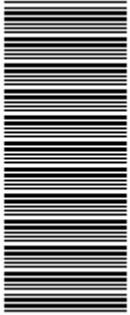


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higher education  
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Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

**T130(E)(A1)T  
AUGUST EXAMINATION  
NATIONAL CERTIFICATE  
BUILDING AND STRUCTURAL SURVEYING N6**

(8060056)

**1 August 2014 (Y-Paper)  
13:00–16:00**

**This question paper consists of 4 pages, 4 addenda and 1 formula sheet.**

**DEPARTMENT OF HIGHER EDUCATION AND TRAINING**  
**REPUBLIC OF SOUTH AFRICA**  
NATIONAL CERTIFICATE  
BUILDING AND STRUCTURAL SURVEYING N6  
TIME: 3 HOURS  
MARKS: 100

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**INSTRUCTIONS AND INFORMATION**

1. Answer ALL the questions.
  2. Read ALL the questions carefully.
  3. Number the answers according to the numbering system used in this question paper.
  4. ALL the diagrams, sketches and drawings should be large and in good proportion, fully and clearly labelled and done in pencil.
  5. Write neatly and legibly.
-

**QUESTION 1**

Complete the field-book page and direction sheet on the attached ADDENDUM 1 to find the oriented directions SA, SB and SD.

**[10]****QUESTION 2**

2.1 Calculate the co-ordinates of T2, T3 and T4 on ADDENDUM 2. Adjustments must be made according to the Bowditch Rule.

(20)

2.2 Plot the co-ordinates of T1, T2, T3, T4 and T5 to scale 1 : 5 000 in the ANSWER BOOK.

Clearly show the direction of true north.

(8)

**[28]****QUESTION 3**

3.1 The following notes refer to observations from F in a tacheometric survey. The elevation of survey station F3 is 569,18 m and the theodolite is 1,64 m above F. The booked vertical angles are zenith distances.

STAFF STATION	HORIZONTAL ANGLE	VERTICAL ANGLE	STADIA READINGS
F1	188 : 12 : 30	99 : 12 : 48	2, 38 ..... 1, 02
F2	272 : 12 : 50	81 : 32 : 16	3, 20 ..... 1, 44
F3	296 : 28 : 40	80 : 42 : 52	2, 22 ..... 0, 78

Use the above information to complete the tacheometric sheet on ADDENDUM 3.

(15)

3.2 Define the following surveying terms:

3.2.1 Horizontal equivalent

3.2.2 Vertical interval

(2 × 2)

(4)

**[19]**

**QUESTION 4**

ADDENDUM 4, FIGURE 1 shows a cutting with a formation width of 16,0 m and a formation level of 196,0 m.

The ground slope is 1 : 10

The side slopes is 1 : 3

Slope rails (batter boards) are used with a 1,5 m traveller held vertically to monitor the formation of the cutting.

The point R (ground level at CL) has a level of 202,54 m.

The slope rails on the left side of the cutting are attached to verticals A and B. These stakes were positioned as shown in ADDENDUM 4, FIGURE 2.

- 4.1 Calculate the area of the cutting. (8)
- 4.2 Calculate the reduced level at point P (the toe of the cutting). (3)
- 4.3 Calculate the reduced level of the batter board on stake A. (3)
- 4.4 Calculate the reduced level of the batter board on stake B. (3)

**[17]****QUESTION 5**

A right circular curve connects two straights AB and BC.

Point B is the intersection point (IP).

Point A is the start of the chainage measure.

Direction AB is 210 : 00 : 00

Direction CB is 74 : 30 : 20.

The radius of the curve is 215,50 m.

A peg is required at every FULL 20 m chainage.

The coordinates are:

A + 1 500,00 + 2 640,00

B + 1 150,00 + 2 033,78

Calculate the following:

- 5.1 Deflection angle (2)
- 5.2 Tangent length (3)
- 5.3 Length of arc (3)
- 5.4 Chainage at beginning of curve (6)
- 5.5 Chainage at end of curve (2)
- 5.6 The complete setting-out data from beginning of curve to end of curve  
Tabulate the setting-out data. (10)

**[26]****TOTAL: 100**

**ADDENDUM 1**

**EXAMINATION NUMBER:**

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

FIELD-BOOK PAGE OBSERVATIONS AT S					
	CL	CR	Mean	Correction	Corrected
A	68:30:24	248:31:36			
B	126:28:54	306:29:10			
C	200:42:28	20:42:48			
D	342:52:40	162:53:24			
A	68:32:24	248:32:00			

