higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T130(E)(A10)T
APRIL EXAMINATION

NATIONAL CERTIFICATE

BUILDING AND STRUCTURAL SURVEYING N4

(8060034)

10 April 2015 (Y-Paper)
13:00–16:00

Calculators may be used.

This question paper consists of 5 pages, 1 diagram sheet and 1 formula sheet.

ENGINEERING

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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 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.

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QUESTION 1

Define the following survey terms:

1.1 Tacheometry

1.2 Bearing

1.3 Field party

1.4 Change point

1.5 Graticule

(5 × 2) **[10]**

QUESTION 2

2.1 Give THREE reasons why plane surveying and not geodetic surveying is used on a building site. (3)

2.2 Give FIVE reasons why the proper recording of field notes is a very important part of surveying practice. (5)

2.3 In mapping coordinates are used to describe a point.

Draw the South African coordinate system showing ALL the relevant information. (8)
[16]

QUESTION 3

3.1 On a map with a scale of 1 : 50 000, what distance in metres does 28 mm represent? (3)

3.2 A rectangular area was measured on plan and found to be 375 mm × 215 mm.

Calculate the ground area in hectares. The scale is 1 : 2 500. (3)

3.3 Calculate the area of a segment of a circular area with radius 54 m. The included angle is 42°. (6)

3.4 Name the THREE angular measurements used in surveying. (3)

3.5 The quadrant bearing of a line BC is N 63° W.

What is the direction of the line BC? (2)

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3.6 *Mistakes* is a term used in surveying.

3.6.1 Explain what is meant by this term. (2)

3.6.2 Give TWO examples. (2)

3.6.3 Can adjustments be made? (1)
[22]

QUESTION 4

4.1 State FOUR disadvantages of chain surveying. (4)

4.2 Beside the steel tape, name THREE types of tapes used in surveying. (3)

4.3 A base line of 800 m has to be accurately established.

What distance must be measured with a tape which is known to be 0,65% too short? (4)

4.4 A measured distance of 70 m was obtained with a steel tape at 34° C.

Calculate the standard temperature if the coefficient of linear expansion is 0,0000113/C and the temperature correction is +0,011 m. (6)

4.5 A length of 272 m was measured with a steel tape 2 300 m above sea level. The radius of the earth is 6 373 kilometres.

Calculate the correct distance. (4)
[21]

QUESTION 5

5.1 Describe, with the aid of neat sketches, how to solve each of the following practical problems by using a tape:

5.1.1 To obtain a distance AB across a wide river (5)

5.1.2 Setting out a perpendicular line from a point on the line (5)

5.2 Explain the term *collimation error.* (3)
[13]

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QUESTION 6

The field book on the DIAGRAM SHEET (attached), gives details of a chain survey to establish the position of a building measuring 20,0 m × 12,0 m.
ALL measurements are given in metres.

Plot the stations, lines and detail to scale 1 : 500 in the ANSWER BOOK. **[10]**

