

# Exemplar examination paper

## QUESTION 1

Define the following surveying terms:

- 1.1 Cadastral surveying (2)
  - 1.2 Local attraction (2)
  - 1.3 Agonic line (2)
- [6]**

## QUESTION 2

- 2.1 What is the purpose of surveying? (5)
  - 2.2 Name FIVE methods of surveying. (5 × 1)
  - 2.3 Give FOUR types of information that must appear in a field book. (4 × 1)
- [14]**

## QUESTION 3

- 3.1 Name THREE scales used in surveying. (3 × 1)
  - 3.2 A triangular area with a base of 420 mm and a perpendicular height of 190 mm was measured on a plan.  
Calculate the ground area in hectares. The scale is 1:2 000. (4)
  - 3.3 Give FIVE hints concerning the setting up and smooth running of a plane table. (5 × 1)
- [12]**

## QUESTION 4

- 4.1 Use a scale of 1 cm = 100 m and plot the following coordinates as it is done on the South African Coordinate System:

	Y	X
A	+688,5	-320,0
B	-420,5	-440,7

- (6)
  - 4.2 When the direction of a line is 215°, what is the quadrant bearing? (2)
  - 4.3 What is the size of the angle in centesimal measure, if the angle is 60°? (2)
- [10]**

## QUESTION 5

- 5.1 Explain the relationship between coordinates and direction. (5)
- 5.2 The average height a plot in a shape of a trapezium is 325,6 m. The level is to be reduced to 335,1 m. The long side of the trapezium is 74 m. The short side is 39 m. The perpendicular distance between the two sides is 24 m.  
Calculate the volume of earth to be filled. (5)

- 5.3 Calculate the area of a segment in a circle with a radius of 8 m. The included angle is  $65^\circ$ . (5)
- 5.4 Define orientation with regards to a plane table. (3)
- [18]**

### QUESTION 6

- 6.1 Give FOUR disadvantages of using a chain. (4 × 1)
- 6.2 A distance of 104 m was measured with a steel tape at a temperature of  $15^\circ\text{C}$ . The standard temperature of the tape is  $20^\circ\text{C}$  and the coefficient of linear expansion is  $0,0000113/^\circ\text{C}$ . Calculate the correct distance measured. (4)
- 6.3 A length of 85 m was measured horizontally in catenary. The measurement was done in three equal bays. The mass of the tape is 0,015 kg/m and the tension applied is 7 kgF. Calculate the correct distance. (6)
- 6.4 Use diagrams and explain how you would carry out each of the following by using a tape:
- 6.4.1 Erect a perpendicular line from a point on the line. (3)
- 6.4.2 Obtain a distance across a river. (4)
- [21]**

### QUESTION 7

- 7.1 Name FIVE components of the Abney level. (5 × 1)
- 7.2 FIGURE 1, on the attached DIAGRAM SHEET, shows a dumpy. Level set at P and a staff held at M (benchmark) and N.
- 7.2.1 What is the collimation height? (2)
- 7.2.2 What is the reduced level at point N? (2)
- 7.3 The attached DIAGRAM SHEET, shows FOUR different types of instruments. Write the name and use of each instrument next to each number (7.3.1 to 7.3.4) in the ANSWER BOOK. (4 × 2)
- 7.4 Name TWO types of liquid that are used in a bubble tube. (2 × 1)
- [19]**

**Total: 100 marks**

# Diagram sheet

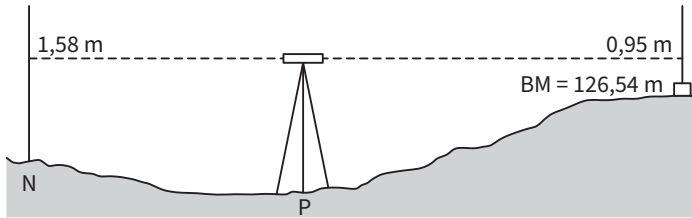
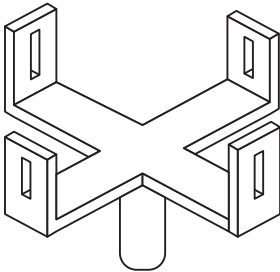


Figure 1



7.3.1



7.3.2



7.3.3



7.3.4

# Exemplar examination paper memorandum

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## Question 1

- 1.1 Cadastral surveying is a survey done for the preparation of plans showing legal boundaries. (2)
  - 1.2 Local attraction is the magnetic material that causes the disturbing influence on the magnetic needle of the compass (2)
  - 1.3 Agonic lines are lines joining places on the earth's surface where the magnetic declination of a given point is zero. (2)
- [6]

