



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING SCIENCE N3

21 November 2024

This marking guideline consists of 7 pages.

QUESTION 1

- 1.1 Cement (2)
- 1.2 The strength of concrete is inversely proportional to the water-cement ratio.✓
The higher the ratio, the lower the strength and vice versa.✓ (2)
- 1.3
- Increasing the water-water ratio
 - Increasing the size of aggregates
 - Using well-rounded and smooth aggregates
 - Using nonporous and saturated aggregates
 - Increasing the mixing time
 - Increasing the mixing temperature
 - Adding plasticisers and air-entraining mixtures
- (Any 6 × 1) (6)
- [10]

QUESTION 2

- 2.1 2.1.1 Take moments about RL:

Anticlockwise moments = Clockwise moments

$$(2 \times 0,5) + (3 \times 0,9) + (2 \times 0,4 \times 1,4) = (R_E \times 1,2) + (0,5 \times 0,5 \times 0,25)✓$$

$$R_E = 3,97 \text{ kN}✓$$

- 2.1.2 Take moments about RR:

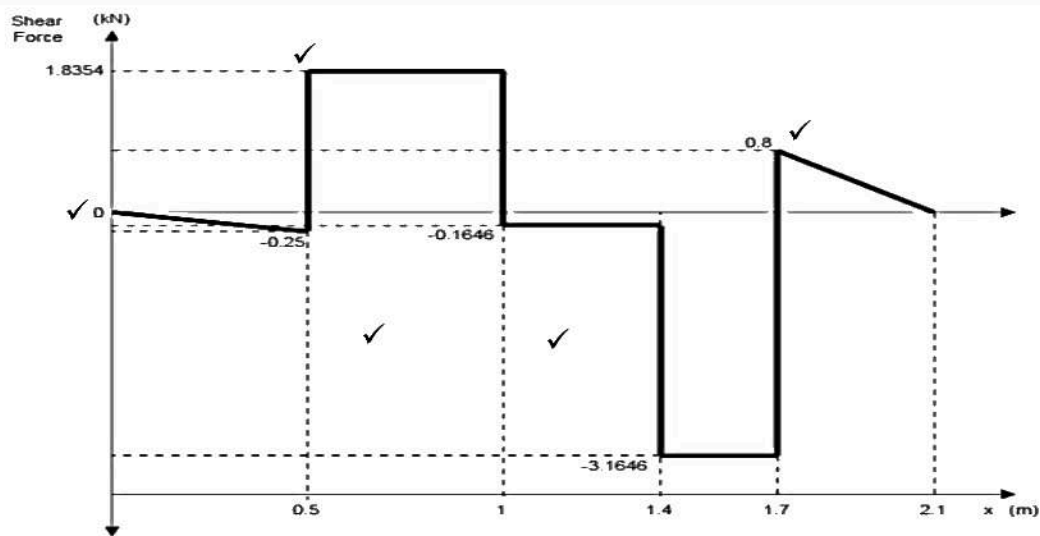
Clockwise moments = Anticlockwise moments

$$(2 \times 0,4 \times 0,2) + (R_B \times 1,2) = (3 \times 0,3) + (2 \times 0,7) + (0,5 \times 0,5 \times 1,45)✓$$

$$R_B = 2,08 \text{ kN}✓$$

(2 × 2) (4)

