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higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T160(E)(A2)T
APRIL EXAMINATION

NATIONAL CERTIFICATE

BUILDING AND STRUCTURAL SURVEYING N4

(8060034)

2 April 2013 (X-Paper)
09:00–12:00

Calculators may be used.

This question paper consists of 5 pages, 1 addendum and a 1-page formula sheet.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
BUILDING AND STRUCTURAL SURVEYING N4
TIME: 3 HOURS
MARKS: 100

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 diagrams, sketches and drawings should be large and in good proportion, fully and clearly labelled and done in pencil.
5. Write neatly and legibly.

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QUESTION 1

Define the following survey terms:

1.1 Engineering survey

1.2 Geodetic surveying

1.3 Horizontal plane

(3 × 2) **[6]**

QUESTION 2

2.1 Name FOUR qualities of a good surveyor. (4)

2.2 Name FIVE types of information that must appear in a field book. (5)
[9]

QUESTION 3

3.1 Name the THREE scales used in surveying. (3)

3.2 On a map scale 1 : 200 000, what distance in metres does 30 mm represent? (3)

3.3 Calculate the distance between two points on the map if the representative fraction on the map is 1 : 25 000 and the actual ground distance is 2 400 m. (3)

3.4 A triangular area with a base of 350 mm and a perpendicular height of 180 mm was measured on a plan.

Calculate the ground area in hectares. The scale is 1 : 2 000. (4)

3.5 Briefly describe systematic errors. (4)

3.6 Define *orientation* with regard to plane tabling. (3)
[20]

QUESTION 4

4.1 State FOUR advantages of chain surveying. (4)

4.2 State FOUR disadvantages of steel tapes. (4)

4.3 Make use of a diagram and explain how to fix a point by method of resection. (3)

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4.4 It is required to set off an exact distance of 150,0 m with a steel tape known to be 0,75% too short.

Calculate the distance to be measured off with this incorrect tape. (4)

4.5 A negative correction of 0,003 m was found when a distance of 60,0 m was measured with a steel tape, which has a standard temperature of 20EC and a coefficient of expansion of $1,13 \times 10^{-5}$/EC.

Calculate the temperature at the time of measurement. (4)

4.6 The horisontal distance between two points is 94,596 m.

Calculate the required sloping distance if the angle between the two points is 7°40' 20" from the horizontal. (3)

4.7 Name the THREE main operations of the surveyor in the field. (3)
[25]

QUESTION 5

5.1 Name FOUR conditions that affect the sensitivity of the bubble tube. (4)

5.2 Describe the hand signals a surveyor will use to convey the following instructions:

5.2.1 Move well to the right.

5.2.2 Hurry.

5.2.3 Keep the staff steady in position.

5.2.4 Continue to move to the left. (4 × 2) (8)

5.3 What is a parallax error? (3)

5.4 What is a collimation error? (3)

5.5 Name TWO types of liquid that are used in a bubble tube. (2)
[20]

QUESTION 6

The field book, ADDENDUM 1, gives details of a chain survey.

ALL measurements are given in metres.

In your ANSWER BOOK, plot the stations, lines and detail using a scale 1 : 500. [10]

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QUESTION 7

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (7.1–7.10) in the ANSWER BOOK.

7.1 Isogonic lines are lines joining points of nil magnetic declination.

7.2 Stepped chaining is used to find the horizontal distance.

7.3 The Abney level is used to measure horizontal angles.

7.4 45° is the same angle as 50 grades.

