



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## **NATIONAL SENIOR CERTIFICATE**

**GRADE 12**

**CIVIL TECHNOLOGY**

**FEBRUARY/MARCH 2011**

**MEMORANDUM**

**MARKS: 200**

**This memorandum consists of 16 pages.**

**QUESTION 1 LO 3 AS 1,2,4,5,7,10**

- 1.1 Wear protective clothing. ✓  
Wear gloves when mixing cement ✓  
Wear gum boots  
Wear overall  
Wear dust mask  
**ANY TWO OF THE ABOVE**  
Explanation – inhalation of cement dust can cause lung diseases ✓  
Contact with wet cement can cause chemical burns ✓ (4)
- 1.2 Keep the electric cable away from rotating parts of the machine. ✓  
Avoid contact with any moving parts of the machine. ✓  
Adopt a steady stance whilst using the machine.  
Do not allow yourself to be distracted whilst using the machine.  
Ensure that the machine is connected to an earth leakage system  
**ANY TWO OF THE ABOVE OR OTHER ACCEPTABLE EXPLANATION** (2)
- 1.3 To protect the reinforcement from harsh weather conditions ✓  
To protect the reinforcement from intense heat in case of fire ✓  
To protect the reinforcement from chemicals when used in rivers and the ocean  
**ANY TWO OF THE ABOVE** (2)
- 1.4 1.4.1 Pitch or bolt pitch ✓  
1.4.2 Seam lap or border seam ✓  
1.4.3 Backmark ✓ (3)
- 1.5 One mark for choice and one mark for motivation (open – ended question) (1)  
  
Bolts and nuts ✓  
Holes must be drilled precisely. Easy to be erected and dismantled ✓  
  
Welding  
Skilled welder to do the job.  
Permanent.  
**ANY ONE OF THE ABOVE OR OTHER ACCEPTABLE EXPLANATION** (1)
- 1.6 The pressure exerted by the wet concrete at the bottom of the formwork is the greatest and gradually decreases as the level rises to the top. ✓ ✓ (2)

1.7	1.7.1	D ✓	(1)
	1.7.2	A ✓	(1)
	1.7.3	D ✓	(1)
	1.7.4	A ✓	(1)
	1.7.5	D ✓	(1)