JOIN				
S		+ 2 593, 48	+ 5 662, 56	
C		+ 1 911, 12	+ 6 099, 04	
S				
C				

DIRECTION SHEET				
NAME	CORRECTED DIRECTONS	ORIENTED DIRECTIONS	CORRECTION	JOINT DIRECTION
A				
B				
C				
D				

**ADDENDUM 2**

**EXAMINATION NUMBER:**

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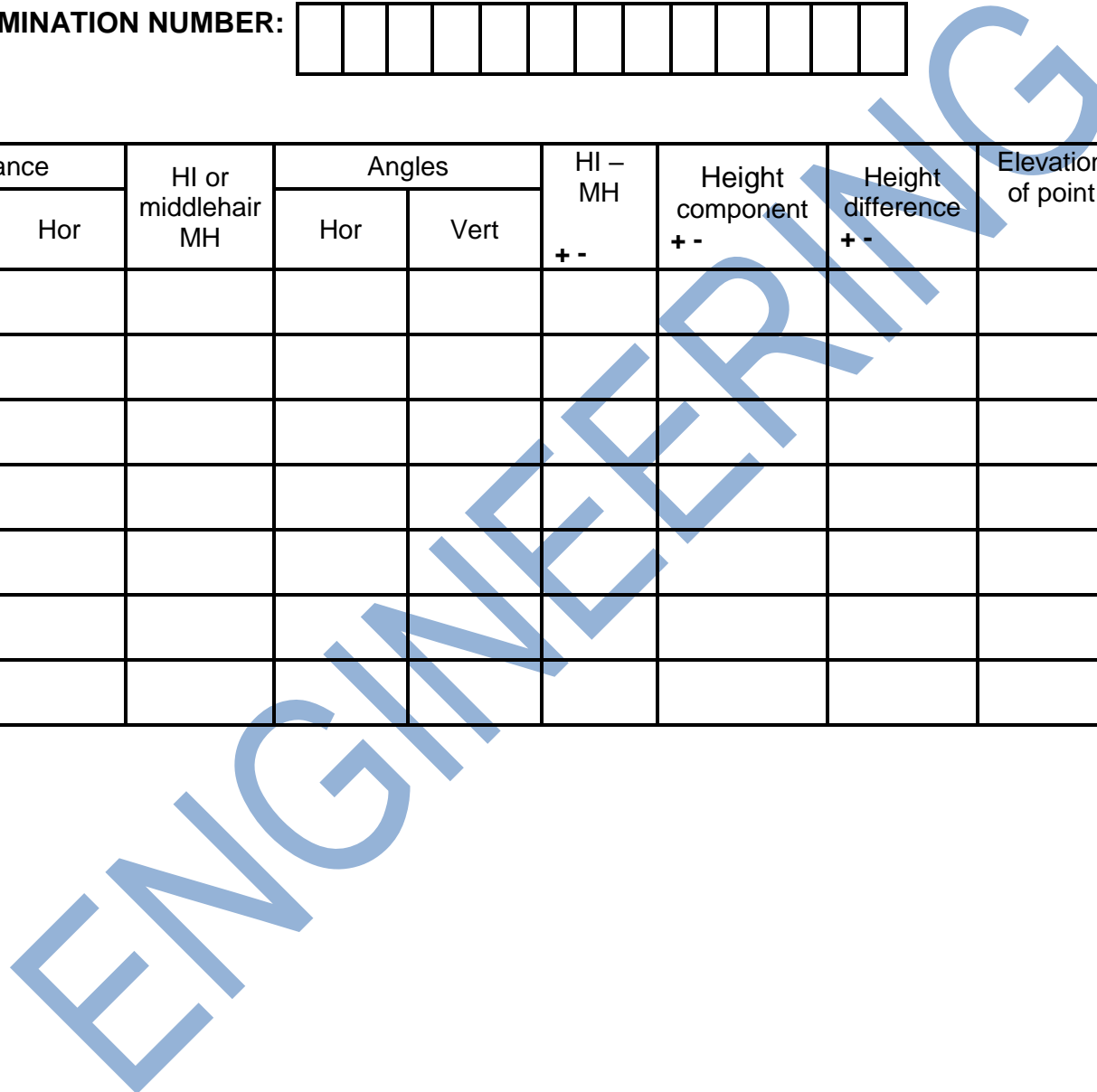
NAME	JOIN	$\Delta Y$	$\Delta X$	NAME	Y	X
T1				T1	+ 2 560,60	+ 1 264,48
244:10:30						
319,27 m						
T2				T2		
306:12:40						
251,77 m						
T3				T3		
77:16:50						
422,69 m						
T4				T4		
92:12:30						
277,70 m						
T5				T5	+ 2 761,09	+ 1 355,61

