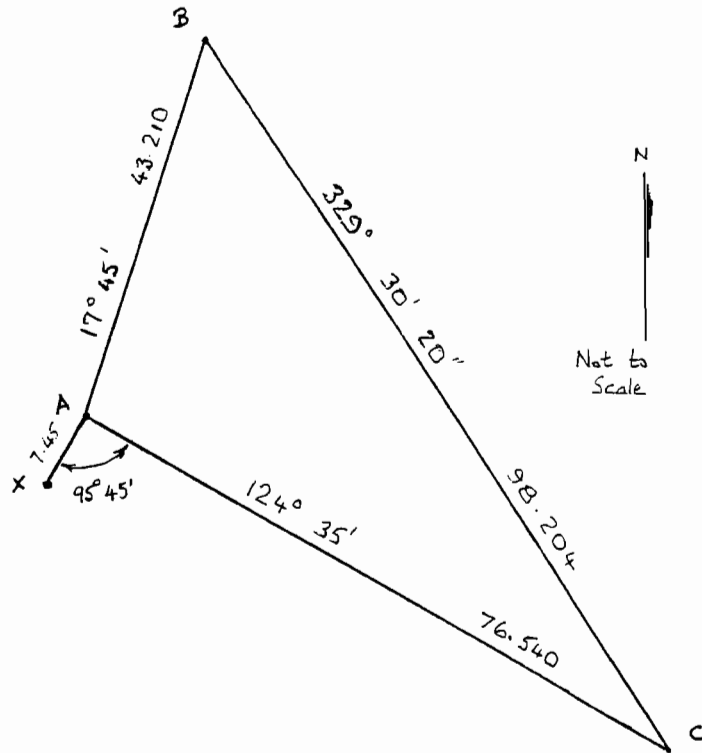
All of the diagrams are sketches for illustrative purposes and are not to scale.

If not enough room has been provided for calculations or written answers, please use the back of adjacent pages and note this fact, so the marker can see your complete answer or working.

**QUESTION 1 (18 Marks)**

A triangular closed traverse was run from point A to B and to C before closing to A, as indicated on the sketch below showing adjusted bearings and horizontal distances. At point A, a radiation was made. The sketch below shows the horizontal angle and horizontal distance to the radiated point X.

- Compute the traverse misclose and the proportional accuracy of the traverse. (7 Marks)
- Use the partial coordinates to calculate the coordinates of each traverse point. (4 Marks)
- Calculate the coordinates of point X. (4 Marks)
- Using the calculated coordinates, calculate the bearing and distance of the line X-B (3 Marks)



LINE	Adjusted Bearing	Horiz. Dist	Δ E		Δ N		CO-ORD INATES		PT.
			E (+)	W (-)	N (+)	S (-)	E	N	
							700.000	400.000	A
A-B									B
B-C									C
C-A									A
							700.000	400.000	A
A-X									X
X-B									

**Traverse Linear Misclose ..... Proportional Accuracy .....**  
**Show coordinates of B, C and X in the traverse table. (Please do all calculations to 3 Decimal Places)**

**Bearing and distance of line X B .....**

**QUESTION 2 (16 Marks)**

A surveyor has to accurately mark out a circular curve for a landscaper building a driveway on a property.

The starting and finishing points 'A' and 'B' have been marked approximately and a radius of 10.0m is required. The surveyor measured the distance from the mid point on the chord AB to the approximate proposed position of the crown of the curve as shown on the sketch plan below.

i) Calculate the exact deflection angle using the measured data for the proposed driveway. (4 Marks)

After discussions, it was then decided to adopt a deflection angle of  $87^{\circ} 00'$  for the set out.