1.8

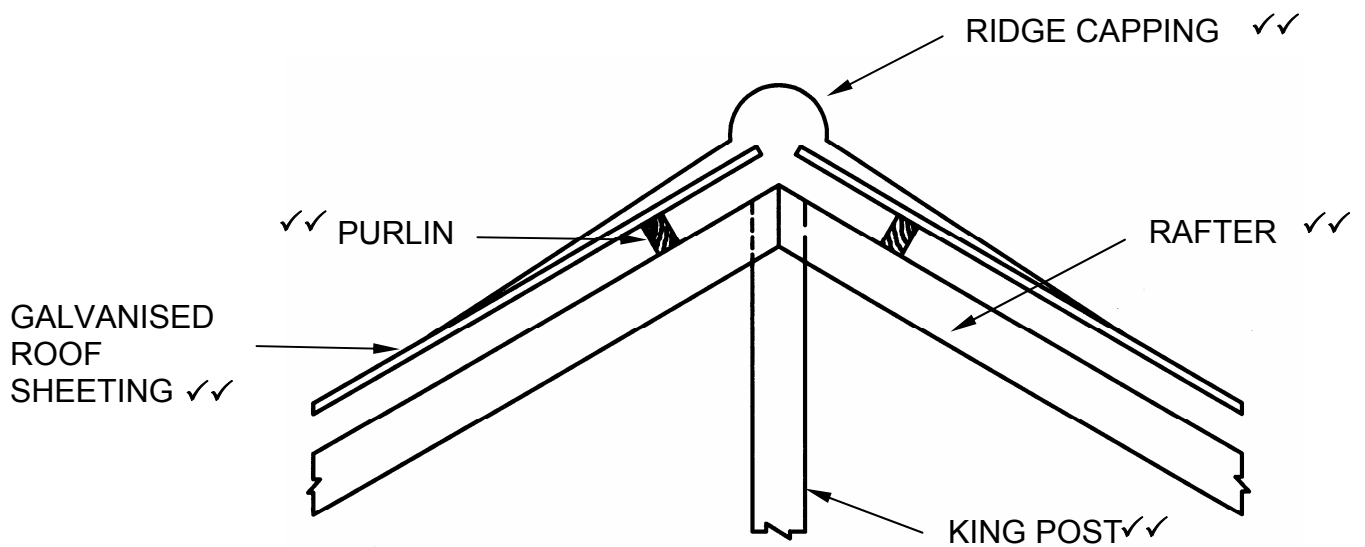


FIGURE 1.8

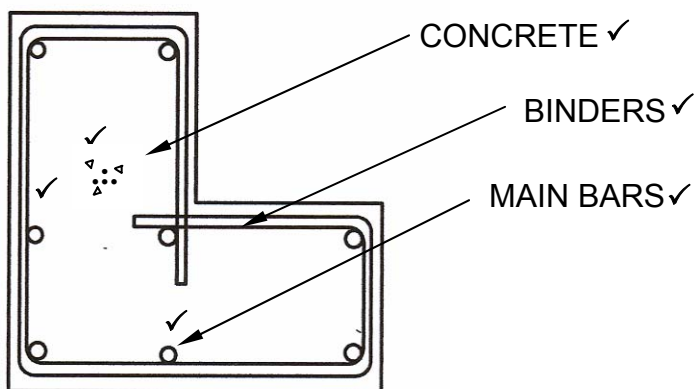
DESCRIPTION	MARK ALLOCATION
Correct placement of kingpost and label	2
Correct indication of rafters and label	2
Correct placement of purlin and label	2
Correct indication of galvanised roof sheeting and label	2
Correct placement of ridge capping and label	2
TOTAL	10

(10)  
[30]

**QUESTION 2 LO 3 AS 3,4,5,7**

- 2.1 A rough arch is built with uncut bricks and then plastered✓ whilst a gauge arch is built with specially cut bricks and not plastered✓ (2)

2.2

**FIGURE 2.2**

Stirrups / binders – 1 mark

Concrete – 1 mark

Main bars – 1 marks

Labels – 1 mark for each of the above (6)

- 2.3 A Wedge ✓  
 B Concrete ✓  
 C Formwork boards ✓  
 D Yoke ✓  
 E Clamp ✓  
 F Bolt & nut or nut ✓ (6)

- 2.4 Horizontal distances ✓  
 Vertical distances ✓  
 Horizontal angles  
 Vertical angles

**ANY TWO OF THE ABOVE** (2)

- 2.5  $A - B = 1,69 - 1,59$   
 $= 0,10$  ✓  
 $C = 1,59 - 0,10$   
 $= 1,49$  ✓ (3)

- 2.6      D ✓  
             E ✓  
             A ✓  
             C ✓  
             B ✓ (5)
- 2.7      REFER TO ANSWER SHEET 2.7 (10)
- 2.8      Maximum span ✓  
             Unit weight ✓  
             Nature of struts ✓  
             Sound insulation ✓  
             Insulation characteristics  
             Thickness of the units  
             Pre-stressed units  
             Fire resistance  
             Construction speed  
             Reinforcement requirements  
             Support and boxing required  
             Safety characteristics  
             Weight reductions  
             Volume reductions  
             Pre-cast layer
- ANY FOUR OF THE ABOVE** (4)
- 2.9      Natural low bearing capacity of soil. ✓  
             High water table. ✓  
             Subsoil – subjected to movement e.g. expansion and contraction of shrinkable clay soil.  
             Subsoil – subjected to high moisture content.  
             Recently placed filling materials which are not sufficiently compacted.
- ANY TWO OF THE ABOVE** (2)
- [40]

**QUESTION 3 LO 3 AS 5,8**

3.1 3.1.1 REFER TO ANSWER SHEET 3.1 (10)

3.1.2 REFER TO ANSWER SHEET 3.1 (5)

3.2 3.2.1 It provides a reliable source of water. ✓  
The water is often suitable for household use. ✓  
It is independent of the municipal supply

**ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWERS** (2)

3.2.2 During power outage an electric pump wont work ✓  
The water may be polluted or dirty ✓  
The water may be too acid or alkaline  
Pumps can break or need expensive repair

**ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWERS** (2)

3.3 Wind power is free energy ✓  
Wind power is a clean source of energy ✓  
Very little maintenance is required

**ANY TWO OF THE ABOVE** (2)

3.4 It is power generated by flowing or falling water (2)

3.5 A reservoir ✓  
Turbines ✓  
Generator ✓  
Power lines ✓ (4)

3.6 In a position facing the equator or facing north. ✓  
± 35° up to 40° to the horizontal

**ANY ONE OF THE ABOVE** (1)

3.7 Use solar-powered appliances  
Use energy-saving appliances  
Switch off unnecessary electrical appliances

**ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER** (2)  
**[30]**

**QUESTION 4 LO 3 AS 2,3,7,8**

4.1 4.1.1 REFER TO ANSWER SHEET 4.1 (12)

4.1.2 REFER TO ANSWER SHEET 4.1 (3)

- 4.2 To protect it against water and rot ✓  
To protect it against attack from fungi ✓  
To protect it against attack from insects such as beetles  
To protect it against attack from wood borers

**ANY TWO OF THE ABOVE** (2)

- 4.3.1 A slump test is done to check the consistency and workability of  
different batches of concrete mixes. ✓

**ONE MARK FOR EITHER CONSISTENCY OR WORKABILITY** (1)

- 4.3.2 A – true slump ✓  
B – shear slump ✓  
C – collapsed slump ✓ (3)

- 4.3.3 Form (conical mould) ✓  
Spirit level ✓  
Ruler  
Base plate  
Tamping rod/Bullet-point rod

**ANY TWO OF THE ABOVE** (2)

- 4.4 It weakens the metal ✓ (1)

- 4.5 Painted ✓  
Galvanised ✓  
Powder coated  
Electroplating (2)

**ANY TWO OF THE ABOVE**

- 4.6 Volume = l x b x d  
          ✓    ✓    ✓  
          = 3 x 0,6 x 0,2  
          = 0,36 m<sup>3</sup> ✓ (4)

**[30]**

**QUESTION 5 LO 3 AS 5,6**

5.1 REFER TO ANSWER SHEET 5.1

(13)

5.2 5.2.1

$$\begin{aligned}\text{Area 1} &= l \times b \\ &= 70 \times 50 \checkmark \\ &= 3\,500 \text{ mm}^2 \checkmark\end{aligned}$$

$$\begin{aligned}\text{Area 2} &= \frac{1}{2} b \times h \\ &= \frac{1}{2} \times 21 \times 30 \checkmark \\ &= 315 \text{ mm}^2 \checkmark\end{aligned}$$

$$\begin{aligned}\text{Total area} &= 3\,500 - 315 \checkmark \\ &= 3\,185 \text{ mm}^2 \checkmark\end{aligned}$$

**OR**

$$\begin{aligned}\text{Total area} &= \overset{\checkmark\checkmark}{3\,500} - \overset{\checkmark\checkmark}{315} \\ &= 3\,185 \text{ mm}^2 \checkmark\checkmark\end{aligned}$$

Two marks if the correct areas are given without any calculations.

(6)

5.2.2

Take moments about A left side

$$\begin{aligned}\overset{\checkmark}{3\,185 \text{ mm}^2} \times \overset{\checkmark}{X} &= \overset{\checkmark}{(3\,500 \times \overset{\checkmark}{35})} - \overset{\checkmark}{(315 \times \overset{\checkmark}{17})} \\ &= 122\,500 - 5\,355 \\ &= \underline{117\,145} \checkmark \\ &\quad \underset{3\,185}{\phantom{117\,145}} \\ &= 36,78 \text{ mm} \checkmark\checkmark\end{aligned}$$

**OR**

	AREA (A)	X	AREA OF X (Ax)
Rectangle	3 500 ✓	$\frac{L}{2} = \frac{70}{2} = 35 \checkmark$	122 500
Triangle	- 315 ✓	$\frac{b}{3} = \frac{21}{3} = 7 + 10 = 17 \checkmark$	- 5 355
Σ	3 185 ✓		117 145

$$\begin{aligned}&\frac{\Sigma Ax}{\Sigma A} \\ &= \frac{117\,145}{3\,185} \checkmark \\ &= 36,78 \text{ mm} \checkmark\checkmark\end{aligned}$$

