



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

CIVIL TECHNOLOGY

NOVEMBER 2009

MEMORANDUM

MARKS: 200

This memorandum consists of 16 pages.

QUESTION 1

LO3 AS1,2,3,5,7,10

- | | | | |
|-----|--------|-----------------|---------------|
| 1.1 | 1.1.1 | TRUE ✓ | |
| | 1.1.2 | TRUE ✓ | |
| | 1.1.3 | FALSE ✓ | |
| | 1.1.4 | TRUE or FALSE ✓ | |
| | 1.1.5 | FALSE ✓ | |
| | 1.1.6 | FALSE ✓ | |
| | 1.1.7 | TRUE ✓ | |
| | 1.1.8 | TRUE ✓ | |
| | 1.1.9 | FALSE ✓ | |
| | 1.1.10 | FALSE ✓ | (10 x 1) (10) |

- | | | | |
|-----|-------|---|-----|
| 1.2 | 1.2.1 | A – Border seam ✓
B – Bolt pitch ✓
C – Back mark ✓ (e.g. Centre Line) | (3) |
| | | NB: Description of correct term is acceptable | |

1.2.2

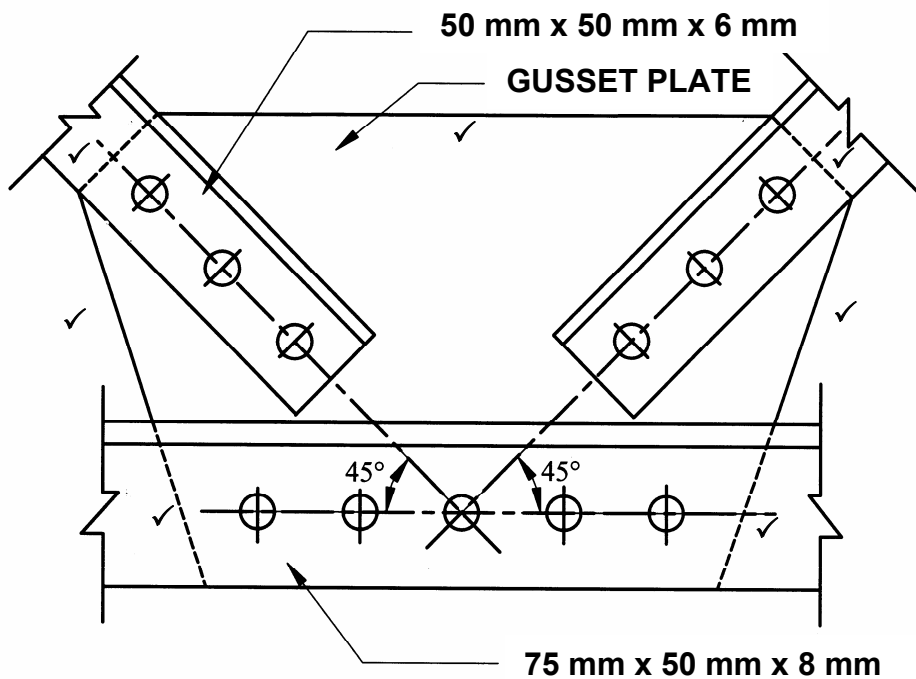


FIGURE 1.2.2 (7)

NB: Different options of the cutting of the gusset plate may also be accepted.
See examples in Grade 12 text books.

- 1.3
- Get the person away from the source of electricity.
 - Use a piece of timber or non-conductor to break the contact of electricity from the person.
 - Switch off the power source.
- (ANY TWO OF THE ABOVE OR ANY OTHER SUITABLE ANSWERS)** (2)
- 1.4
- Only use the tool for its intended purpose.
 - Wet hands can cause ferrous metals to rust, try to make contact with these parts as little as possible.
 - Remove rust from tools with steel wool only and thereafter apply a thin layer of oil or wax over it.
 - Check tools regularly for defects.
 - Avoid stacking tools on top of each other.
 - Tools must not be left lying around, they must be returned to its proper storage place.
 - Cutting tools must be sharp and its edges protected with a covering.
- (ANY FIVE OF THE ABOVE OR ANY OTHER SUITABLE ANSWERS)** (5)
- 1.5
- Take note of overhead electrical cables and avoid contact with it.
 - Place the ladder so that its feet are a quarter of its length away from the object it is resting against.
 - Unless the ladder is securely tied at the top, another person should hold it whilst in use.
 - Wherever possible, the ladder should protrude at least 900 mm above its support.
 - Do not use ladders horizontally as runways or scaffolding.
 - Never place ladders in front of a door without taking precautions.
 - Only one person at a time is to use a ladder.
- (ANY THREE OF THE ABOVE OR ANY OTHER SUITABLE ANSWERS)** (3)
- [30]**

QUESTION 2

LO3 AS1,2,3,5,7,10

2.1 2.1.1

- Should be strong enough to support the load of wet concrete.
- It must not be able to deflect under the load of wet concrete.
- It must be accurately set out.
- It must have grout tight joints.
- The design of the formwork unit should be such that it can be easily erected and dismantled.
- Formwork material must be of such a nature that it can be easily handled by hand or mechanical lifting device.
- The material must be re-usable.