QUESTION 7

7.1 What is the function of the bubble tube in survey instruments? (2)

7.2 Name TWO types of liquid used in a bubble tube. (2)

7.3 Give TWO reasons why these types of liquid are used. (2)

7.4 Why is a bubble tube curved? (1)

7.5 Why are a number of small lines engraved on the bubble tube? (1)
[8]

TOTAL: 100

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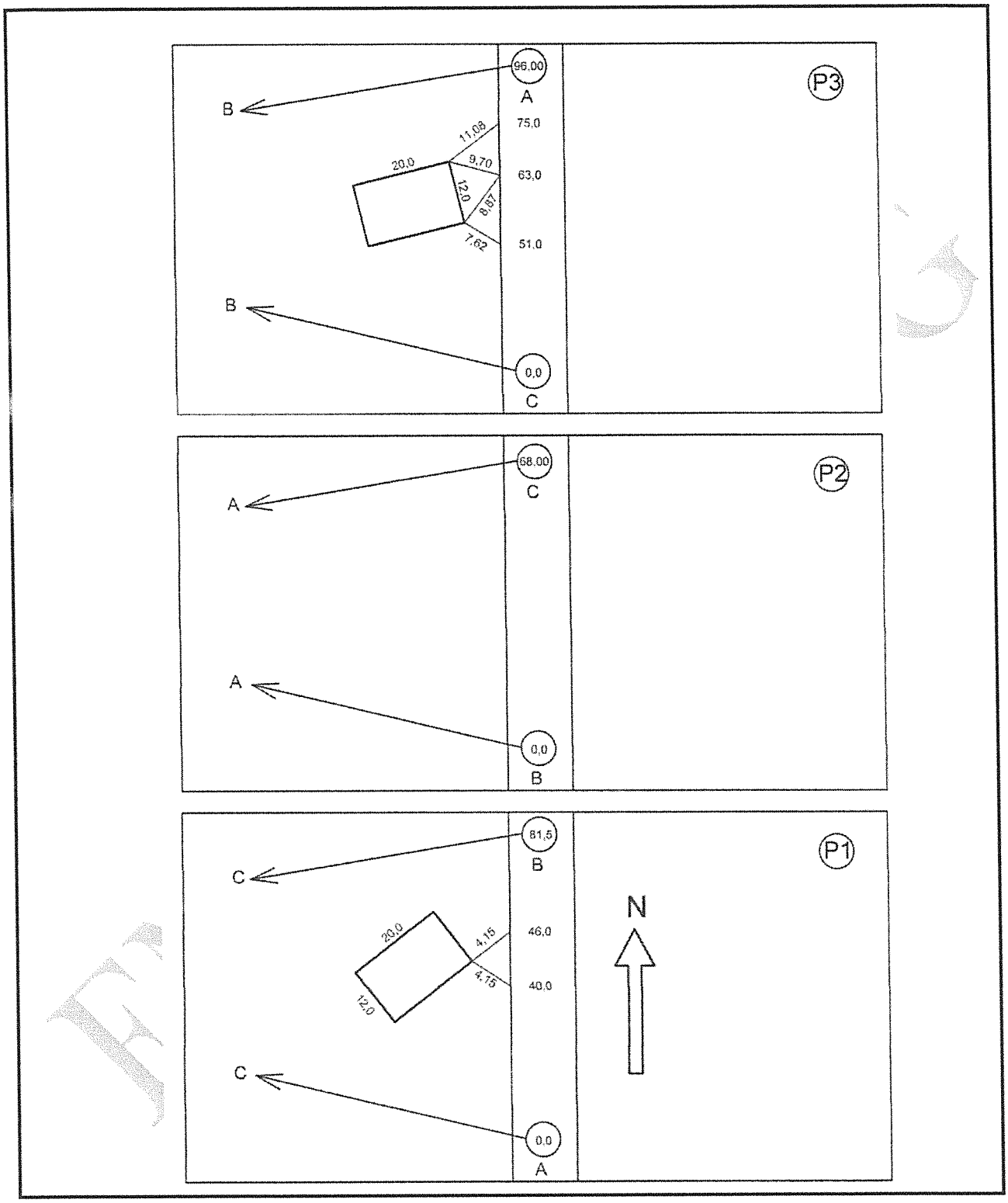
DIAGRAM SHEET



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BUILDING AND STRUCTURAL SURVEYING N4

FORMULA SHEET

Any other applicable formula may also be used.

1. $A = \frac{1}{2}b \times \perp h$

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

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

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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REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

BUILDING AND STRUCTURAL SURVEYING N4

10 APRIL 2015

This marking guideline consists of 9 pages.

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QUESTION 1

1.1
- The method of surveying where distances and elevation of points are obtained by theodolite and staff
- The method of surveying when measurements are done by optical means

(Any 1 × 2)

1.2 The bearing of a line is the angle it makes with the meridian

1.3 Are members of a survey team doing work on site

1.4 When the position of the previous foresight is used for the new backsight reading

1.5 Is the representation of the lines of latitude and longitude on a map

(5 x 2) **[10]**

QUESTION 2

2.1
- The area worked on is relatively small.
- It can therefore be assumed to be a horizontal plane.
- All measurements are portrayed on this plane except elevations.
- The curvature of the earth need not be taken into account. (Any 3 × 1) (3)