7.5 Tachometry is when distances are measured by optical means.

7.6 Azimuth of a line is the angle which a line makes with the north-south meridian measuring clockwise from south.

7.7 Meridians are parallel to the equator.

7.8 The direction of N12°W is 168°.

7.9 Sag correction may be positive or negative.

7.10 Local attraction denotes any influence preventing the needle from pointing to magnetic north in a given locality.

(10 × 1) **[10]**

TOTAL: 100

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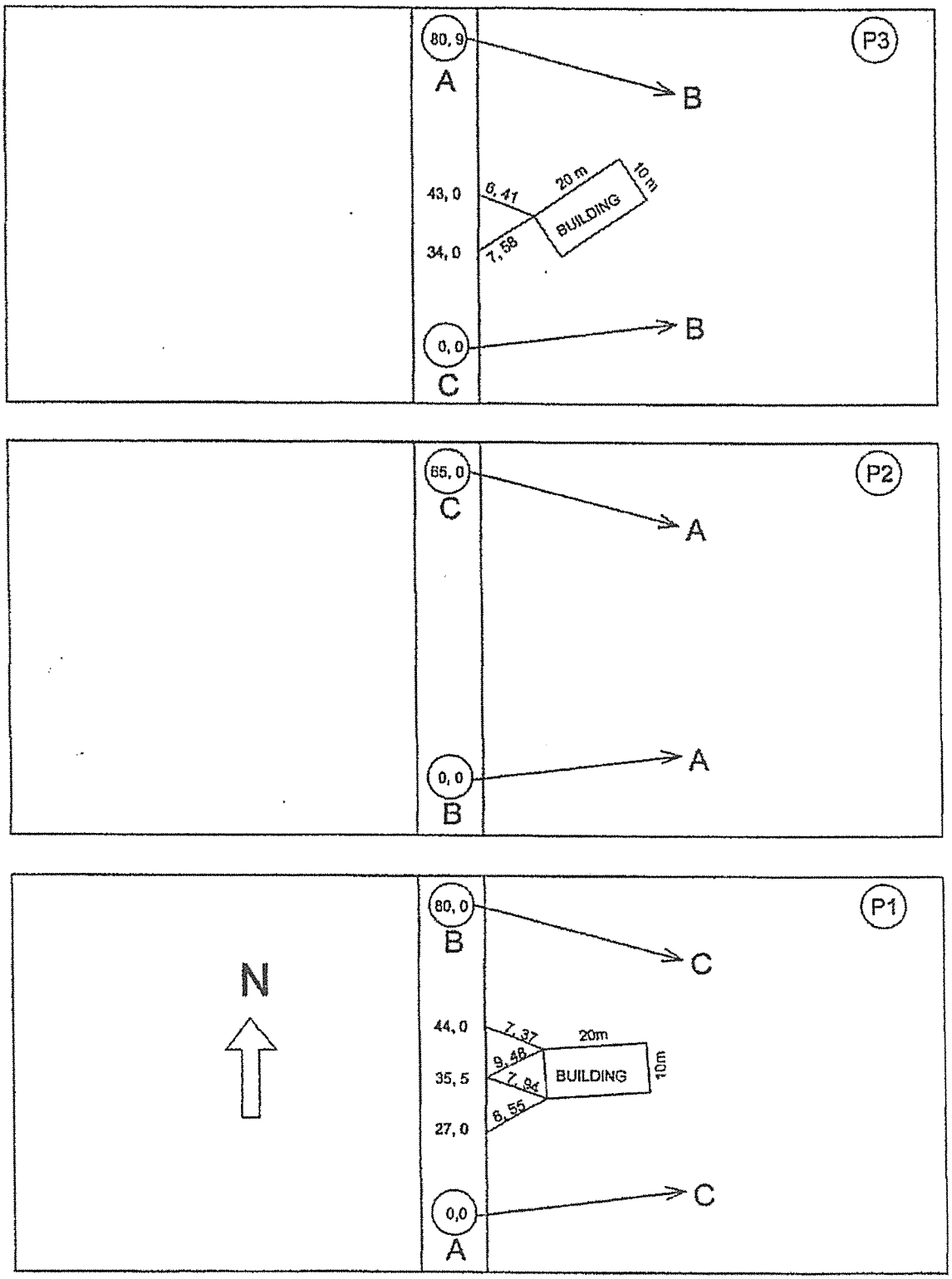
ADDENDUM 1



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BUILDING AND STRUCTURAL SURVEYING N4

FORMULA SHEET

Any other applicable formula may also be used.

1. $A = ½b \times \perp h$

2. $A = \sqrt{s(s-a)(s-b)(s-c)}$, $s = \frac{a+b+c}{2}$

3. $A = \frac{(a+b) \times h}{2}$

4. $A = a \times h$

5. $A = \frac{d}{3}\left[(y_1 + y_n) + 2(y_3 + y_5 + \ldots + (y_{n-2})) + 4(y_2 + y_4 + \ldots + y_{n-1})\right]$

6. $A = d\left[\left(\frac{y_2 + y_n}{2}\right) + y_2 + y_3 + \ldots + y_{n-1}\right]$

7. $C = L \times e \times (t_m - t_s)$

8. $C = \frac{w^2 L^3}{24\, T^2}$

9. $C = L(1 - \cos\theta)$

10. $C = H(\sec\theta - 1)$

11. $C = \frac{L.H}{R}$

12. $A = \frac{1}{2}\, abSinC$

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Department:
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MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

BUILDING AND STRUCTURAL SURVEYING N4

2 APRIL 2013

This marking guideline consists of 8 pages.

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QUESTION 1

1.1 It has to do with the preparation and execution of civil engineering works such as roads, railways, bridges et cetera.

1.2 In geodetic surveying the curvature of the earth is taken into account.

1.3 A plane perpendicular to the direction of gravity from only one point in that plane.

(3 × 2) **[6]**

QUESTION 2

2.1
- Honesty is of prime importance. √
- Sound knowledge of the theory and the practice of surveying. √
- Neatness: i.e. booking of field observations etc. √
- Initiative and resourcefulness should be applied to each problem. √
- Only accept information given or results obtained as being trustworthy when verified.
- Must be reliable.
- Judgement must be sound.
- Must be able to think clearly without confusion.
- Reason logically without prejudice.
- Must be thorough and be content with his/her work only when it has been finished in a workmanlike manner.