(ANY FOUR OF THE ABOVE OR ANY OTHER SUITABLE ANSWERS)

(4)

2.1.2

MARK ALLOCATION		
1	Joist / Bearer	✓
2	Cleats	✓
3	Stay / Strut	✓
4	Board shuttering	✓
5	Fixing plate / Kicker	✓
6	Head / Head tree	✓
7	Fish plate / Cleat	✓
8	Strut / Brace	✓
9	Wedges	✓
10	Post / Prop	✓
11	Folding wedges	✓
12	Sole plate / Sole piece	✓

(12)

- 2.2
- 1 – concrete or in-situ concrete ✓
 - 2 – Reinforcing mesh/steel or weld mesh ✓
 - 3 – Hollow blocks ✓
 - 4 – Pre-stressed ribs or ribs ✓

(4)

- 2.3
- Pre-stressed units
 - Maximum span
 - In-situ concrete layer
 - Unit weight
 - Reinforcement requirements
 - Insulation characteristic
 - Fire resistance
 - Volume reduction
 - Sound insulation
 - Nature of struts
 - Thickness of units
 - Speed of construction
 - Support and formwork needed
 - Weight reduction
 - Foundation reduction
 - Safety characteristics
 - Precast top layer

(ANY FOUR OF THE ABOVE) (4)

- 2.4 2.4.1 Red ✓ or Red on white (1)
- 2.4.2 Yellow ✓ Yellow on black (1)
- 2.4.3 Green ✓ Green on white (1)

