higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# NATIONAL CERTIFICATE

# BUILDING AND STRUCTURAL SURVEYING N6

(8060056)

**25 November 2024 (X-paper)**
**09:00–12:00**

**Nonprogrammable calculators may be used.**

**This question paper consists of 5 pages, 3 addenda and 1 formula sheet.**

090Q1E2425

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# 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. Use only a black or blue pen.
5. Write neatly and legibly.

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## QUESTION 1

Combine the following circle left and circle right horizontal angle observations which were taken from station B and find the oriented direction B–K, B–L and B–M. Use the co-ordinates of B and K. Use ADDENDUM 1 (attached).

At B

| Station | Circle left | Circle right |
|---|---|---|
| K | 236:30:49 | 56:30:22 |
| L | 98:20:36 | 278:20:12 |
| M | 186:34:40 | 6:34:10 |
| K | 236:30:26 | 56:30:16 |
| Co-ordinates | | |
| B | +1 737,40 | -2 012,16 |
| K | +2 617,14 | -2 597,62 |

**[10]**

## QUESTION 2

The following information is given. Use ADDENDUM 2 (attached) to answer the questions that follow.

| **Observation angles** | | **Distances** | |
|---|---|---|---|
| TAB | 119:13:04 | AB | 414,50 m |
| ABC | 300:16:26 | BC | 191,48 m |
| BCD | 114:15:56 | CD | 106,82 m |
| CDE | 235:43:02 | DE | 188,37 m |
| DER | 127:06:52 | | |

| **Co-ordinates** | | | **Directions** | |
|---|---|---|---|---|
| A | +340,66 | +1 553,90 | TA | 98:21:06 |
| E | +873,76 | +1 540,20 | ER | 94:56:01 |

2.1 Calculate the oriented directions in the ANSWER BOOK. (10)

2.2 Use the oriented directions to calculate the co-ordinates. (20)

**[30]**

## QUESTION 3

The following observations were recorded by a theodolite during a tacheometric survey. The reduced level at station R is 239,00 m and the height of the theodolite above station R1 is 1,60 m. Complete the tacheomatric field book on ADDENDUM 3 (attached).

| Staff station | Horizontal angle | Vertical angle | Staff readings |
|---|---|---|---|
| R1 | 23: 47: 25 | 92: 35: 20 | 3,97……2,42 |
| R2 | 38: 23: 15 | 94: 42: 10 | 2,19……1,70 |
| R3 | 94: 39: 00 | 96: 22: 30 | 2,53……1,00 |
| R4 | 92: 30: 00 | 84: 24: 40 | 1,62……0,56 |

**[20]**

## QUESTION 4

4.1 Define the following contouring terms:

4.1.1 Contour line

4.1.2 Embankment

(2 × 2) (4)

4.2 Explain why contour interval selection depends on the following:

4.2.1 The nature of the ground (3)

4.2.2 The purpose and extent of the survey (3)

**[10]**

## QUESTION 5

5.1 Define each of the following terms:

5.1.1 Setting out

5.1.2 Survey grid

(2 × 2) (4)

5.2 State any TWO distinct objectives of vertical alignment controls.

(1 × 2) (2)

5.2 Name FOUR means of checking the verticality of buildings. (4)

**[10]**

**QUESTION 6**

A left circular curve connects straights which deflects at an angle of 38: 44: 28.

- The point of intersections has co-ordinates +2 528,46 +3 012,42.
- The co-ordinates of the point of zero chainage on the first straight are +1 321,91 +5 812,38.
- The radius of the curve is 170 m and the pegs are required at every full 20 m chainage.
- Calculate and tabulate the setting-out data. **[20]**

**TOTAL: 100**

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**ADDENDUM 1**

**QUESTION 1**

| STA. | Circle-left | Circle-right | Mean Angle | Cor. | Adj. Angle |
|---|---|---|---|---|---|
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**ADDENDUM 2**

**QUESTION 2.2**

| NAME | JOIN | ΔY | ΔX | NAME | Y | X |
|---|---|---|---|---|---|---|
| M | | | | M | +2017,40 | +1389,15 |
| 210:24:00 | | | | | | |
| 224,40 | | | | | | |
| | | | | | | |
| N | | | | N | | |
| 220:12:40 | | | | | | |
| 154,50 | | | | | | |
| | | | | | | |
| P | | | | P | | |
| 120:20:20 | | | | | | |
| 200,40 | | | | | | |
| | | | | | | |
| Q | | | | Q | | |
| 320:10:23 | | | | | | |
| 120,10 | | | | | | |
| | | | | | | |
| R | | | | R | +1899,29 | +1070,12 |
| | | | | | | |
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**ADDENDUM 3**

**QUESTION 3**

| Station | | Distance | | HI or Middlehair MH | Angles | | HI – MH + - | Height Component + - | Height Difference + - | Elevation of point | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| From | To | Stadia | Hor | | Hor | Vert | | | | | |
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**BUILDING AND STRUCTURAL SURVEYING N6**

**FORMULA SHEET**

Any applicable formula may be used.

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

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

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

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

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

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

$\Delta y = s.sin\alpha$

$\Delta x = s.cos\alpha$

$C = \frac{Distance}{Total\ distance}$ X

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

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

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

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

$\vartheta = \frac{1718.9.\alpha}{R}$

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

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

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

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

$A = \frac{W1.W2-a^2}{S}$

$a^2 = b^2 + c^2 - 2bc.CosA$

$b^2 = a + c^2 - 2ac.CosB$

$c^2 = a + b^2 - 2ab.CosC$

$\frac{SinA}{a} = \frac{SinB}{b} = \frac{SinC}{C}$

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