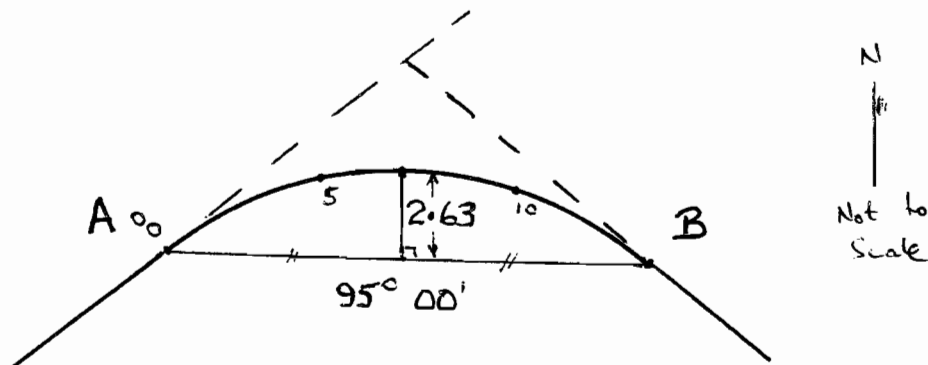
ii) Calculate the following set out information:

a) Tangent Length (3 Marks)

b) Chord Length (3 Marks)

c) Bearings and Distances to set out points on the driveway 5.0m and 10.0m around the arc from the starting point A. (B was used as the azimuth and AB has a bearing of  $95^{\circ} 00'$ .)

(6 Marks)



**ANSWERS**

i) Exact Deflection Angle of Driveway .....

ii)

a) Tangent Length ..... b) Chord Length .....

c) Bearings and Distances to set out

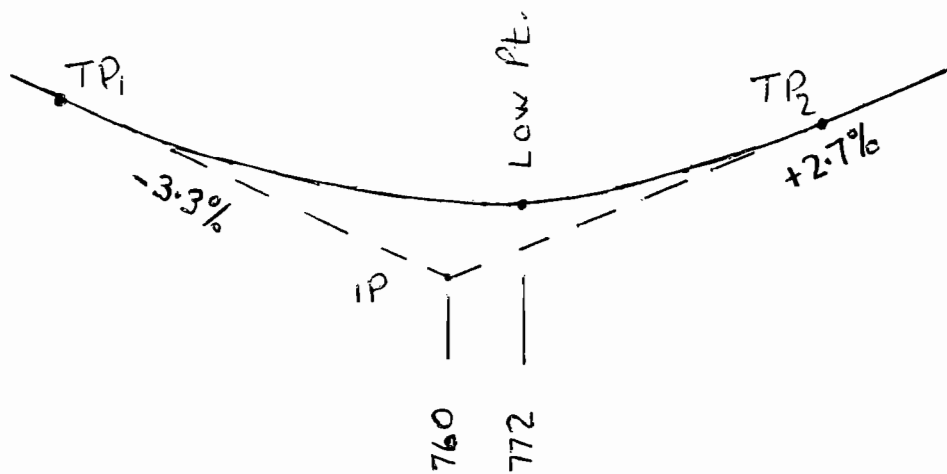
5.0 m ....., .....

10.0 m ....., .....

**QUESTION 3 (16 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. (6 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 T.P. 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 ( )				