## Question 2

- 2.1 The purpose of surveying to prepare drawings, such as maps, plans, cross sections or elevations, with profiles that have all the necessary information about natural and man-made features. These are then used by the architect and engineer to work on the design of the proposed structure. The final plan is then given to the surveyor, who sets out the work. (5)
- 2.2 Any FIVE of the following:
  - Chain survey
  - Levelling
  - Traversing survey
  - Tacheometric survey
  - Trilateration survey
  - Triangulation survey
  - Compass survey
  - Plane table survey
  - Photographic survey(5 × 1)
- 2.3 Any FOUR of the following:
  - Title page
  - Index/Index diagram
  - Surveyor's signature/name
  - Field party names
  - Job description
  - Observations
  - Benchmark description and location

- Sketches
  - Descriptions
  - Equipment list
  - Weather information
- (4 × 1)  
[14]

### Question 3

- 3.1
- Natural scale
  - Engineering scale
  - Divided scale
- (3 × 1)

- 3.2 Area =  $\frac{1}{2}$ base × perpendicular height

$$\begin{aligned}
 \text{Ground area} &= \frac{1}{2} \times \frac{420 \times 2\,000}{1\,000} \times \frac{190 \times 2\,000}{1\,000} \\
 &= 0,5 \times 840 \times 380 \\
 &= 159\,600 \text{ m}^2 \\
 &= 15,96 \text{ ha}
 \end{aligned}$$

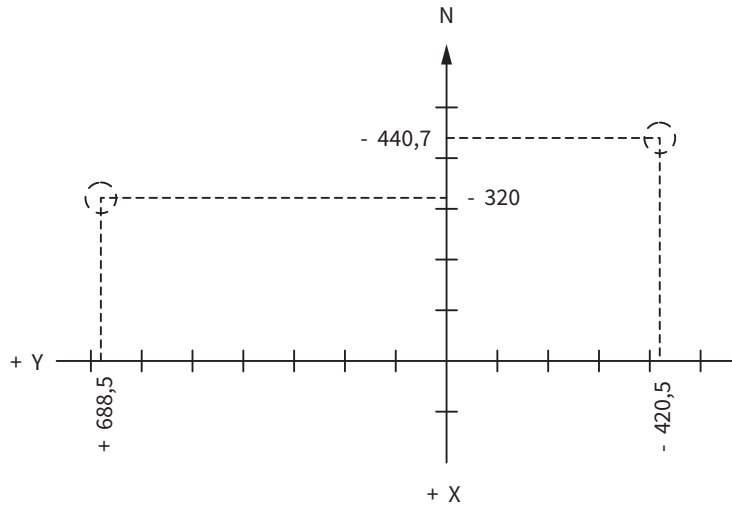
(4)

- 3.3
- The table should be level when erected.
  - The table should be at a workable height.
  - Keep all the equipment to be used on hand.
  - Do not attempt to work in bad weather.
  - First acquaint yourself with the area to be surveyed.
  - Select well-defined stations for orientation.
  - Orientate the table accurately.
  - Select stations that are recognised on the map.
  - Always recheck your orientation.
  - The point on the table should be directly above the point on the ground which it represents.
  - Each ray should be easily identified.
  - A notebook should be kept to enter written descriptions of each ray.
  - Use reference numbers to refer to each ray.
- (5 × 1)

[12]

## Question 4

4.1



(6)

4.2  $\text{Quadrant bearing} = 215 - 180 = 35$

$\text{Quadrant bearing} = \text{N}35^\circ\text{E}$

(2)

4.3 
$$\frac{x}{100} = \frac{60}{90}$$
$$x = \frac{60 \times 100}{90}$$
$$x = 66,7^g$$

(2)

[10]

## Question 5

- 5.1
- Coordinates are values in metres that indicate the latitude and longitude of the position of a point on the ground represented on a plan or map. Direction is the horizontal angle formed by the line between the coordinated points and a reference line.
  - The observed direction and distance between two coordinated points are used to calculate the coordinates of other points in-between.
  - Coordinates of points are used to determine the true direction and horizontal of a line between two coordinated points.