2.5

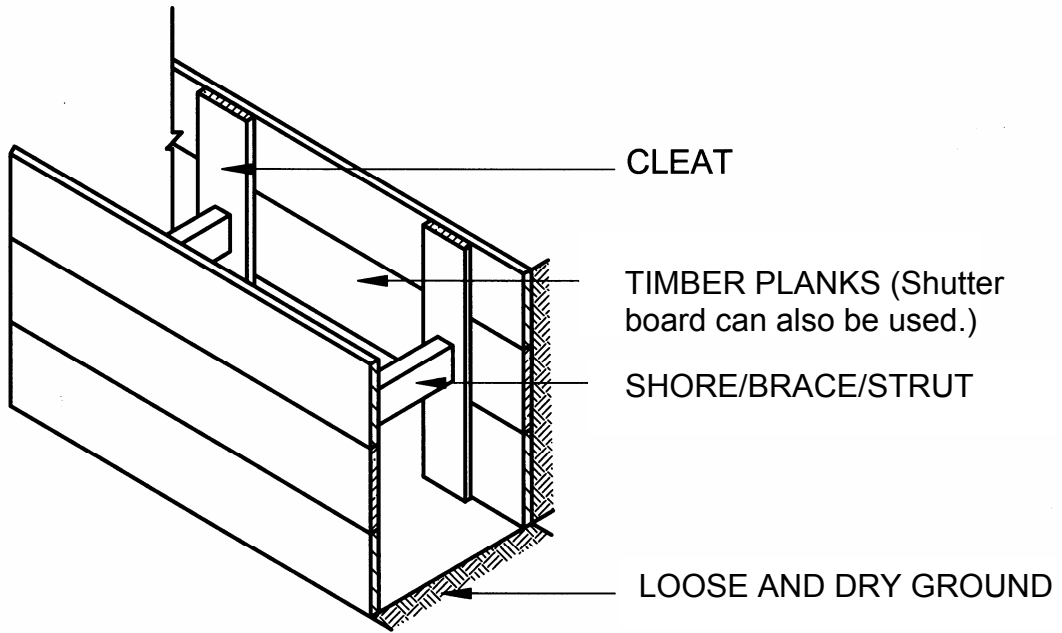


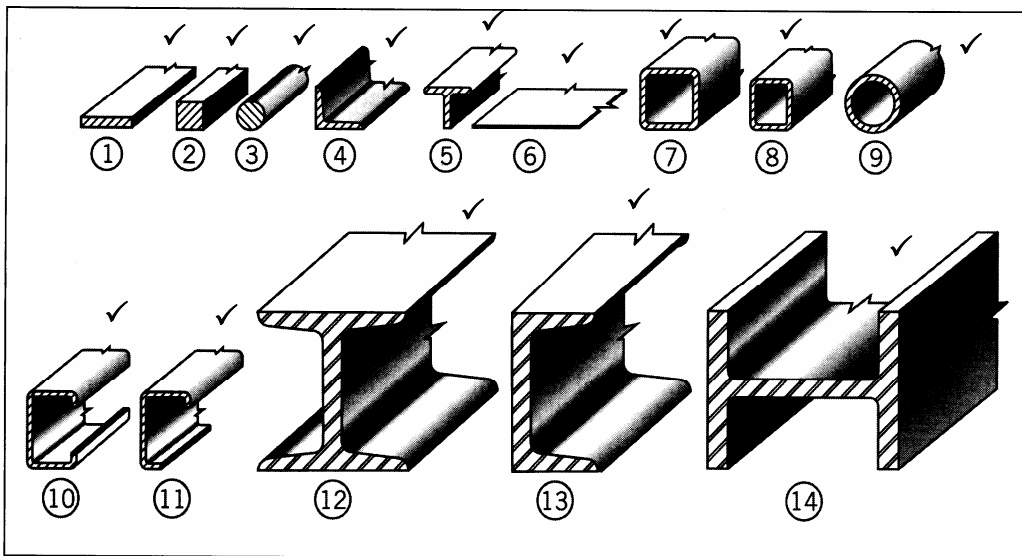
FIGURE 2.5

Basic members must be present, but the layout of the drawing can differ.

MARK ALLOCATION	
Cleat	1
Timber Planks/Shutter board	1
Shore	1
Loose and dry ground	1
Neatness	1
Correctness	2
TOTAL	7

(7)

2.6



- 1 – Flat bar
- 2 – Square bar
- 3 – Rod/round bar
- 4 – Angle iron
- 5 – T-beam
- 6 – Plate or sheet metal
- 7 – Square tube
- 8 – Rectangular tube
- 9 – Piping
- 10 – Lipped channel iron
- 11 – Lipped angle iron
- 12 – I-beam
- 13 – Channel or U-channel
- 14 – H-beam

(ANY THREE OF THE ABOVE. ONE MARK FOR THE SKETCH AND ONE MARK FOR THE LABEL.)

(6)
[40]

QUESTION 3

LO3 AS5,8,10

3.1 3.1.1

1	Bath or B✓
2	Wash hand basin or WHB✓
3	Sink or S✓
4	Water closet or WC✓ Water toilet
5	Shower or S✓
6	Gulley or G✓

(6)

