higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING AND STRUCTURAL SURVEYING N6

30 JULY 2021

This marking guideline consists of 6 pages and 1 addendum.

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QUESTION 1

1.1 This is when circle left and circle right observations are made and the mean of these two observations is calculated to obtain an accurate reading.

1.2 This method of survey is also known as traverse. It involves the location of a point by measuring distances and angles.

1.3 Swing is the process of turning the telescope about the vertical axis in a horizontal plane.

1.4 Whole-circle bearing is the bearing of a line in a clockwise direction from true north towards the line and varies from 0 to 360 degrees.

1.5 Face left is when the vertical circle of a theodolite is situated on the left of the observer.

(5 × 2) **[10]**

QUESTION 2

2.1

Direction	AS	86:12:50	
Angle	SAB	108:57:44	
	AB	195:10:34✓ + 00:01:05	= 195:11:39✓
	BA	15:10:34	
Angle	ABC	290:01:06	
	BC	305:11:40✓ + 00:02:10	= 305:13:50✓
	CB	125:11:40	
Angle	BCD	104:00:36	
	CD	229:12:16✓ + 00:03:15	= 229:15:31✓
	DC	49:12:16	
Angle	CDE	225:27:42	
	DE	274:39:58 ✓ + 00:04:20	= 274:44:18✓
	ED	94:39:58	
Angle	DEK	116:51:32	
		211:31:30✓ + 00:05:25	= 211:36:55✓
But	EK	= 211:36:55	

$$\text{Correction} = \frac{211:36:55 - 211:31:30}{5} = 00:01:05$$

(10)

2.2 **ADDENDUM 1**

NAME	**JOIN**	**∆Y**	**∆X**	**NAME**	**Y**	**X**
A				A	+306,38	+ 1 476,18
195:11:39		-118,09√	-434,81√			
450,56 m		- 0,84√	+0,29√			
B				B	+187,45✓	+1 041,66✓
305:13:50		-185,65√	+131,11√			
227,28 m		-0,42√	+0,15√			
C				C	+1,38✓	+1 172,92✓
229:15:31		-108,06√	-93,08√			
142,62 m		-0,26√	+0,09√			
D				D	-106,94✓	+1 079,93✓
274:44:18		-223,40√	+18,52√			
224,17 m		-0,42√	+0,15√			
E				E	- 330,76	+1 098,60
1 044,63		-635,20√	-378,26√		- 637,14✓	- 377,58✓
		-637,14√	-377,58√			
		-1,94√	+0,68√			

- 1,94 **× leg** **+0,68** **× leg** 24 × √ = 12
1044,63√ **1 044,63**√ 8 × ✓ = 8

(20)
[30]

QUESTION 3

SEE ADDENDUM ATTACHED **[20]**

QUESTION 4

Area for Y1	Area for Y2
$W1 = \frac{g\{a + (h.s)\}}{g - s}$ $W1 = \frac{4,5\{5 + (2,45 \times 2,0)\}}{4,5 - 2,0}$ ✓ $= 17,82$ m ✓ $W2 = \frac{g\{a + (h.s)\}}{g + s}$ $W2 = \frac{4,5\{5 + (2,45 \times 2,0)\}}{4,5 + 2,0}$ ✓ $= 6,85$ m ✓ $Area = \frac{(W1 \times W2) - a^2}{S}$ $= \frac{(17,82 \times 6,85) - 5^2}{2,0}$ ✓ $= 48,53$ m² ✓	$W1 = \frac{g\{a + (h.s)\}}{g - s}$ $W1 = \frac{6,0\{5 + (1,98 \times 2,0)\}}{6,0 - 2,0}$ ✓ $= 13,44$ m ✓ $W2 = \frac{g\{a + (h.s)\}}{g + s}$ $W2 = \frac{6,0\{5 + (1,98 \times 2,0)\}}{6,0 + 2,0}$ ✓ $= 6,72$ m ✓ $Area = \frac{(W1 \times W2) - a^2}{S}$ $= \frac{(13,44 \times 6,72) - 5^2}{2,0}$ ✓ $= 32,66$ m² ✓

$$\text{Mean area} = \frac{\text{area 1} + \text{area 2}}{2}$$
$$= \frac{48,53 + 32,66}{2}$$
$$= 40,60 \text{ m}^2 ✓$$