(5)

$$5.2 \quad \text{Depth} = 335,1 - 325,6 \\ = 9,5 \text{ m}$$

$$V = \frac{74 + 39}{2} \times 24 \times 9,5 \\ = 12\,882 \text{ m}^3 \quad (5)$$

$$5.3 \quad \text{Area} = \frac{\theta}{360}(\pi r^2) - \frac{r^2 \sin \theta}{2} \\ = \frac{65}{360}(\pi \times 8^2) - \frac{8^2 \sin 60}{2} \\ = 36,303 - 29 \\ = 7,303 \text{ m}^2 \quad (5)$$

5.4 Orientation of the plane table means positioning the table so that the lines on the paper are parallel to the lines on the ground which they represent. (3)

[18]

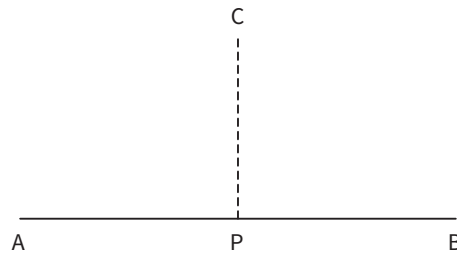
### Question 6

- 6.1
- It is a robust instrument.
  - The chain can be dragged around over the ground.
  - Reading a chain is fairly easy.
  - The chain can be cleaned.
  - Repairing a chain is fairly easy.
  - The chain can be read from both sides. (4 × 1)

$$6.2 \quad C_t = L \times e(t_m - t_s) \\ C_t = 104 \times 0,0000113(15 - 20) \\ C_t = -0,006 \\ CD = 104 - 0,006 \\ CD = 103,994 \text{ m} \quad (4)$$

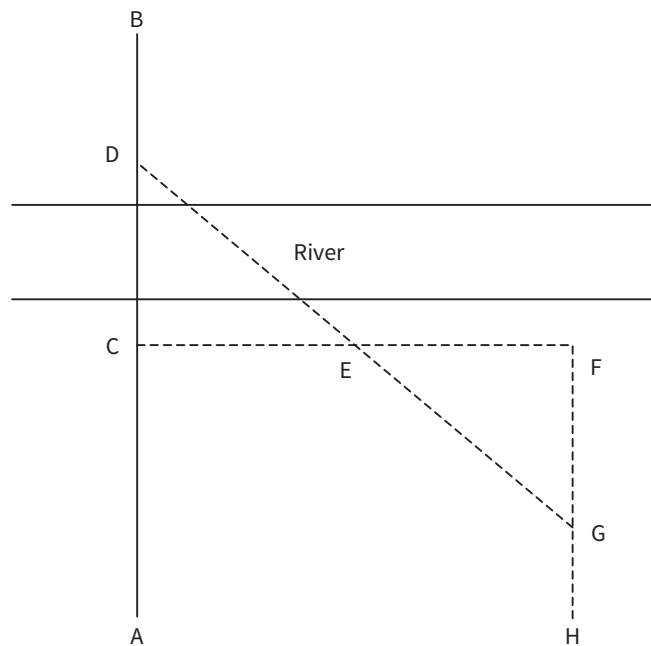
$$6.3 \quad C_s = \frac{W^2 L^3}{24 T^2} \\ C_s = \frac{0,015^2 \times \left(\frac{85}{3}\right)^3}{24(7)^2} \times 3 \\ = 0,004 \times 3 \\ = 0,012 \text{ m} \\ CD = 85 - 0,012 \\ = 84,988 \text{ m} \quad (6)$$

6.4 6.4.1



Line AB is a known base line. To fix a perpendicular offset line to point C, an optical square is used to measure the right angle APC or BPC and distance PC. (3)

6.4.2



A chain line AB passes over a river. CD is the distance that must be measured; C and D are ranged on opposite sides of the river banks. To find CD, from point C set a perpendicular offset CEF so that CE is equal to EF. From point F set a perpendicular offset FH, so that FH is parallel to chain line AB. Move a ranging rod along the line FH until the rod is in line with point E and D. This will be point G. Now distance CD can be found by measuring FG. (4)



### Question 7

- 7.1
- Spirit level
  - Vernier
  - Index
  - Eyepiece
  - Protractor
  - Telescope
- (5 × 1)
- 7.2. 7.2.1  $HC = 126,54 + 0,95$   
 $= 127,49$  (2)
- 7.2.2  $RL_N = 127,49 - 1,58$   
 $= 125,91$  (2)
- 7.3. 7.3.1 Surveyor's compass: measures the quadrant bearing of a line (2)
- 7.3.2 Cross staff: measures offsets from a line (2)
- 7.3.3 Change plate: marks the change point position from a staff and prevents staff from sinking (2)
- 7.3.4 Electronic distance measuring instrument: measures distance using light and radio waves (2)
- [8]
- 7.4
- Alcohol
  - Chloroform
- (2 × 1)
- [19]

**Total: 100 marks**