2.2
- It is an official record of the survey.
- It may be the only evidence of conditions at the time of survey.
- It reflects the surveyor's competence.
- It reflects the surveyor's credibility.
- It could supplement the original.
- Mistakes can be costly.
- It prevents backtracking.
- The notes are used to make drawings and calculations.
- Mistakes can occur if field notes cannot be read properly. (Any 5 × 1) (5)

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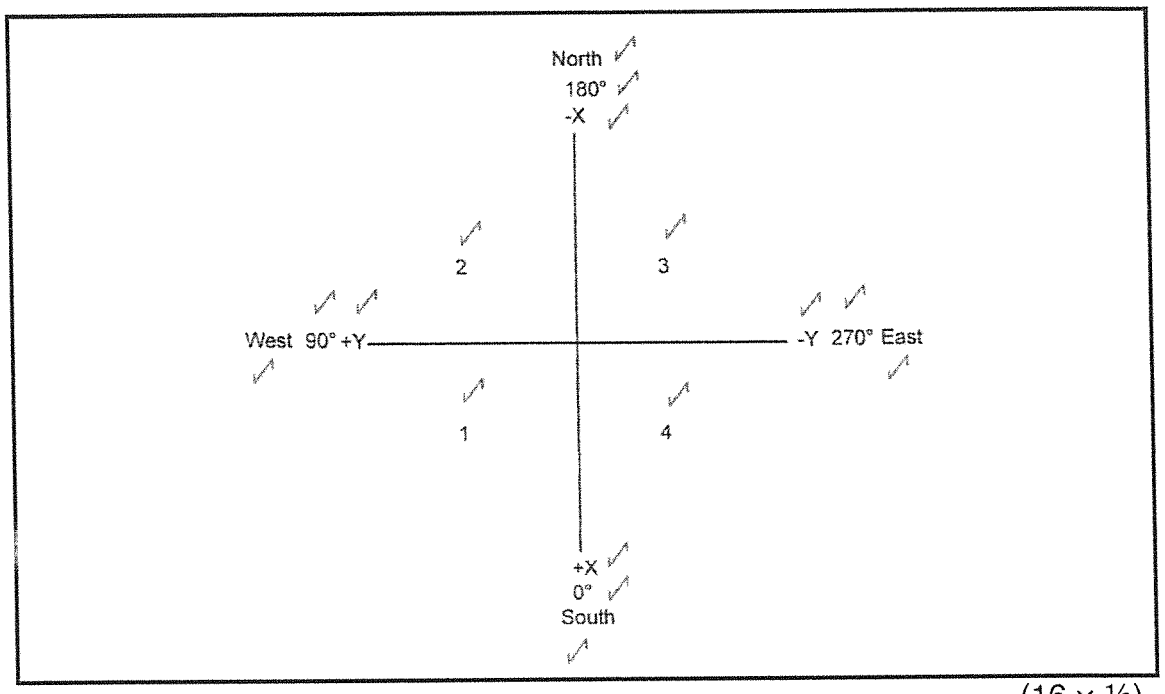
2.3



(16 × ½) (8)
[16]

QUESTION 3

3.1 RF = 1 : 50 000
Map distance = 28 mm
Actual distance = 28 × 50 000√
= 1 400 000 mm√
= 1 400 m√ (3 x 1) (3)

3.2 A = length × width

$$A = \left(\frac{375\,x\,2500}{1\ 000}\right) x \left(\frac{215\,x\,2500}{1\ 000}\right) \sqrt{}$$

$$A = 503\ 906,25\ m^2\sqrt{}$$

$$A = 50,39\ ha\sqrt{}$$ (3)

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3.3 Area of sector = $(\prod r^2)x\frac{\theta}{360}\sqrt{}$

= $(\prod 54^2)x\frac{42}{360}\sqrt{}$

Area of sector = 1 068,77 $m^2\sqrt{}$

Area of triangle = $\frac{r^2 \sin\theta}{2}\sqrt{}$

= $\frac{54^2 \sin 42}{2}\sqrt{}$

Area of triangle = 975,60 $m^2\sqrt{}$

Area of segment = 1 068,77 - 975,60 $\sqrt{}$

Area of segment = 93,17 $m^2\sqrt{}$ (Any 6 × 1) (6)

3.4
- Sexagesimal
- Centesimal
- Radian

(3 x 1) (3)

3.5 180 + 63 = 243°√√ (2)

3.6 3.6.1
- Mistakes are blunders which are avoidable.
- They occur because of inexperience, carelessness or mental lapse.
- Mistakes are also unpredictable.