3.1.2

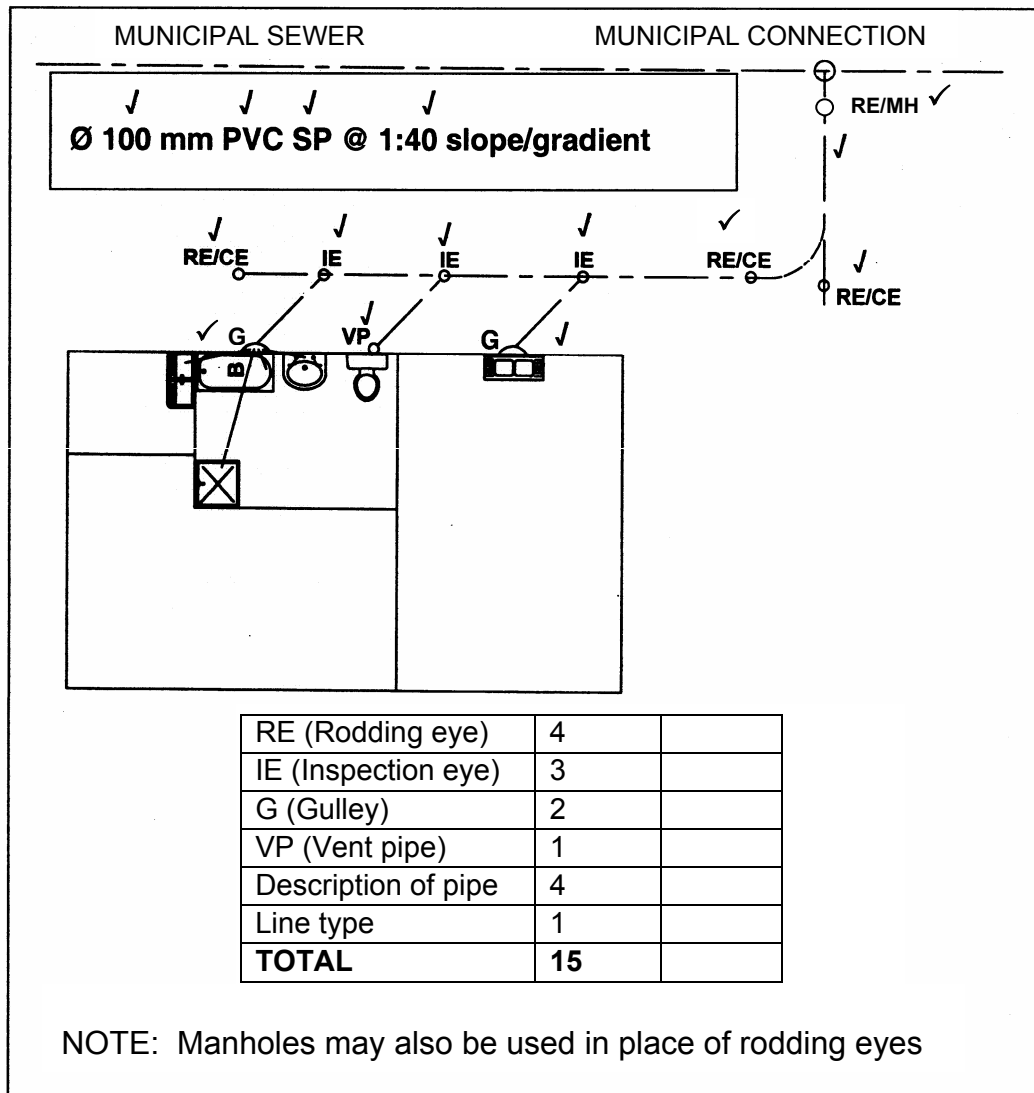


FIGURE 3.1.2

(15)

3.1.3 45° ✓

(1)

3.1.4 Waste-water pipe ✓

(1)

- 3.2
- Pipe must be encased with concrete.
 - Pipe must be laid on a fixed concrete base.
 - Inspection eyes must be provided on both sides of building.
 - There must be no change in direction under the building.
 - There must be no connection under the building.
 - It is preferable to use heavy cast-iron pipes under the building.
 - The sewer should be laid at least 50 mm clear of any foundation
- (ANY TWO OF THE ABOVE)** (2)
- 3.3
- Do not use strong or harsh chemical agents to wash toilet pans.
 - Do not dispose of cigarette ashes and cigarette stubs into the toilet pan.
 - If sewer line is blocked, do not use chemicals to clear the blockage but rather use cleaning rods.
- (ANY ONE OF THE ABOVE)** (1)
- 3.4
- Breaks the siphon that could empty the hot-water cylinder to inlet level.
 - Prevents back-flow of hot water to cold-water taps.
 - Prevents contamination of fresh water supply.
 - Allow air into the cylinder to ensure good flow of water when the cylinder must be drained.
- (ANY ONE OF THE ABOVE)** (1)
- 3.5
- Solar
 - Hydro
 - Nuclear
 - Wind
 - Sea waves
 - Bio gas
 - Fossil oils
 - Fossil gas
 - Geothermal
- (ANY THREE OF THE ABOVE)** (3)
[30]

QUESTION 4

LO3 AS2,5,9

- 4.1 Visual grading is done visually/looking at it ✓ whilst mechanical grading is done with testing equipment (machines). ✓ (2)
- 4.2
- 4.2.1 In mechanical grading the strength or stiffness of timber is tested. ✓ (1)
- 4.2.2 In visual grading – The size of the knots, or the arrangements of the grain or the number of the annual rings, or colour or the estimated strength are noted. ✓ (1)
- 4.3
- Cement should be stored on a raised platform covered with waterproof material.
 - Should not be exposed to moisture.
 - Should be used as soon as possible.
 - Must be used in a cycle of first in first out.
 - Must be stacked away from the walls.
 - Do not store more than 12 bags on top of one another.
 - Do not stack more than two pallets on top of each other.
- (ANY THREE OF THE ABOVE)** (3)

4.4.1

A	B	C	D
			FOUNDATION
			Centre line: $2 / 6\ 000 = 12\ 000 \checkmark$
			$2 / 3\ 000 = \underline{6\ 000} \checkmark$
			$= 18\ 000 \checkmark$
			Less $4 / 600 = \underline{2\ 400} \checkmark$
			$= 15\ 600 \checkmark$
1/	15.6 \checkmark		
	0.60 \checkmark		Volume of concrete required for foundation
	<u>0.25</u> \checkmark	2,34 m ³ \checkmark	2,34 m ³

Penalise the first error only and mark positively.

