higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# MARKING GUIDELINE

## NATIONAL CERTIFICATE

## BUILDING AND STRUCTURAL SURVEYING N4

## 7 December 2023

**This marking guideline consists of 7 pages.**

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## QUESTION 1

1.1 **T**his survey involves the building up of a network of triangles✓ from an accurately measured base line,✓ by measuring the lengths of the side only.✓

1.2 Include sketching in the field, plan-drawing,✓ levelling, military reconnaissance,✓ also a particular description of the surveying instruments commonly employed by the military with instructions for using and adjusting them.✓

1.3 A line✓ that is normal to the direction✓ of gravity at all points.✓

1.4 Errors which depend on their magnitude✓ and sign and external circumstances✓ such as temperature changes; excessive refraction are avoided by not observing under such condition.✓

1.5 When the cross hairs of the instrument✓ and the sighted object✓ are not seen on the same plane.✓

(5 × 3) **[15]**

## QUESTION 2

2.1 $CH = \frac{L\ x\ H}{R}$✓

$= \frac{250\ x\ 1700}{6575\ 000}$✓

$= 0{,}06$

$CD = 250 + 0{,}06$

$= 250{,}06\ m$✓ (3)

2.2 $Tc = L\ x\ e\ (tm - ts)$✓

$-0{,}017 = 94{,}50\ x\ 0{,}0000112\ (30 - ts)$

$-0{,}017 = 0{,}0010584\ (30 - ts)$✓

$-0{,}017 = 0{,}031752 - 0{,}0010584\ ts$✓

$ts = 46°C$✓ (4)

2.3 $Sc = L(1 - Cos\ \theta)$

$= 120\ (1 - Cos\ 6°35'40'')$✓

$= 0{,}794$✓

$Horizontal\ Distance = 120 - 0{,}79$

$= 119{,}21\ m$✓ (3)

2.4
- Heavy and bulky.
- Can get entangled easily.
- Needs regular checks.
- If suspended, it sags considerably.
- Can expand and contract due to repeated use. (5)

**[15]**

## QUESTION 3

3.1 Ranging rods are tools used to mark the position of a survey station; they are made of hardwood and have a metal shoe. (2)

3.2
3.2.1 Milled knob
3.2.2 Bubble tube
3.2.3 Index arm
3.2.4 Veneer
3.2.5 Eyepiece
3.2.6 Sighting tube
3.2.7 Cross hairs
3.2.8 Protractor arc

(8 × 1) (8)

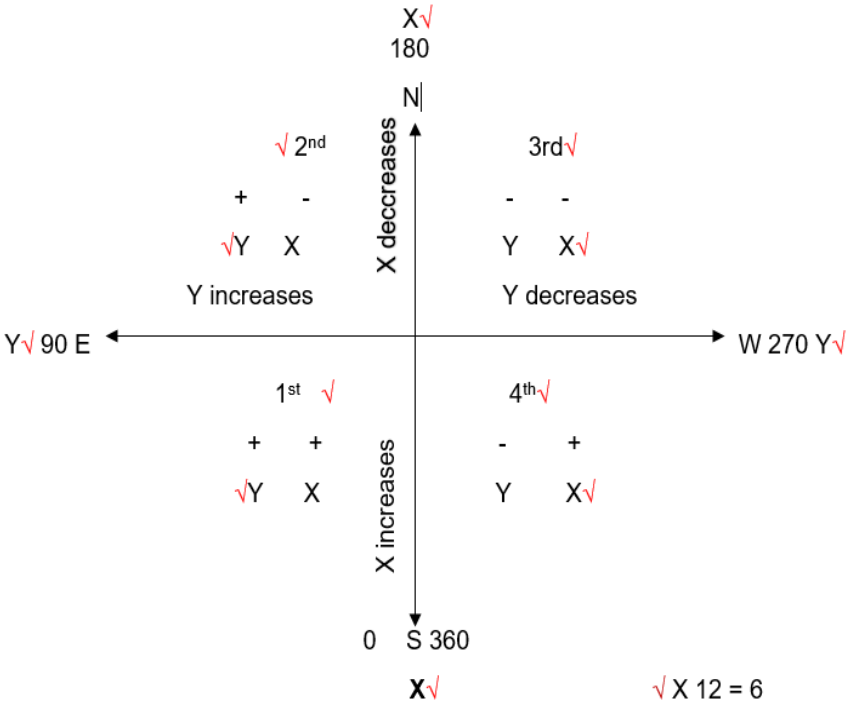
**[10]**

## QUESTION 4

4.1 MU =?
RF = 1: 20 000
GU = 1,25 km convert to cm = 125 000 cm or 1 250 000 mm

MU = RF × GU✓
$= \frac{1}{20000} X \frac{1250000}{1}$ ✓
= 62,5 mm✓✓ (4)