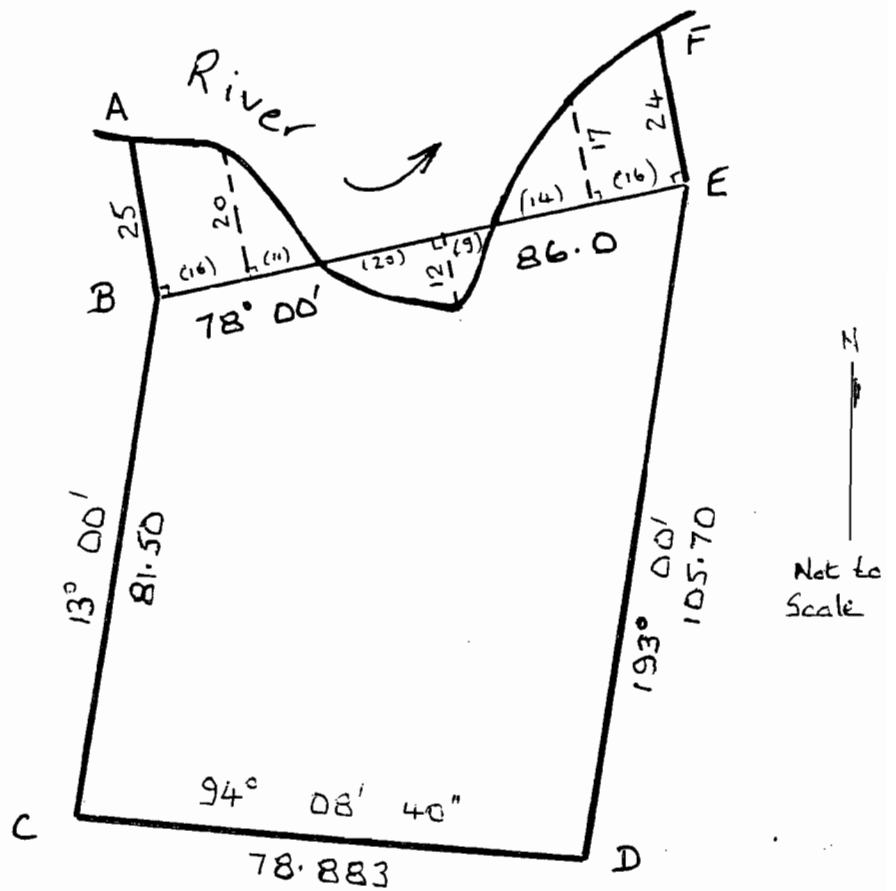
**QUESTION 4 (9 Marks)**

Lot 1 in the sketch plan below is bounded by straight lines connecting points A, B, C, D, E and F and then the river bank as shown by the thick line. The useable area of the block of land has to be found.

To do this a survey line was run from B to E as shown and offsets measured from the line BE to the river bank at appropriate points, as shown.

Determine the total useable area of Lot 1 by calculating

- the area within the regular shape comprised of the straight lines connecting B C D E, then
- use the trapezoidal rule for the 'offset' area between the line BE and the river bank.



Area inside shape BCDE (3 Marks) .....

Useable area of Lot 1, between the line BE and the river bank (5 Marks) .....