**ADDENDUM 3**

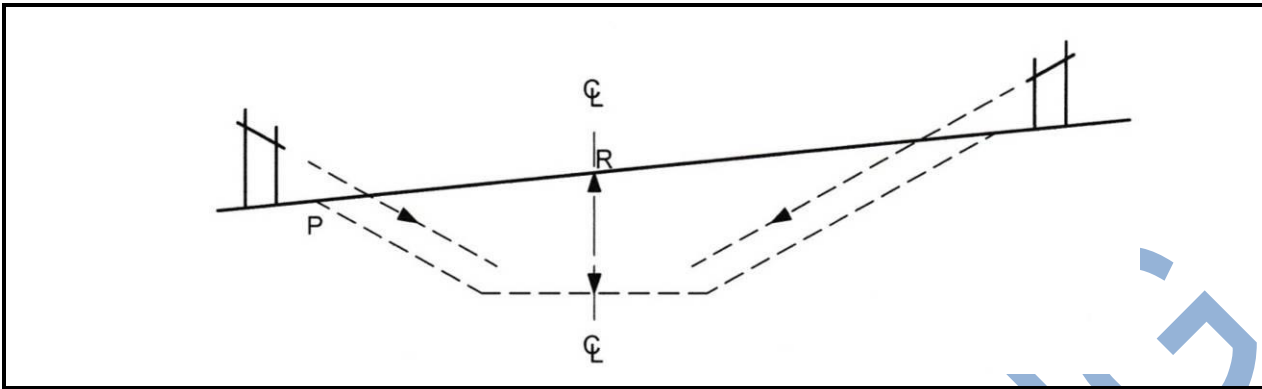
**EXAMINATION NUMBER:**

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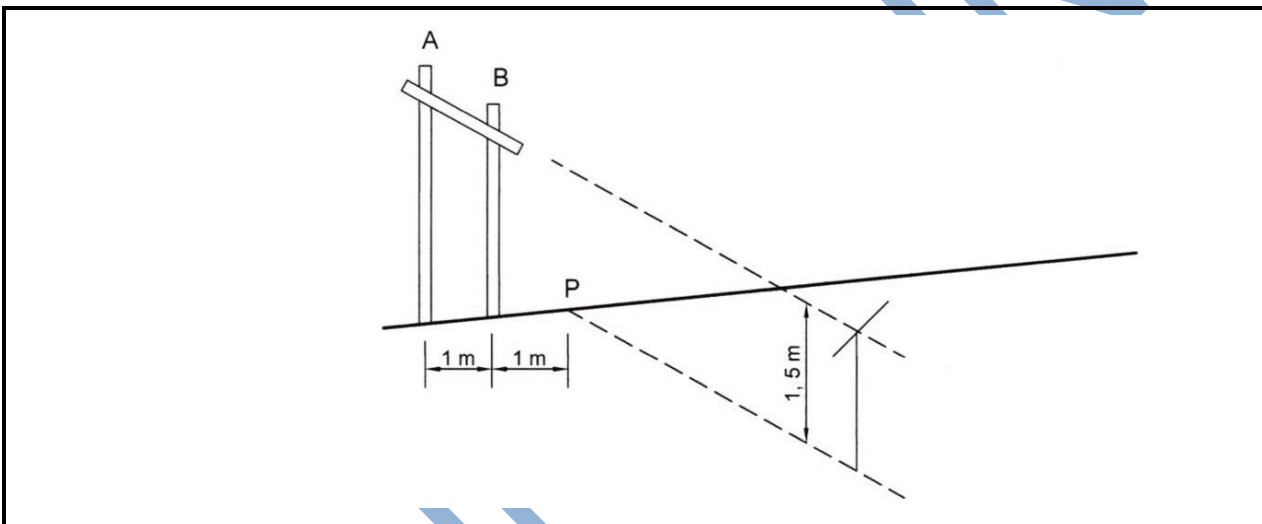
Station		Distance		HI or middlehair MH	Angles		HI - MH + -	Height component + -	Height difference + -	Elevation of point	Remarks
From	To	Stadia	Hor		Hor	Vert					



**ADDENDUM 4**



**FIGURE 1**



**FIGURE 2**



**BUILDING AND STRUCTURAL SURVEYING N6****FORMULA SHEET**

Any applicable formula may also be used.

$$\alpha = \tan^{-1} \frac{\Delta y}{\Delta x}$$

$$\alpha = \tan^{-1} \frac{\Delta x}{\Delta y} + 90^\circ$$

$$\alpha = \tan^{-1} \frac{\Delta y}{\Delta x} + 180^\circ$$

$$\alpha = \tan^{-1} \frac{\Delta x}{\Delta y} + 270^\circ$$

$$S = \frac{\Delta y}{\sin \alpha}$$

$$S = \frac{\Delta x}{\cos \alpha}$$

$$\Delta y = s \cdot \sin \alpha$$

$$\Delta x = s \cdot \cos \alpha$$

$$C = \frac{\text{Distance}}{\text{Total distance}} X_1$$

$$\Delta h = 50I \sin 2\theta + HI - MH = 100I \sin \theta \cos \theta + HI - MH$$

$$HD = 100I \cos^2 \theta$$

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

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

$$g = \frac{17189 \cdot a}{R}$$

$$Cd = T \cdot \tan \frac{\Delta}{4}$$

$$Lc = 2 \cdot R \cdot \sin \frac{\Delta}{2}$$

$$W_1 = \frac{g(a + hs)}{g - s}$$

$$W_2 = \frac{g(a + hs)}{g + s}$$

$$A = \frac{W_1 \cdot W_2 - a^2}{s}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cdot \cos B$$

$$c^2 = a^2 + b^2 - 2ab \cdot \cos C$$

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$