4.2




√ X 12 = 6

(6)
**[10]**

## QUESTION 5

5.1 5.1.1 30° is in quadrant NE and QB is the same as WCB.
QB = N 30° 20′ E✓✓

5.1.2 140° is in the quadrant SW
QB = 180 – 140° 50′
= S 39° 50′ E✓✓

5.1.3 240° is in the quadrant NW
QB = 240° 30′ – 180
= S 60° 30′ W✓✓

(3 × 2) (6)

5.2 5.2.1 WCB is the same as QB
QB = N 30° 20′ E✓✓

5.2.2 QB is in the quadrant SE
WCB = 180° – 38° 50′
= 141° 10′✓✓

(2 × 2) (4)
**[10]**

## QUESTION 6

6.1 The prism is a right-angled triangular glass prism with convex sides and serves for both the bisection and taking readings.✓ The prism can be raised or lowered for proper focussing to see the graduations clearly.✓

6.2 The mirror is used to facilitate the sighting of bearing✓ of the object at high or low altitude.✓

6.3 A dumping device in the form of a push button✓ is used to dampen the oscillation (vibration) of the needle.✓

6.4 The graduation ring is attached to the needle and is used for taking readings.✓ It is graduated clockwise from 0° at the south end of the needle to 360° and the graduation is engraved inverted for easy reading.✓

6.5 Sunglasses to sight a luminous object.

(5 × 2) **[10]**

## QUESTION 7

7.1 $S = \frac{a+b+c}{2}$ ✓

$S = \frac{200 + 130 + 100}{2}$

$S = 215$ ✓

$Area = \sqrt{S\,(s-a)(S-b)(S-c)}$✓

$= \sqrt{215\,(215-200)(215-130)(215-100)}$

$= 5614{,}66\,m^2 \div 10\,000$✓

$= 0{,}56\,Ha$✓ (5)

7.2 Area = h/2[Frist + last +2 (all the rest)]
= $\frac{4.5}{2}[3.4 + 3.4 + 2(4.2 + 3.7 + 4.6 + 0.9)]$✓
= 2.25[6.8 + 26.8]✓
= 2.25[33.6]
= 93.225 $m^2$✓
Volume = 93.225 × width of road (8 m)✓
= 745.800 $m^3$✓ (5)
**[10]**

## QUESTION 8

8.1 Plane table surveying is a type of surveying that is suitable for small or medium scale mapping in which great accuracy is not required.✓ It is particularly useful when filling in details between stations fixed by triangulation or theodolite traversing or on a prepared map.✓ (2)

8.2
- It cannot be done in rainy or windy conditions and poor weather causes frequent delays.
- Instruments are cumbersome and heavy.
- It is not highly accurate.
- The plane table must be centred and oriented at every station.
- It is inconvenient to calculate the quantities or replot the survey to a different scale if required.
- It cannot be used in an area that has many bushes and trees. (6)

8.3 Traversing in plane surveying is used to run lines between stations✓ that have been fixed previously by other surveying methods.✓ (2)

**[10]**

## QUESTION 9

9.1
- In construction of roads, bridges, airports, railways and water supply and sewerage lines.
- To calculate volumes for earthworks, such as cut and fill on site.
- To investigate drainage in an area.
- To set out a structure according to building plans.
- For preparing an engineering map showing engineering details, for example highways, railways, canals, dams and reservoirs.
- For preparing a topographical map showing, for example, hills, rivers, forests and valleys. (6)

9.2
- Earth curvature
- Atmospheric refraction
- Variations in temperature
- Wind vibration (4)

**[10]**

**TOTAL: 100**

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