(9)

4.4.2

			FLOOR SLAB
			(Floor is cast up to the middle of one-brick wall)
			$6\ 000 - 2(190 + 110) = 6\ 000 - 600 = 5\ 400 \checkmark$
			$3\ 000 - 2(190 + 110) = 3\ 000 - 600 = 2\ 400 \checkmark$
1/	5.4 \checkmark		
	2.4 \checkmark		Volume of concrete required for floor slab
	<u>0.075</u> \checkmark	0,972 m ³ \checkmark	0,972 m ³
			OR
			(Floor is cast up to the middle of one-brick wall)
			$6\ 000 - 380 = 5\ 620$ (External measurements of wall)
			$5\ 620 - (2 \times 110) = 5\ 400 \checkmark$
			$3\ 000 - 380 = 2\ 620$ (Short wall)
			$2\ 620 - (2 \times 110) = 2\ 400 \checkmark$
1/	5.4 \checkmark		
	2.4 \checkmark		
	0.075 \checkmark	0,972 m ³ \checkmark	
			OR (Floor is cast between external walls)
			$6\ 000 - 380 = 5\ 620$ (External measurements of wall)
			$5\ 620 - (2 \times 220) = 5\ 180 \checkmark$
			$3\ 000 - 380 = 2\ 620$ (External measurements of wall)
			$2\ 620 - (2 \times 220) = 2\ 180 \checkmark$
1/	5.18 \checkmark		
	2.18 \checkmark		
	0.075 \checkmark	0,847 m ³ \checkmark	

			OR (Floor is cast over external walls)
			6 000 – 380 = 5 620 ✓ (External measurements of wall)
			3 000 – 380 = 2 620 ✓ (External measurements of wall)
1/	5.62 ✓		
	2.62 ✓		
	0.075 ✓	1,104 m ³ ✓	

(6)

Mark positively with the candidate's error.

IF A CANDIDATE USED ANOTHER CALCULATION METHOD IT WILL STILL BE ACCEPTED FOR 2009 IF THE ANSWERS ARE CORRECT

4.5

TYPE OF GLASS	WHERE USED
Rolled glass/Sheet glass/window glass	Windows/Mirrors
Patterned/translucent/obscured glass	Windows
Safety/Reinforced/shatterproof/laminated/armoured glass	Shower doors Sliding doors Safety doors Windows
Glass bricks	Transparent walls

(4)

Trade names are also acceptable

(ANY TWO OF THE ABOVE AND ONE MARK EACH)

4.6

- It is available in long lengths.
- Lighter to handle.
- Easier to join.
- Does not rust.
- Less maintenance.
- It is cheaper than copper pipe.
- Durable
- Not much resale value (stolen)

(4)

[30]

(ANY FOUR OF THE ABOVE OR ANY OTHER SUITABLE ANSWERS)

QUESTION 5

LO3 AS5,6

5.1 5.1.1 **SHEAR FORCES**

$$\text{SF A} = 25 \text{ N } \checkmark \checkmark$$

$$\begin{aligned} \text{SF B} &= 25 - 40 \checkmark \\ &= -15 \text{ N } \checkmark \end{aligned}$$

$$\begin{aligned} \text{SF C} &= 25 - 40 - 20 \checkmark \\ &= -35 \text{ N } \checkmark \end{aligned}$$

OR

$$\begin{aligned} \text{SF C} &= -15 - 20 \\ &= -35 \text{ N} \end{aligned}$$

$$\text{SF D} = 0 \text{ N } \checkmark$$

OR

$$\begin{aligned} \text{SF D} &= 25 - 40 - 20 + 35 \\ &= 0 \text{ N} \end{aligned}$$

OR

$$\begin{aligned} \text{SF D} &= -35 + 35 \\ &= 0 \text{ N} \end{aligned}$$

OR

(7)