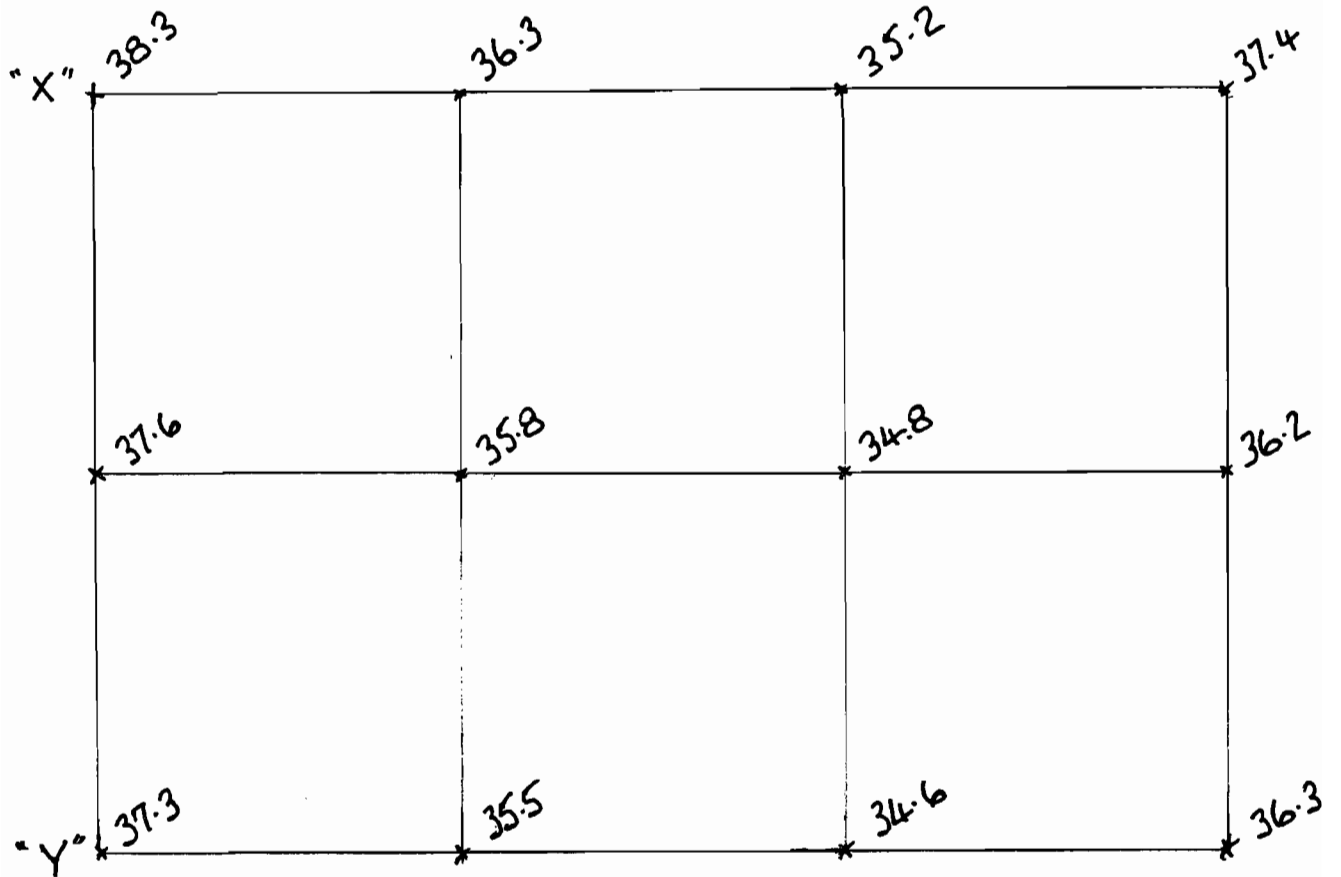
Total Area of Lot 1 (1 Mark) .....

**QUESTION 5 (12 Marks)**

The 10m x 10m grid is drawn to a scale of 1:200.

Plot the contours on the plan using a contour interval of 1m. Interpolate along each grid line only. (10 Marks)

What is the grade between points "X" and "Y". (2 Marks)