(Any 4 x 1) (4)

2.2
- Observations √
- Descriptions √
- Sketches √
- Data √
- Weather information √
- Equipment list
- Benchmark description and location
- Party names
- Job description
- Surveyor's signature
- Date

(Any 5 x 1) (5)
[9]

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QUESTION 3

3.1
- Natural scale √
- Engineer's scale √
- Divided scale line √

(3 × 1) (3)

3.2 RF = 1: 200 000
Map distance = 30 mm
Actual distance = 30 x 200 000 √
= 6 000 000 mm √
= 6 000 m √

(3 × 1) (3)

3.3 Required distance $= \frac{2\,400 \times 1\,000}{25\,000}$ √ √
= 96 mm √

(3 ×1) (3)

3.4 A = ½ base x ζ height √

$$A = \left(\frac{350\ x\ 2000}{2\ x\ 1000}\right) x \left(\frac{180\ x 2000}{1000}\right) \surd$$

$$A = 126\,000\ m^2 \surd$$

$$A = 12,6\ ha \surd$$

(4 × 1) (4)

3.5 Errors which depend for their magnitude and signs√, upon external conditions √such as temperature changes, slope of the land etc. √
These errors can be corrected by computation. √

(4 × 1) (4)

3.6 The process of ensuring that the plane–table board√ is in the direct relationship√ to the detail depicted on it. √

(3 × 1) (3)
[20]

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QUESTION 4

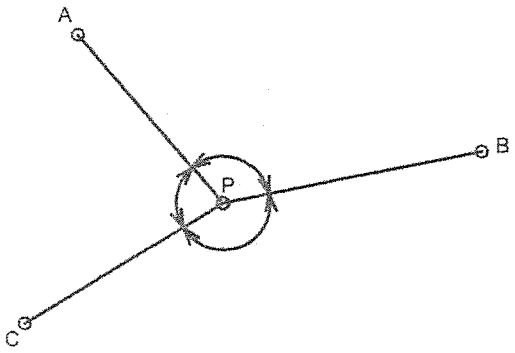
4.1
- The methods are easily mastered. √
- The amount of apparatus required is minimum. √
- It is inexpensive. √
- The location of detail is performed to a high degree of accuracy. √

(4 × 1) (4)

4.2
- It is brittle - breaks easily. √
- It kinks easily. √
- It is liable to rust.√
- It requires continual maintenance. √
- It stretches easily.
- It is difficult to repair accurately.
- Excessive tension can permanently damage it.

(4 × 1) (4)

4.3



A, B and C are known points.
Measure angle APB. √
Measure angle CPB. √
Measure angle APC. √

(3 × 1) (3)

4.4

Correct distance $C = MDx\left(\frac{actual\ tape\ length}{graduated\ tape\ length}\right)$ √

$$150\ m = MDx\left(\frac{100-0,75}{100}\right)\ \surd$$
$$150\ m = MD\ x\ (0,9925)$$
$$\frac{150}{0,9925} = MD\ \surd$$
$$MD = 151,134\ m\ \surd$$

(4 × 1) (4)

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4.5 $CT = L\ x\ E\ x\ (Tm - Ts)$ √

$-0{,}003 = 60x1{,}13x10^{-5}\ (TM - 20)$ √

$\frac{-0{,}003}{0,000678} = Tm - 20$ √

$Tm = 20 + \left(\frac{-0{,}003}{0{,}000678}\right)$

= 15, 575 EC √

(4 × 1) (4)

4.6 Slope distance $= \frac{\text{hor distance}}{\cos 7°40''20'}$ √

Slope distance $= \frac{94,596}{\cos 7°40''20'}$ √

Slope distance = 95, 45 m √

(3 × 1) (3)

4.7
- Reconnaissance √
- Measuring distances and angles. √
- Recording field notes. √
- Setting out. √

(ANY 3 × 1) (3)
[25]

QUESTION 5

5.1
- The radius of curvature of the internal surface √
- The diameter of the level tube √
- Length of the vapour bubble √
- The viscosity and surface tension of the liquid √
- Smoothness of the finish of the internal surface of the tube

(Any 4 × 1) (4)

5.2 5.2.1 Rapid throwing out movements to the right side with the right hand. √√

5.2.2 Right arm extended to the right, slightly bent and closed fist pumped up and down. √√

5.2.3 Both hands rose vertically above the head and kept there. √√

5.2.4 Left arm held out horizontally to the left. √√

(4 × 2) (8)

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5.3 It is when the cross hairs of the instrument and sighted object are not seen on the same plane.