$$a^- = 0 \text{ N}$$

$$a^+ = +35 \text{ N}$$

$$b^- = +35 (-10 \times 4) = -5 \text{ N}$$

$$b^+ = -5 \text{ N}$$

$$c^- = -5 \text{ N}$$

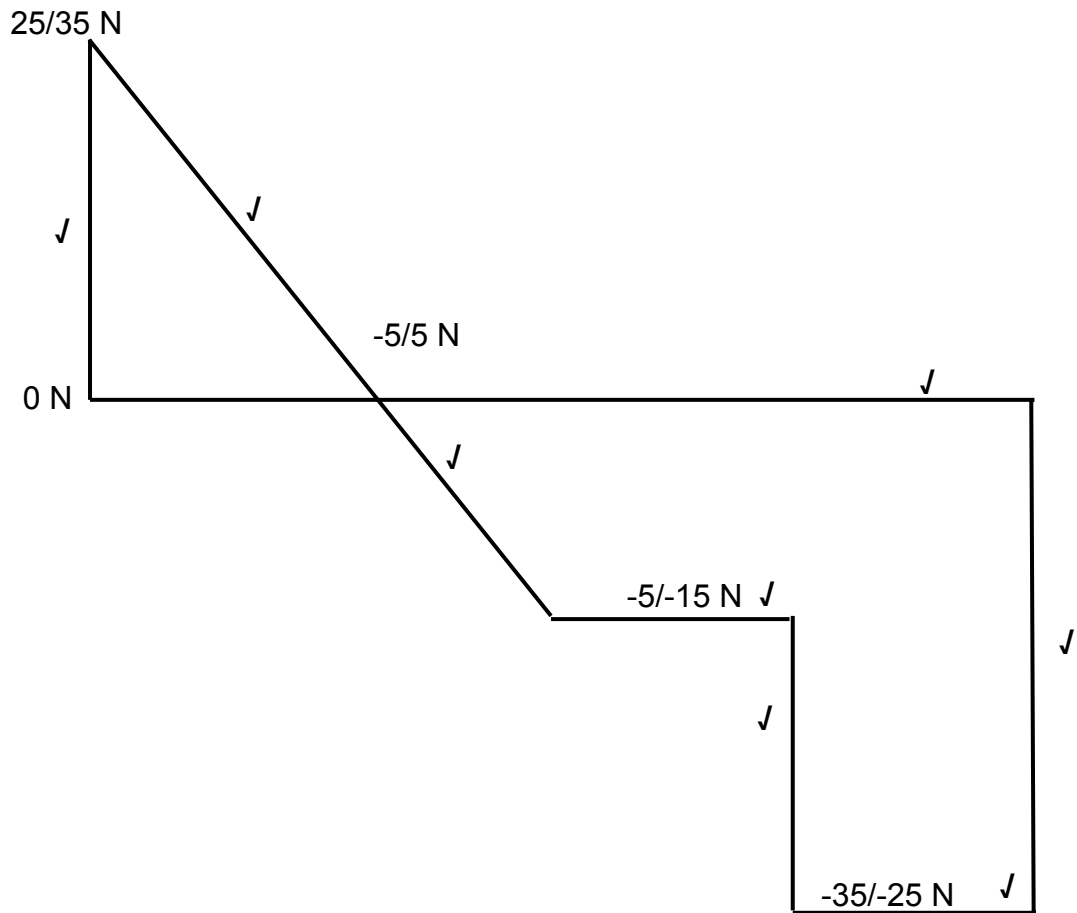
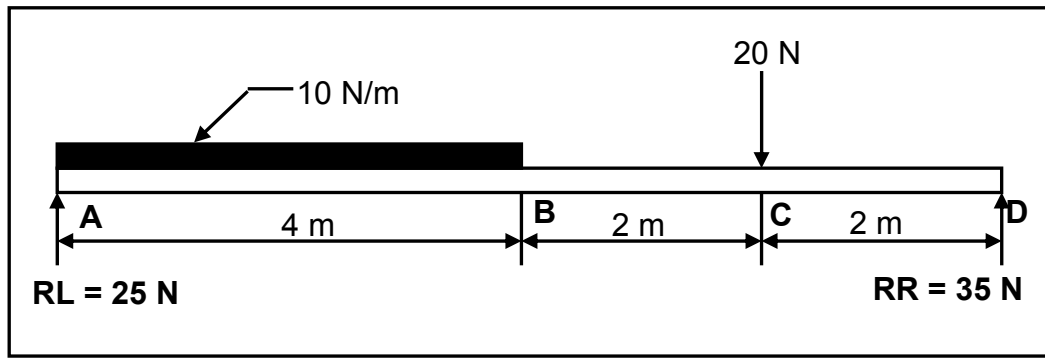
$$c^+ = (+35) (-10 \times 4) (-20) = -25 \text{ N}$$

$$d^- = -25 \text{ N}$$

$$d^+ = (+35) (-10 \times 4) (-20) (+25) = 0 \text{ N}$$

NB: 1 mark is given for the units if indicated in all answers.

5.1.2



DEDUCT 1 MARK IF THE WRONG SCALE WAS USED. CREDIT CANDIDATE FOR THE REST OF THE DIAGRAM.

(7)

NOT TO SCALE

5.2 5.2.1 Area of triangle = $\frac{1}{2} b \times h$
 = $\frac{1}{2} \times 120 \text{ mm} \times 250 \text{ mm} \checkmark$
 = $15\,000 \text{ mm}^2 \checkmark$

Area of rectangle = $l \times b$
 = $400 \text{ mm} \times 120 \text{ mm} \checkmark$
 = $48\,000 \text{ mm}^2 \checkmark$

Area of square = $l \times b$
 = $100 \text{ mm} \times 100 \text{ mm} \checkmark$
 = $10\,000 \text{ mm}^2 \checkmark$

Total area = $15\,000 \text{ mm}^2 + 48\,000 \text{ mm}^2 + 10\,000 \text{ mm}^2$
 = $73\,000 \text{ mm}^2 \checkmark$

(7)