(Any 2 × 1) (2)

3.6.2
- Wrong bookings
- Using incorrect data
- Incorrect reading

(Any 2 × 1) (2)

3.6.3 Adjustments cannot be made. (1)
[22]

QUESTION 4

4.1
- Wrong bookings can occur.
- It is a laborious task.
- It takes a long time.
- Measurement could be entered on the wrong side of the chain line.

(4 × 1) (4)

4.2
- Metallic tape
- Linen tape
- Plastic tape

(3 × 1) (3)

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4.3 $$CD = MD \times \frac{ATL}{GTL}$$

$$800 = MD \times \frac{100 - 0,65}{100} \surd$$

$$800 = MD \times \frac{99,35}{100} \surd$$

$$800 = MD\ x\ (0,9935)$$

$$MD = \frac{800}{0,9935} \surd$$

$$MD = 805,234\,m \surd$$ (4 × 1) (4)

4.4 $$Ct = L\ x\ E\ x\ (Tm - Ts) \surd$$

$$+0,011 = 70\ x\ 0,0000113\ x\ (34 - ts) \surd$$

$$+0,011 = 0,000791\ x\ (34 - ts) \surd$$

$$\frac{+0,011}{0,000791} = 34 - ts \surd$$

$$ts = 34 - \left(\frac{0,011}{0,000791}\right) \surd$$

Ts = 20°C√ (6 × 1) (6)

4.5 $$Ch = \frac{LH}{R}$$

$$Ch = \frac{272\,x\,2300}{6373000} \surd$$

$$Ch = 0,098\,m \surd$$

Correct distance = 272 - 0,098√
= 271,902 m√ (4 × 1) (4)
[21]