(3 × 1) (3)

5.4 The angle between the line of sight through an optical instrument and the position the line would have in a perfect instrument.

Or

Is the small angle by which the line of sight departs from the actual level surface through the instrument when the instrument is considered to be level.

(ANY 3 × 1) (3)

5.5
- Alcohol√
- Chloroform √
- Ether √

(ANY 2 × 1) (2)
[20]

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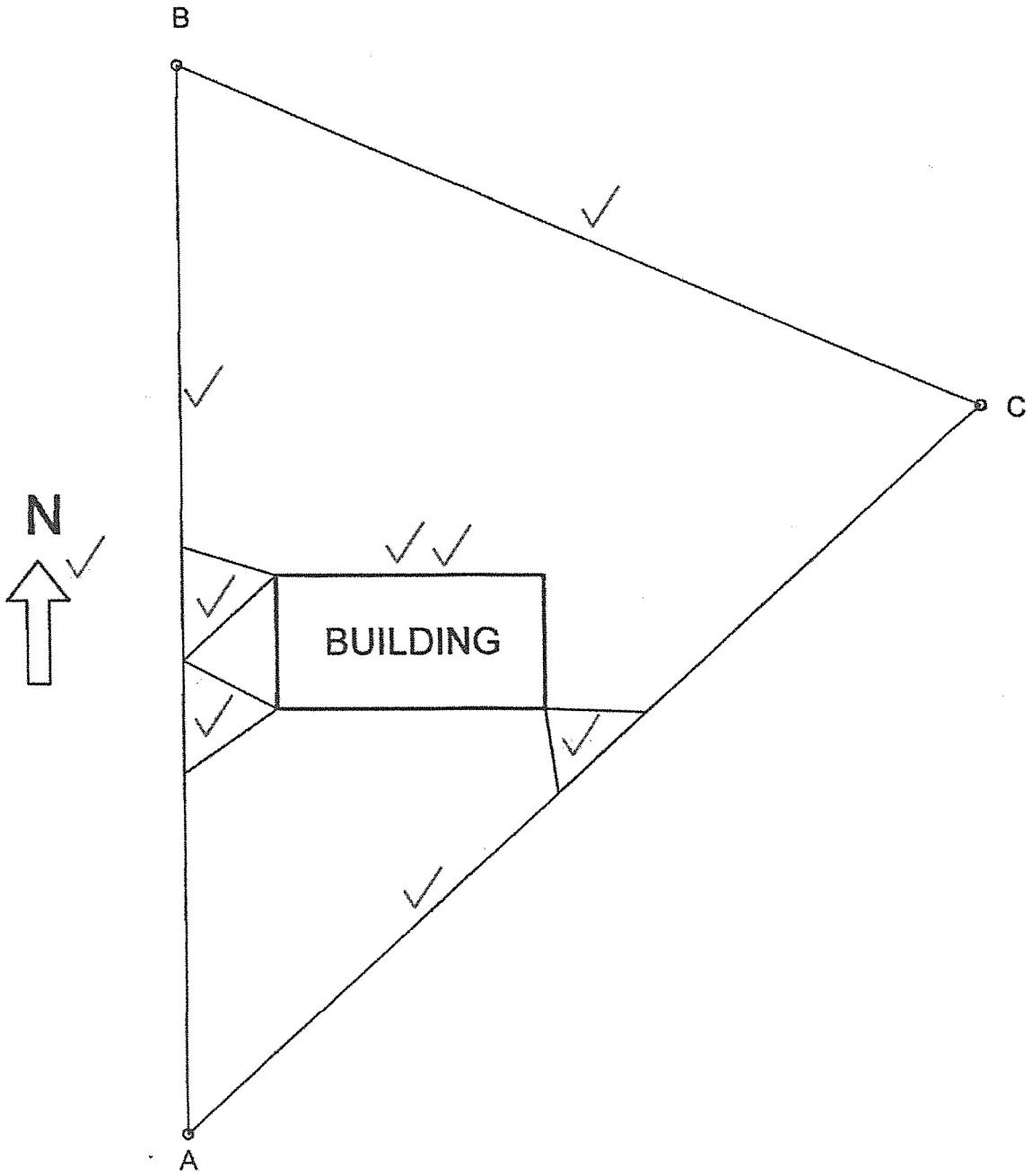
QUESTION 6



Correct plotting of AB = 1
BC = 1
CB = 1
Correct ties = 3 x 1
Building correct = 2 x 1
North = 1
Neatness = 1
Total **10**

[10]

QUESTION 7

7.1 False √

7.2 True √

7.3 False √

7.4 True √

7.5 True √

7.6 False √

7.7 False √

7.8 True √

7.9 False √

7.10 True √

(10 × 1) **[10]**

TOTAL: 100

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