5.2.2 Take moments about B left side

$$73\,000 \text{ mm}^2 \times X = (15\,000 \times 180) + (48\,000 \times 160) + (10\,000 \times 50)$$

$$73\,000 \text{ mm}^2 \times X = 2\,700\,000 + 7\,680\,000 + 500\,000 \checkmark$$

$$X = \frac{10\,880\,000}{73\,000} \checkmark$$

$X = 149,04 \text{ mm} \text{ OR } 149 \text{ mm} \checkmark$

OR

PART	AREA (A)	X	AREA of X (AX)
Triangle	15 000 \checkmark	$\frac{b}{3} = 180 \checkmark$	2 700 000
Rectangle	48 000 \checkmark	$\frac{b}{2} = 160 \checkmark$	7 680 000 \checkmark
Square	10 000 \checkmark	$\frac{b}{2} = 50 \checkmark$	500 000
Σ	73 000		10 880 000

$$X = \frac{\Sigma Ax}{\Sigma A}$$

$$= \frac{10\,880\,000}{73\,000} \checkmark$$

$$= 149,04 \text{ mm} \checkmark \text{ OR } 149 \text{ mm}$$

OR

$$\begin{aligned}
 \text{Position of centroid} &= \frac{(A_1 \times d) + (A_2 \times d) + (A_3 \times d)}{\text{Total area}} \\
 &= \frac{(1\ 500 \times 180) + (4\ 800 \times 160) + (10\ 000 \times 50)}{73\ 000} \\
 &= \frac{2\ 700\ 000 + 7\ 680\ 000 + 500\ 000}{73\ 000} \\
 &= \frac{10\ 880\ 000}{73\ 000} \\
 &= 149,04\ \text{mm OR } 149\ \text{mm}
 \end{aligned}$$

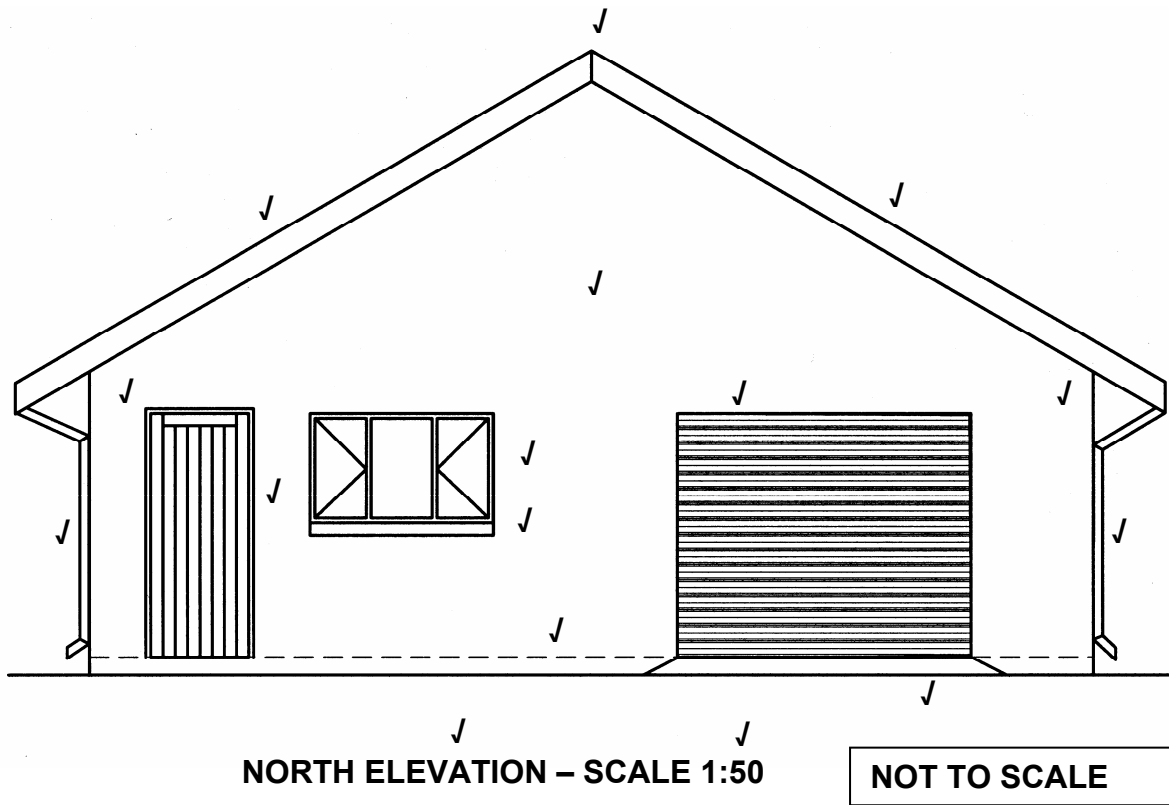
(9)
[30]