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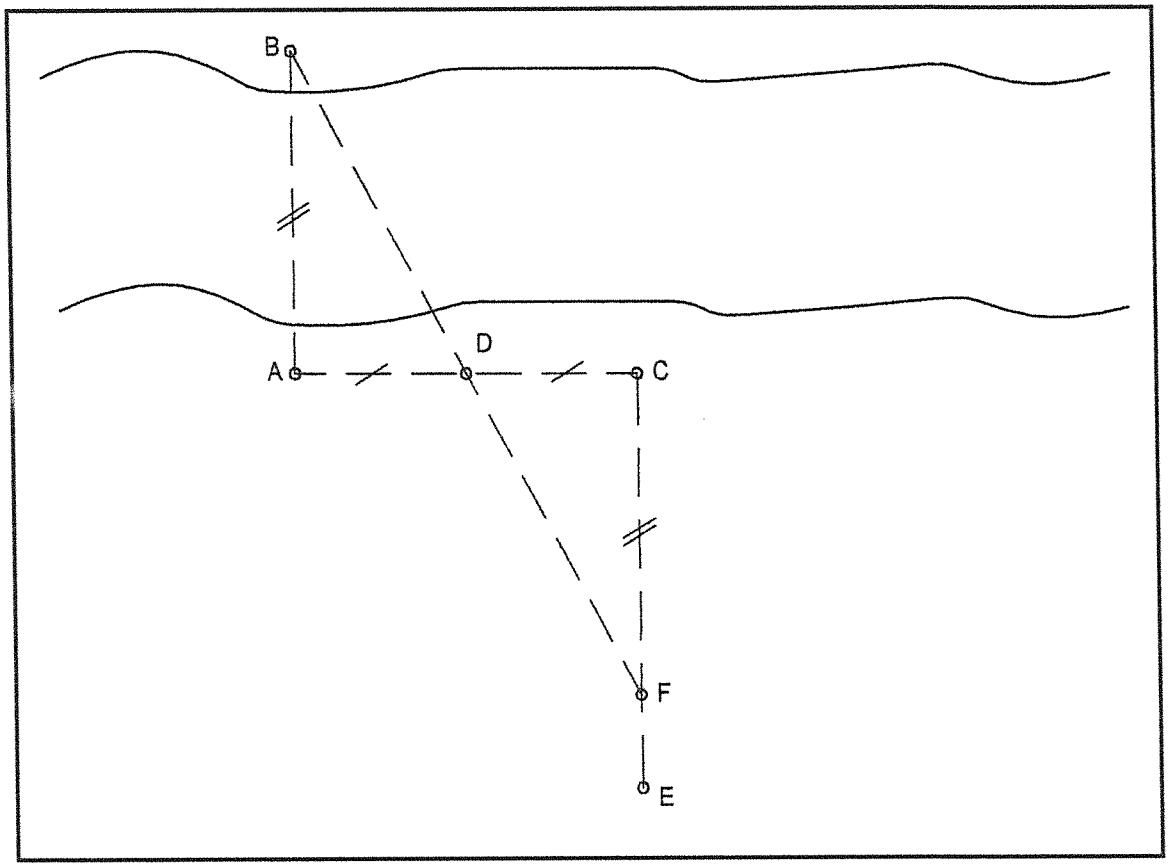
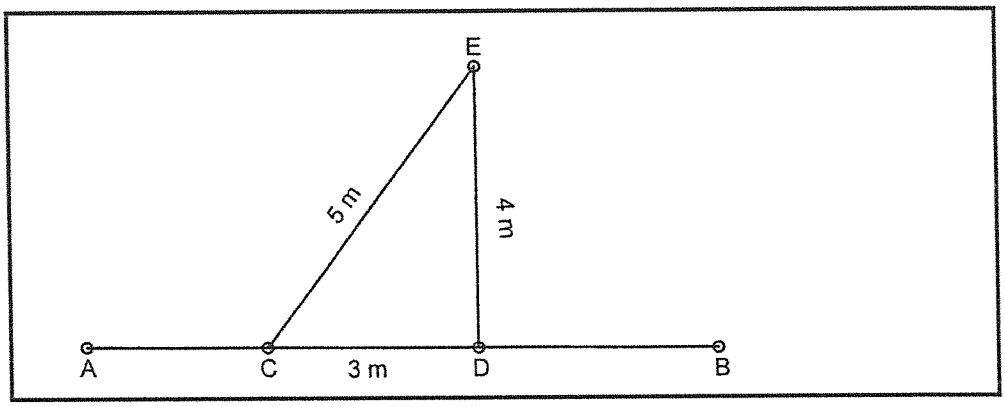
QUESTION 5

5.1 5.1.1



SKETCH N/N
Set out line AC perpendicular to AB. N N
Find D the midpoint of AC. N
Set off CE perpendicular to AC. N N
Move along CE until point B and D are in line. N
This will be point F. N
CF will be equal to AB. N (10 × ½) (5)

5.1.2



SKETCH N N

D is the point from which the right angle must be set out. N
Place a peg at C 3 m from D along line AB. N
One person keeps the first tape at the zero mark at D. N
Another person keeps the zero mark of a second tape at C. N
A third person keeping the first tape at the 4 m mark and the second tape at N
the 5 m mark walks outwards until both tapes are fully extended and the 4 m N
and 5 m marks on the tapes coincides at E. N
A peg is placed at E which will be perpendicular to D N (10 × ½) (5)

5.2
- The angle between the line of sight through an optical instrument and the position the line would have in a perfect instrument
- 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 1 × 3) (3)

[13]

