higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING AND STRUCTURAL SURVEYING N6

27 November 2023

This marking guideline consists of 8 pages.

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QUESTION 1

1.1.
- A benchmark is a fixed point of known height✓ and is usually a steel or copper pin solidly fixed in a position where it is unlikely to be disturbed or destroyed.✓
- It used as a reference point✓ during surveying and it is where other elevations are established.✓ (4)

1.2
- Theodolite
- Optical plumb
- Plumb bob
- Laser
- Spirit level (Any 4 × 1) (4)

1.3
- Gradients of landscapes can be estimated.
- The volume of excavation or hill can be estimated.
- The ability to see directly between two points can be established by interpolating along a line across contours. (Any 2 × 2) (4)

1.4
- Control framework
- Scale
- Checks
- Speed and cost
- Skill and experience (Any 4 × 1) (4)

[12]

QUESTION 2

2.1

Corner	Height	Times Used	Product
P1	73,10	1	√73,10
P2	96,30	2	√192,60
P3	97,90	2	√159,80
P4	86,23	1	√66,23
Q1	68,44	2	√136,88
Q2	64,90	4	√259,60
Q3	87,54	4	√350,16
Q4	70,58	2	√141,16
R1	63,26	2	√126,52
R2	67,36	4	√269,44
R3	75,08	4	√300,32
R4	78,01	2	√156,02
S1	65,34	1	√65,34
S2	78,22	2	√156,44
S3	77,21	2	√154,42
S4	74,29	1	√74,29
		36	√2682,32

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Mean height = $\frac{2\ 728,32}{36}$
= 75,79√

Excavation height = 75,79 – 45
= 30,79

Volume = 9(20 × 25) × 30,79
= 138555 m³√

10 % = 138555 × 0,1
= 13855,5 m³

Total Volume = 138555 + 13855,5
= 152 410,50 m³√ (√ × 20) (10)

2.2 The contour passes between
P1 – P2
Q2 – P2
Q2 – Q3
R3 – Q3
Q4 – Q3
Q4 – P4

Difference in level
P1 – P2 = 96,30 – 73,10 = 23,20√
Q2 – P2 = 96,30 – 64,90 = 31,40
Q2 – Q3 = 87,54 – 64,90 = 22,64√
R3 – Q3 = 87,54 – 75,08 = 12,46√
Q4 – Q3 = 87,54 – 70,58 = 16,96
Q4 – P4 = 86,23 – 70,58 = 15,65√

Difference in level to 85 m contour (from lower level)
P1 – P2 = 85 – 73,10 = 11,90√
Q2 – P2 = 85 – 64,90 = 20,10
Q2 – Q3 = 85 – 64,90 = 20,10√
R3 – Q3 = 85 – 75,08 = 9,92
Q4 – Q3 = 85 – 70,58 = 14,42√
Q4 – P4 = 85 – 70,58 = 14,42√

Horizontal distance to 100 m contour (from lower level)
P1 – P2 = $\frac{11,90}{23,20}$ × 20 = 10,23√

Q2 – P2 = $\frac{20,10}{31,40}$ × 25 = 16,00 √

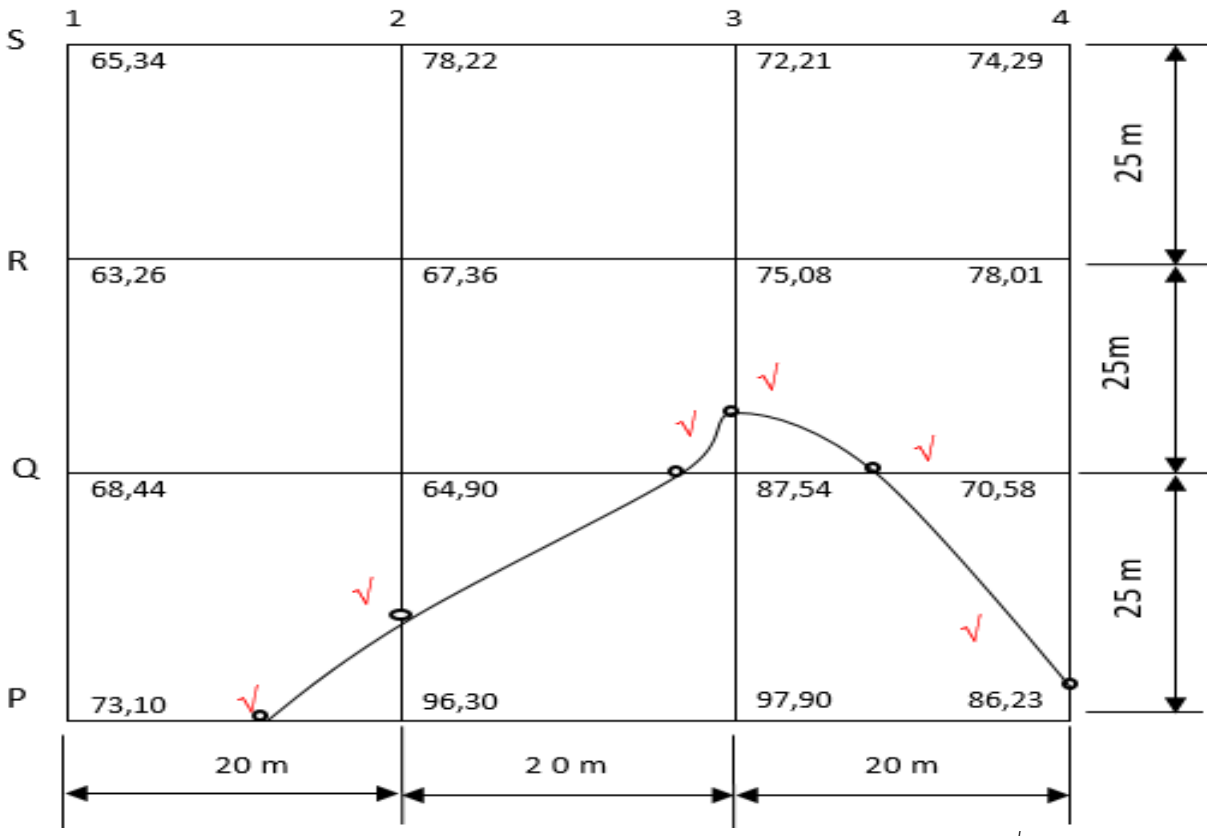
Q2 – Q3 = $\frac{20,10}{22,64}$ × 20 = 17,76√