**OR**



$$\begin{aligned}
 \text{Position of centroid} &= \frac{(A_1 \times d) - (A_2 \times d)}{\text{Total Area}} \\
 &= \frac{(3\,500 \times 35) - (315 \times 17)}{3\,185} \\
 &= \frac{122\,500 - 5\,355}{3\,185} \\
 &= \frac{117\,145}{3\,185} \\
 &= 36,78 \text{ mm}
 \end{aligned}$$

(8)

5.3                      Strain =  $\frac{\text{change in length}}{\text{Original length}}$

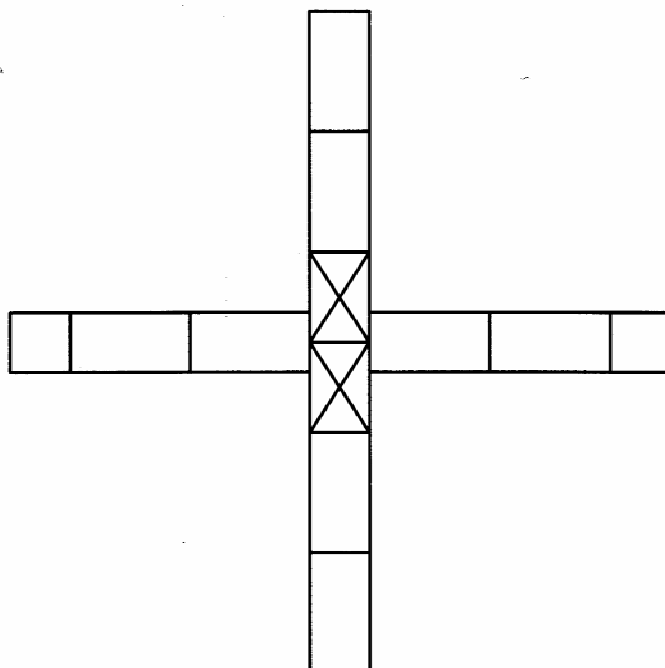
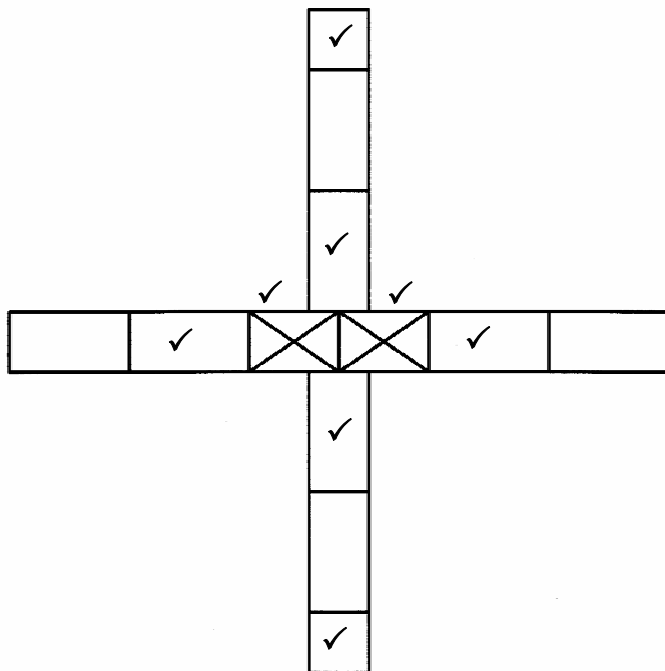
$$\begin{aligned}
 &= \frac{0,4 \text{ mm}}{800 \text{ mm}} \\
 &= 0,0005 \quad \text{OR} \quad 0,5 \times 10^{-3} \quad \text{OR} \quad 5 \times 10^{-4}
 \end{aligned}$$

(3)  
[30]