NB: MARK POSITIVELY WITH THE MISTAKE
DO NOT PENALISE CANDIDATES FOR OMITTING UNIT/ SYMBOL

QUESTION 6

LO3 AS4,5

6.1

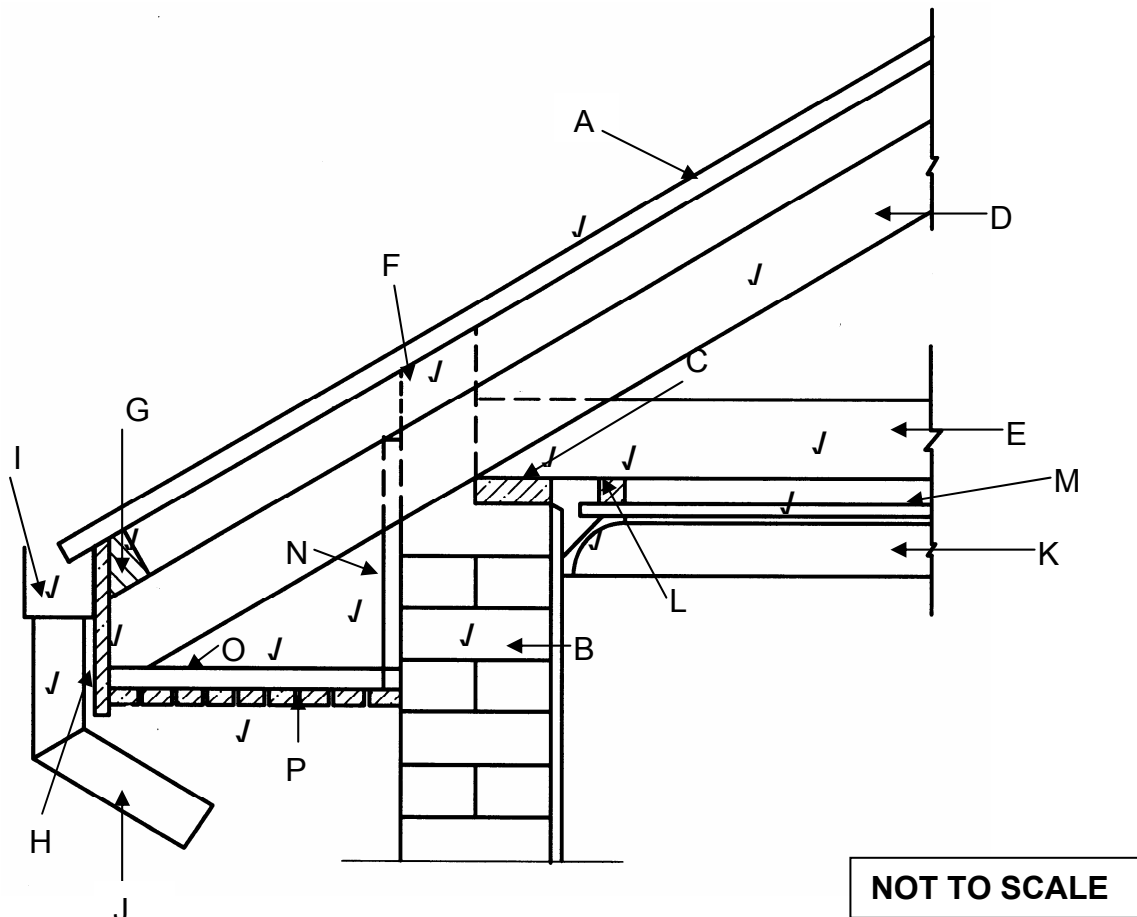


NB: THE ROOF CAN SPAN THE SHORTER OR LONGER WALL

NOTE: Use a mask to mark the accuracy of this question.

(20)

ITEM	MARK ALLOCATION
Floor slab height	1
Entrance door	1
Window	1
Window sill	1
Ramp	1
Roll-up door	1
Down pipes	2
Barge boards	2
Gable wall/Roof	1
Wall height	2
Roof pitch/Ridge	1
North elevation	1
Scale	1
Accuracy	4
TOTAL	20



MARK ALLOCATION		
A	Galvanised roof sheet	1
B	Wall 220 mm	1
C	Wall plate 114 mm x 38 mm	1
D	Rafter 114 mm x 38 mm	1
E	Tie beam 114 mm x 38 mm	1
F	Beam filling	1
G	Purlin 76 mm x 50 mm	1
H	Fascia board 225 mm x 30 mm	1
I	Square gutter 100 mm x 100 mm	1
J	Down pipe 75 mm diameter	1
K	Cornice 75 mm	1
L	Branding (ceiling batten) 38 mm x 38 mm	1
M	Ceiling board 6 mm thick	1
N	Hanger 38 mm x 38 mm	1
O	Bearer 38 mm x 38 mm	1
P	Covering material	1
	Accuracy	4
	TOTAL	20

(20)
[40]

NOTE: Provincial moderators and chief markers may accept alternative answers provided they can verify that such answers are indicated in reference material relevant to Civil Technology used in the province.

TOTAL: 200