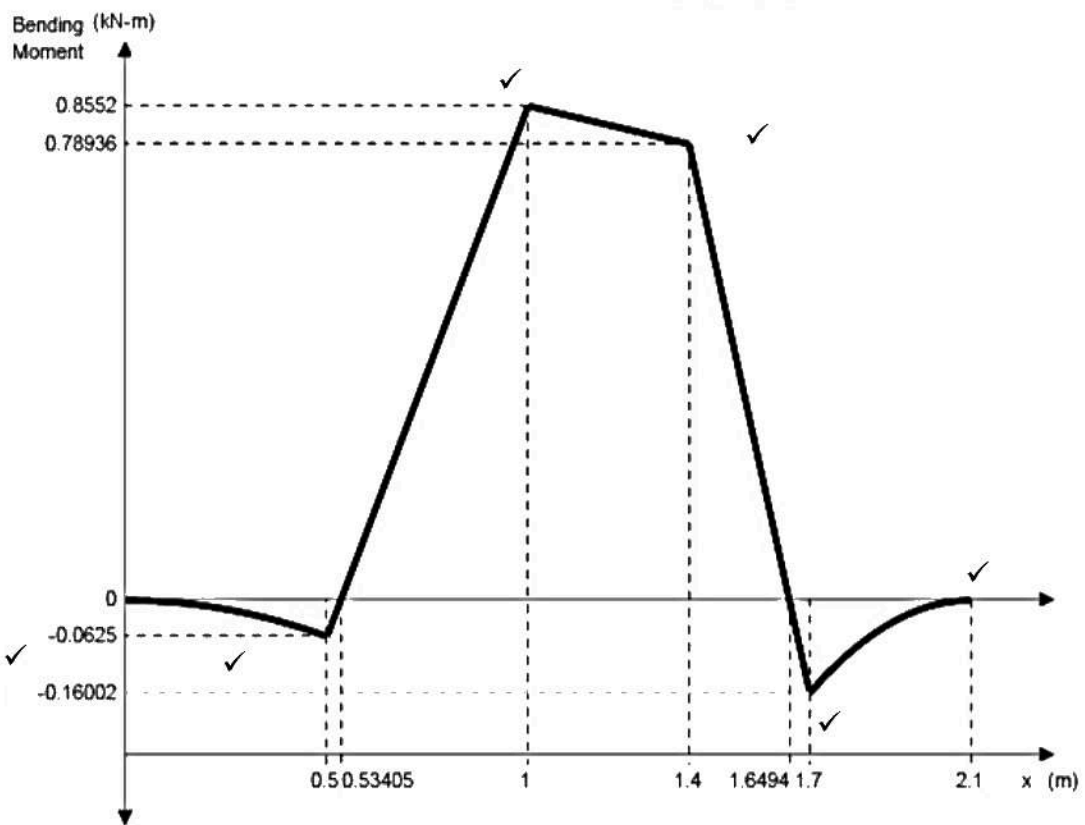
2.2



SHEAR-FORCE DIAGRAM

(5)

2.3



BENDING-MOMENT DIAGRAM

(6)
[15]

QUESTION 3

- 3.1 Two parallel forces with the same magnitude acting at any distance in the opposite direction on a lever (2)

3.2

SHAPE	AREA [mm ²]	X [mm]	Y [mm]	MOMENT AX [mm ³]	MOMENT AY [mm ³]
A	1 500,00✓	25,00✓	15,00✓	37 500,00✓	22 500,00✓
B	-50,00✓	13,33✓	3,33✓	-666,5✓	-166,5✓
C	-78,54✓	15,00✓	20,00✓	-1 178,57✓	-1 571,43✓
D	-25,00✓	47,50✓	7,50✓	-1 187,50✓	-187,50✓
TOTAL	1 346,46✓			34 467,9✓	20 575,20✓

$$\bar{X} = \frac{\sum AX}{\sum A} \checkmark$$

$$= \frac{34\,467,9}{1\,346,46} \checkmark$$

$$= 25,599 \text{ mm} \checkmark$$

$$\bar{Y} = \frac{\sum AY}{\sum A} \checkmark$$

$$= \frac{20\,575,20}{1\,346,46} \checkmark$$

$$= 15,281 \text{ mm} \checkmark$$

(18)

[20]