**QUESTION 6   LO 6 AS 4,5,7,8**

- 6.1            REFER TO ANSWER SHEET 6.1 (15)
- 6.2            REFER TO ANSWER SHEET 6.2 (25)
- [40]**

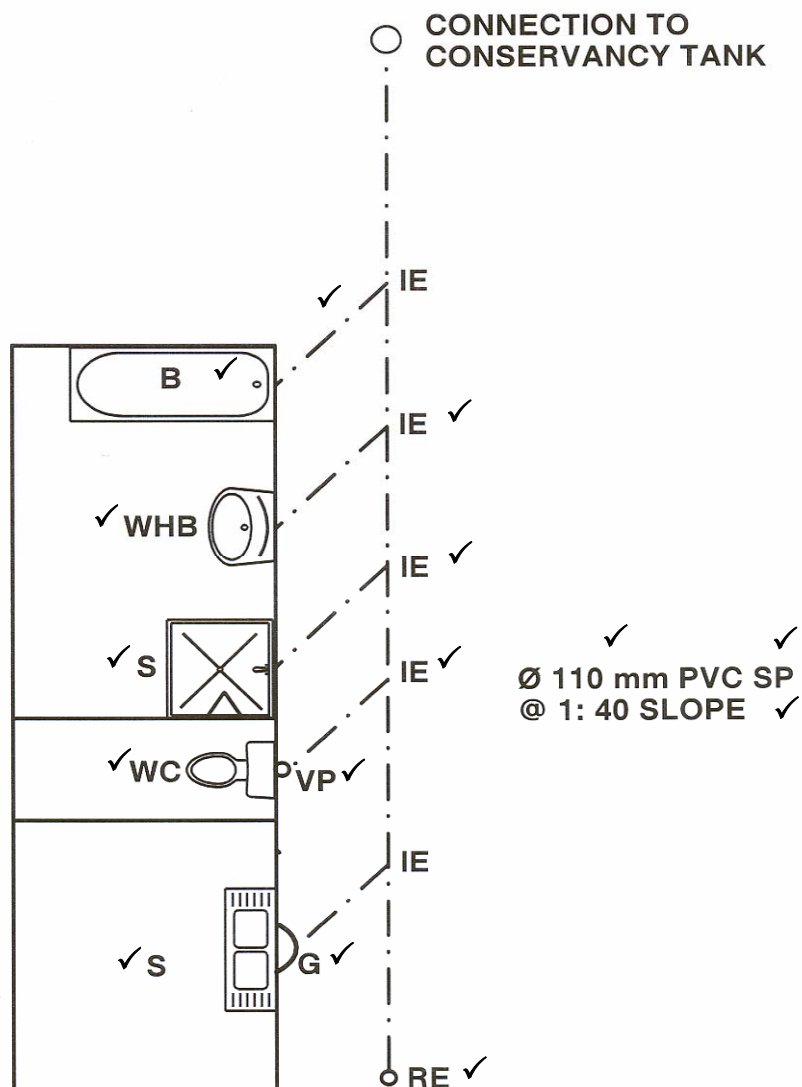
**TOTAL:    200**

**QUESTION 2.7****ANSWER SHEET 2.7**

Neatness	1 mark
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**CROSS JUNCTION ✓  
(OR ANY OTHER SUITABLE TITLE)**

(10)

**QUESTION 3.1****ANSWER SHEET 3.1**

MARK ALLOCATION		
RE	1	
IE	3	
VP	1	
G	1	
Correct line type	1	
Description of pipe	3	
Sanitary fixtures	5	
TOTAL	15	

(15)

**QUESTION 4.1****ANSWER SHEET 4.1**

## 4.1.1

DESCRIPTION	NO. REQUIRED	LENGTH	WIDTH	THICKNESS	SUBTOTAL LENGTH REQUIRED
A – RAFTER	20 ✓	6 420 mm	114 mm	38 mm	128 400 mm <b>OR</b> 128,4 m ✓
B – TIE BEAM	10 ✓	4 400 mm	114 mm	38 mm	44 000 mm <b>OR</b> 44 m ✓
C – KING POST	10 ✓	2 100 mm	114 mm	38 mm	21 000 mm <b>OR</b> 21 m ✓
D – STRUT	20 ✓	1 850 mm	114 mm	38 mm	37 000 mm <b>OR</b> 37 m ✓
E – QUEEN POST	20 ✓	1 550 mm	114 mm	38 mm	31 000 mm <b>OR</b> 31 m ✓
TOTAL LENGTH REQUIRED FOR TEN TRUSSES					261 400 mm <b>OR</b> 261,4 m ✓✓