R3 – Q3 = $\frac{9,92}{12,46}$ x 25 = 19,90√

Q4 – Q3 = $\frac{14,42}{16,96}$ x 20 = 17,00√

Q4 – P4 = $\frac{14,42}{15,65}$ × 25 = 23,04√

(√ × 14) (7)



(√ × 6) (3)
[20]

QUESTION 3

3.1

	Y	X	Y x X	X x Y
A	+150,45	_- 120,20		
B	+75,00	- 350,00	-52657,50√	-9015,00√
C	-250,10	-200,50	-15037,50√	+87535,00√
D	-120,00	+ 500,20	-125100,02√	+24060,00√
E	+120,09	+ 420,80	-50496,00√	+60069,018√
A	+150,45	+ 120,20	+14434,818√	+63309,36√
		∑	**-228856,20✓**	**+225958,38✓**
			+225958,38	
		÷2	**2897,82✓**	
		÷ 10 000	**1448,91✓**	
			0,14 Ha✓	

(√ × 10) (10)

3.2

JOINT SHEET				
PEG/ STATION	CO-ORDINATES		CALCULATION	DIRECTION and DISTANCE
	Y	X	4th Quadrant	Direction (α)
A	+150,45	+120,20	$\theta = \tan^{-1}\frac{\Delta y}{\Delta x} + 360°$ ✓	324:33:37✓
D	-120,00 -270,45✓	+500,20 +380,00✓	$\theta = \tan^{-1}\frac{-270,45}{+380,00} + 360°$ = 324:33:37✓	Distance (S) 466,42m✓
			S = $\sqrt{x^2 + y^2}$✓ S = $\sqrt{(-270,45)^2 + (+380)^2}$ = 466,42 m✓	
			CHECK: $\Delta Y = S \sin\theta$ = 466,42 sin 324:33:37 = -270,45✓	
			$\Delta X = S \cos\theta$ = 466,42 cos 324:33:37 = + 380,00✓	

(√ × 10) (5)
[20]

QUESTION 4

Station		Distance		HI or Middlehair MH	Angles		HI – MH + -	Height Component + -	Height Difference + -	Elevation of point	Remarks
From	To	Stadia	Hor		Hor	Vert					
A				1.70						3080,25√	
	A1	1,90 1,20	69,15✓	1,55✓	120:10:30	96:20:09	+0,15✓	-7,68✓	-7,53√	3072,72√	
	A2	2,60 1,40	118,78✓	2,00✓	160:23:20	84:12:30	-0,30✓	+12,05✓	+11,75√	3092,00	BM
	A3	2,10 1,60	49,07✓	1,85✓	200:12:40	97:50:09	-0,15✓	-6,75✓	-6,90√	3073,35√	
	A4	2,20 1,10	108,86✓	1,65✓	220:50:00	84:09:10	+0,05✓	+11,15✓	+11,20√	3091,45√	
			4	4			4	4	2	2	

[20]

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QUESTION 5

5.1 $BC = PI - T$

$T = R \tan \frac{\Delta}{2}$

= 200 tan 22:30:00✓

= 82,84 m✓

BC = 5090,90 – 82,84✓

= 5008,06 m✓

$EC = BC + La$

$La = \frac{\pi \,.\, \Delta \,.\, R}{180°}$

= $\frac{\pi \; X \; 45{:}00{:}00 \; X \; 200}{180°}$✓

= 157,08 m✓

$EC = 5008{,}06 + 157{,}08$

= 5165,14 m (✓ × 2) (2)

(a – 11,94) = $\frac{1718{,}9 \times 11{,}94}{200 \times 60}$ = 1:42:37✓

(a – 20) = $\frac{1718{,}9 \times 20}{200 \times 60}$ = 2:51:53✓

(a – 5,14) = $\frac{1718{,}9 \times 5{,}14}{200 \times 60}$ = 0:44:11✓ (✓ × 3) (3)

Chainage	Chord	Deflection Angle	Off-set Angle
BC 5008,06			360:00:00
5020	11,94	1:42:37	√ 358:17:23
5040	20,00	2:51:53	√ 355:25:30
5060	20,00	2:51:53	√ 352:33:37
5080	20,00	2:51:53	√ 349:41:44
5100	20,00	2:51:53	√ 346:49:51
5120	20,00	2:51:53	√ 343:57:58
5140	20,00	2:51:53	√ 341:06:05
5160	20,00	2:51:53	338:14:12
EC 5165,14	5,14	0:44:11	√ 337:30:01
√157,08	√ 157,08	√ 22:29:59	√ 22:29:59

5.2 $Cd = T.tan\frac{\Delta}{4}$✓

= 82,84 tan 11:15:00✓

= 16,48 m✓ (3)

5.3 $Lc = 2.R.\sin\frac{\Delta}{2}$✓

= 2 × 200 × sin 22:30:00✓

= 153,07 m✓ (3)
[24]

TOTAL: 100

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