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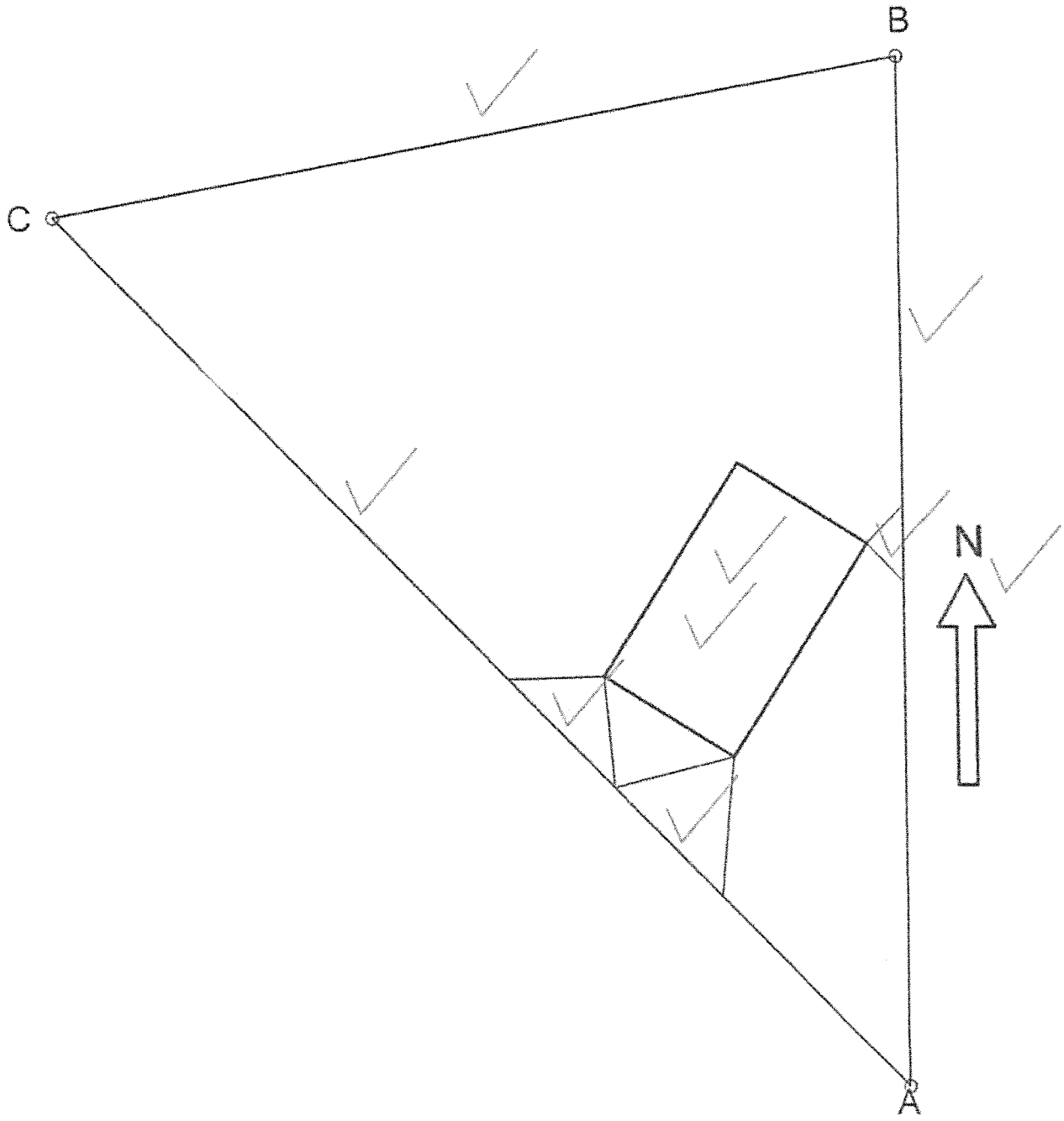
QUESTION 6



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

[10]

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QUESTION 7

7.1 It is to set the line of sight of the instrument perpendicular to gravity. (2)

7.2
- Alcohol
- Ether
- Chloroform (Any 2 × 1) (2)

7.3
- They have a lower viscosity.
- They have a low freezing point.
- They do not evaporate easily. (Any 2 × 1) (2)

7.4 So that the bubble will find its way to the highest part of the tube. (1)

7.5
- To bring the bubble to the centre of its run.
- To show the exact position of the bubble when it is level. (Any 1 × 1) (1)

[8]

TOTAL: 100

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