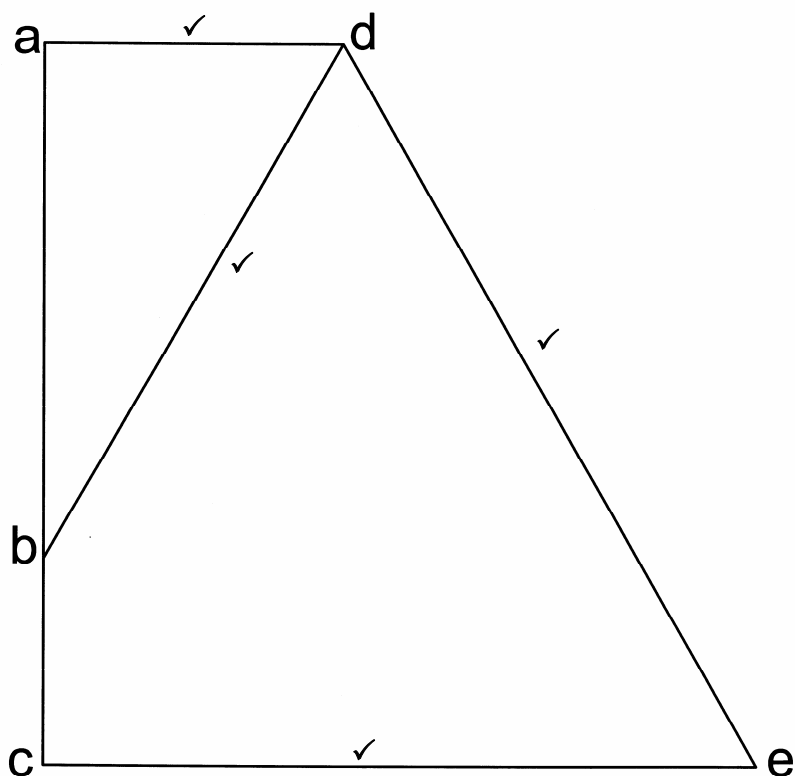
(12)

- 4.1.2 Number of lengths required  
 =  $261,4 \text{ m} \div 6 \text{ m}$  ✓  
 = 43,56 lengths ✓  
 = 44 lengths ✓

(3)

**QUESTION 5.1****ANSWER SHEET 5.1**

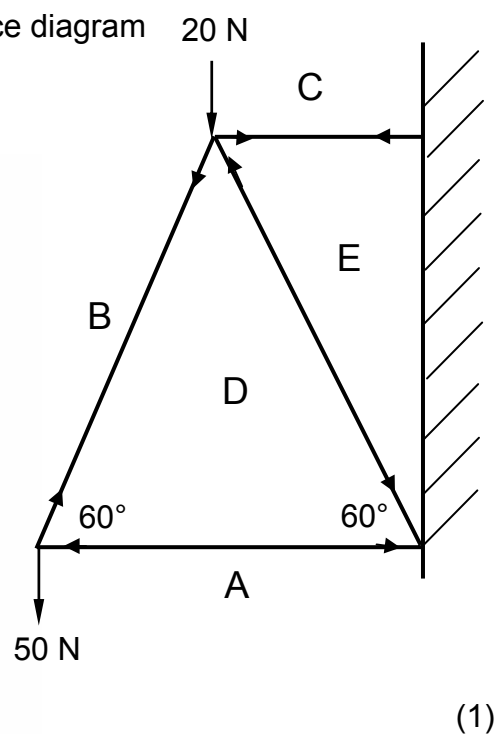
## 5.1.1 Vector diagram



Scale: 1 mm = 1 N

NB: Vector diagram not to scale

## 5.1.2 Space diagram



(1)

## 5.1.3

MEMBER	MAGNITUDE	NATURE
AD	29 N ✓	STRUT ✓
BD	58 N ✓	TIE ✓
CE	69 N ✓	TIE ✓
DE	81 N ✓	STRUT ✓

(4)