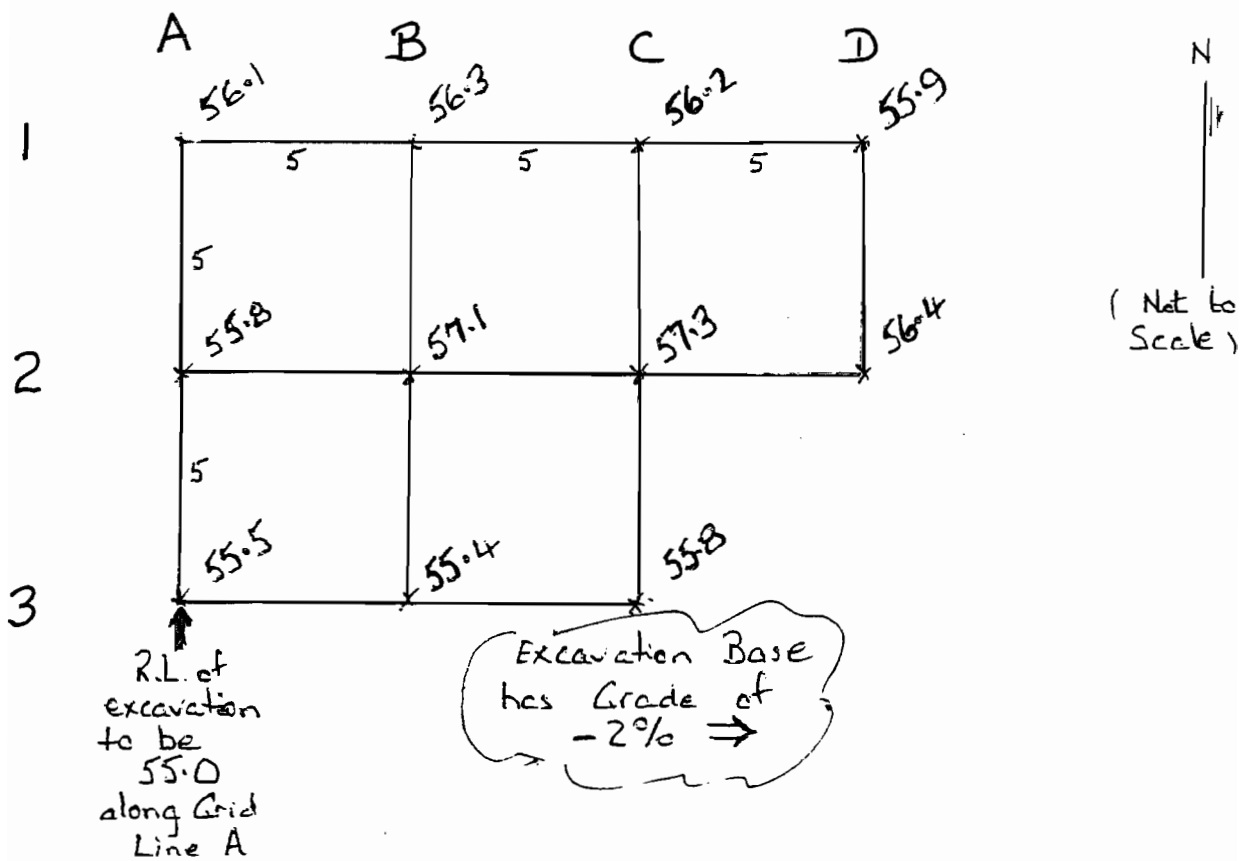


Grade between "X" and "Y" .....

**QUESTION 6 (14 Marks)**

The 5m x 5m grid, shown below, has been levelled for a proposed basement excavation, which is to have vertical sides around the perimeter. The base of the excavation is to have a 3% grade falling to the east. At Grid Line A, the basement must have a finished (excavated) R.L. of 55.0.

- a) Calculate the finished (excavation) R.L. at grid lines B, C and D (3 Marks)
- b) Show on the diagram the depth of excavation at each grid point. (3 Marks)
- c) Calculate the total volume of material to be excavated from this site. (8 Marks)



Excavation R.L. at Grid line B ..... Grid line C ..... Grid line D .....

Total Volume to be excavated from site .....

**QUESTION 7 (15 Marks – all parts of equal value)**

a) (3 marks)

Briefly describe a Cadastral Survey. Give three examples of a Cadastral Survey.

b) (4 marks)

Surveyors developed a system when using Global Positioning System to overcome errors that had previously been introduced by the US Department of Defence. While these errors are no longer present, the method is still in use for accurate Surveying. Briefly describe the principles of this method.

c) (2 marks)

List two advantages of using a laser level on a construction site, compared to using a traditional level and staff.



d) (3 marks)

Briefly describe an Identification Survey. Include in your answer the information contained in an Identification Survey

e) (3 marks)

List and in about one sentence explain three advantages that come from using a Total Station Instrument to undertake a detail, level and contour survey, when compared to the stadia method with theodolite and staff. You should include both office and field procedures.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$Area = \pi R^2$$

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

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

$$2 \times Area = (N_1 E_2 + N_2 E_3 + \dots + N_n E_1) - (E_1 N_2 + E_2 N_3 + \dots + E_n N_1)$$

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

$$Area = \left(\frac{O_1 + O_2}{2}\right) \times w$$

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