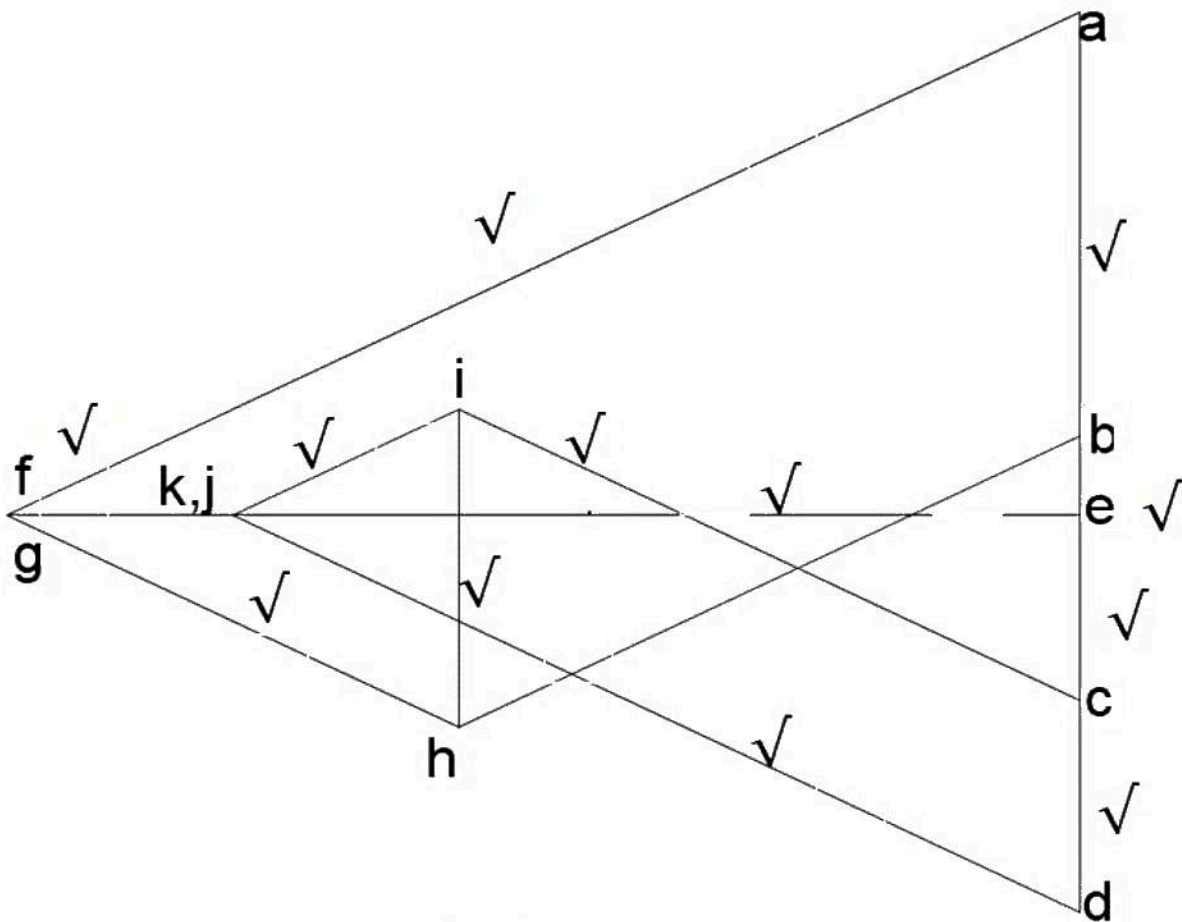
QUESTION 4

- 4.1 $\sum M_{RR} = 0$
 $12R_L = 8 \times 9 + 5 \times 6 + 4 \times 3$
 $R_L = 114/12$
 $R_L = 9,5 \text{ kN} \checkmark$

$$\begin{aligned} \sum M_{RL} &= 0 \\ 12R_R &= 8 \times 3 + 6 \times 5 + 9 \times 4 \\ R_R &= 90/12 \\ R_R &= 7,5 \text{ kN} \checkmark \end{aligned}$$

(2)

4.2



+/- 2 tolerance

$$(12 \times \frac{1}{2} + 12)$$

(18)

QUESTION 5

- 5.1 Ohm's law states that the current through a conductor under constant conditions✓ is proportional to the potential difference (voltage) across the conductor.✓

$$I = V/R✓$$

Where: V: voltage (volts)
I: current (amps)
R: resistance (Ω)

(3)

- 5.2 The purpose of the earth wire is to prevent electrocution✓ by providing a safe route for current to flow if the live wire comes loose and get into contact with a metal casing.✓

(2)

- 5.3 $R_1 = 63 + 37 + 71 = 171 \Omega✓$
 $R_2 = 17 \Omega✓$
 $R_3 = 13 + 33 + 20 = 66 \Omega✓$

$$\begin{aligned} 1/R_T &= 1/R_1 + 1/R_2 + 1/R_3 \\ &= 1/171 + 1/17 + 1/66✓ \\ &= 0,08✓ \\ R_T &= 12,5 \Omega✓ \end{aligned}$$

(6)
[11]

QUESTION 6

- 6.1 $F_{//} = W \sin \theta$
 $= 55 \times 9,81 \times \sin 30^\circ✓$
 $= 269,78 \text{ N}✓✓$
- 6.2 $F_{\perp} = W \cos \theta$
 $= 55 \times 9,81 \times \cos 30^\circ✓$
 $= 467,26 \text{ N}✓✓$
- 6.3 $F_{\mu} = \mu \times W \cos \theta✓$
 $= 0,5 \times 55 \times 9,81 \times \cos 30^\circ✓$
 $= 233,63 \text{ N}✓$
- 6.4 $F_{up} = \mu \times W \cos \theta + W \sin \theta✓$
 $= 233,63 + 269,78✓$
 $= 503,41 \text{ N}✓$

(4 × 3) [12]