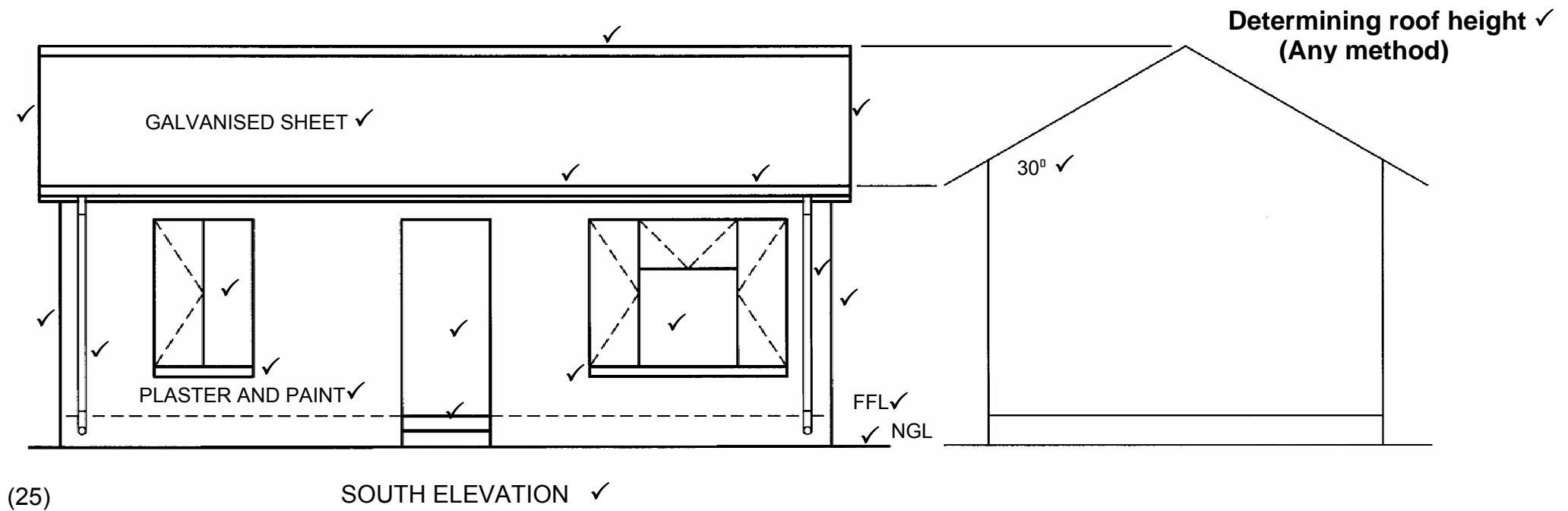
Allow a tolerance of 1 Newton on either side.

(8)

**QUESTION 6.1****ANSWER SHEET 6.1**

<b>No.</b>	<b>QUESTIONS</b>	<b>ANSWERS</b>	<b>MARKS</b>
<b>1</b>	What is the scale of the drawing?	1 : 500	1
<b>2</b>	What is the site number on the western side of the proposed building?	122	1
<b>3</b>	Identify number 1.	Building line	1
<b>4</b>	Identify number 2.	North point	1
<b>5</b>	What is the street name on the south side of the site?	PARK STREET	1
<b>6</b>	What is the number of the site on which the proposed building is to be erected?	123	1
<b>7</b>	What colour is used to indicate new buildings on a site plan?	RED	1
<b>8</b>	What is the length of the boundary line on the eastern side of the site?	42 000 mm <b>OR</b> 42 m	1
<b>9</b>	Calculate the total perimeter of the house.	44 m	2
<b>10</b>	Calculate the total area of the site.	$1\,134\text{ m}^2 \left[ \begin{array}{l} 27\text{ m} \times 42\text{ m} = \\ 1\,134\text{ m}^2 \end{array} \right]$	2
<b>11</b>	Calculate the total area of the proposed house.	$96\text{ m}^2 [ (10\text{ m} \times 8\text{ m}) + (4\text{ m} \times 4\text{ m}) = 96\text{ m}^2 ]$	2
<b>12</b>	Calculate the percentage area that the proposed house will occupy on the site.	$8,47\% \left[ \frac{96}{1\,134} \times \frac{100}{1} \right]$	1

(15)

**QUESTION 6.2****ANSWER SHEET 6.2**

SCALE 1 : 50

Neatness

Roof construction	3
Fascia boards	1
Gutters	1
Down pipe	2
Windows	2
Door	1
Step	1
Wall	2
Window sills	2
Floor level	1
Natural ground level	1
Wall finishing	1
Roof pitch	1
Roof covering	1
Scale (print)	1
South elevation (print)	1
Accuracy/Neatness	2
Determining roof height	1
TOTAL	25