Height = chainage of Y2 – chainage of Y1
= 2 386,67 – 1 987,65
= 399,02 m ✓

Volume = mean area × height
= 40,60 × 399,02
= 16 200,212 m³ ✓ **[15]**

QUESTION 5

5.1 Find distance and direction XY.

Δ dy XY = +1 150,00 – (+196,00)
= +954,00✓

Δ dx XY = +1 033,78 – (+640,00)
= +393,78✓

Direction = $\tan^{-1} \frac{dy}{dx}$ (1st quadrant)

= $\tan^{-1} \frac{+954,00}{+393,78}$

= 67°34'15''

Distance = $\sqrt{\Delta y^2 + \Delta x^2}$
= 1 032,07 m✓

Find direction YZ.

Δ dy YZ = +1 478,20 – (+1 150,00)
= +328,20✓

Δ dx YZ = +927,50 – (+1 033,78)
= -106,28✓

Direction = $\tan^{-1} \frac{dy}{dx} + 180^o$ (2nd quadrant)

= $\tan^{-1} \frac{+328,20}{-106,28}$ + 180°

= 107°56'36'

Δ = 107°56'36' – 67°34'15'✓
= 40°22'21'✓ (7)

5.2 T = R tan Δ/2
= 300,00 tan 20°11'11"✓
= 110,30 m✓ (2)

5.3 La = $\frac{\pi \Delta R}{180}$

= $\frac{\pi \times 40°22'21' \times 300,00}{180°}$✓

= 211,39 m✓ (2)

5.4 BC = PI – T
= 1 032,07 – 110,30✓
= 921,77 m✓ (2)

5.5 EC = BC + La
= 921,77 + 211,39✓
= 1 133,16 m✓ (2)

5.6 $(a - 18{,}16) = \frac{1\,718{,}9 \times 18{,}16}{300{,}00 \times 60} = 1°:44':3"$✓ (1)

$(a - 20{,}00) = \frac{1\,718{,}9 \times 20{,}00}{300{,}00 \times 60} = 1°:54':36"$✓ (1)

$(a - 13{,}16) = \frac{1\,718{,}9 \times 13{,}16}{300{,}00 \times 60} = 1°:54':24"$✓ (1)

Chainage		Chord	Deflection angle	Offset angle
BC	921,77			360°:00':00"√
	940,00	18,23√	01°:44':03"√	358°:15':57"
	960,00	20,00	01°:54':36"	356°:21':21"√
	980,00	20,00	01°:54':36"	354°:26':45"
	1 000,00	20,00	01°:54':36"	352°:32':09"√
	1 020,00	20,00	01°:54':36"	350°:37':33"
	1 040,00	20,00	01°:54':36"	348°:42':57"√
	1 060,00	20,00	01°:54':36"	346°:48':21"
	1 080,00	20,00	01°:54':36"	344°:53':45"√
	1 100,00	20,00	01°:54':36"	342°:59':09"
	1 120,00	20,00	01°:54':36"	341°:04':33"√
EC	1 133,16	13,16√	01°:15':24"√	339°:49':09"
	211,39√	211,39√	20:10':51"√	20°:10':51"√

(14 × ½) (7)

[25]

TOTAL: 100

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ADDENDUM

Station		Distance		HI or Middlehair MH	Angles		HI – MH + -	Height Component + -	Height Difference + -	Elevation of point	Remarks
From	To	Stadia	Hor.		Hor.	Vert.					
P				**1,50**						833,24√	
	P1	3,30 2,41	88,45✓√	2,86✓	60:20:37	94:30:48	-1,36√	-6,98✓	-8,34√	824,90√	
	P2	2,04 1,34	69,57✓√	1,69✓	200:18:50	85:30:23	-0,19√	+5,47✓	+5,28√	838,52√	
	P3	2,98 1,09	185,63✓√	2,04✓	167:36:49	97:40:20	-0,54√	-25,01✓	-25,55√	807,69√	
	P4	3,23 0,93	229,75✓√	2,08✓	228:39:39	88:06:09	-0,58√	+7,61✓	+7,03√	**840,27**	**Stat. P**
			✓√ x 4 = 6	✓ x 4= 4			√ x 4 = 2	✓ x 4 =4	√ x 4 = 2	√ x 4 = 2	

[20]

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