



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

27 JULY 2018

This marking guideline consists of 6 pages.

QUESTION 1

- 1.1 The purpose of a roof is to protect the structure of a building✓ and its contents from the elements of nature (rain, hail, snow, sun and wind).✓ (2)
- 1.2
- Copper
 - Lead
 - Galvanised-iron sheeting
 - Asbestos cement slate
 - Natural slates
 - Wood shingles
 - Thatch
 - Malthoid
 - Clay and concrete tiles
 - Fibreglass sheets
- (Any 5 × 1) (5)
- 1.3 Porosity is the amount✓ of pores or voids present in a material.✓ A material that is porous has many pores and can absorb water.✓ (3)
- [10]**

QUESTION 2

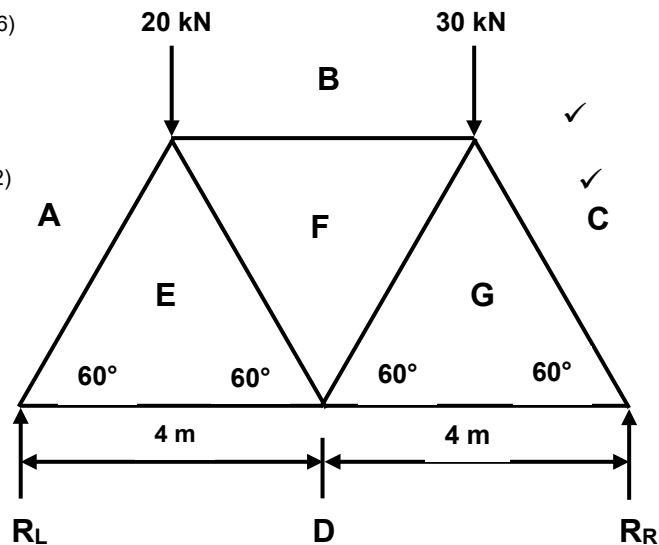
- 2.1 A system of forces is in equilibrium when the sum of the clockwise moments✓ around the pivot point is equal to the sum of the anticlockwise moments✓ around the same pivot point.✓ (3)
- 2.2 2.2.1 Take moments about R_R to calculate the magnitude of R_L :
- $$\begin{aligned}
 \sum \text{CW moments} &= \sum \text{ACW moments}✓ \\
 (R_L \times 8) &= (60 \times 10) + (2 \times 10 \times 5) + (30 \times 4)✓ \\
 (R_L \times 8) &= 600 + 100 + 120 ✓ \\
 R_L &= \frac{820}{8}✓ \\
 R_L &= 102,5 \text{ kN}✓✓ \quad (6)
 \end{aligned}$$
- 2.2.2 Take moments about R_L to calculate the magnitude of R_R :
- $$\begin{aligned}
 \sum \text{ACW moments} &= \sum \text{CW moments}✓ \\
 (R_R \times 8) + (60 \times 2) &= (2 \times 10 \times 3) + (30 \times 4) + (30 \times 8)✓ \\
 (R_R \times 8) &= 60 + 120 + 240 - 120✓ \\
 R_R &= \frac{300}{8}✓ \\
 R_R &= 37,5 \text{ kN}✓✓ \quad (6)
 \end{aligned}$$
- 2.2.3 Test the answer to prove equilibrium:
- $$\begin{aligned}
 \sum \text{Upwards forces} &= \sum \text{Downwards forces} \\
 (102,5 \text{ kN} + 37,5 \text{ kN}) &= (60 \text{ kN} + 20 \text{ kN} + 30 \text{ kN} + 30 \text{ kN})✓ \\
 140 \text{ kN} &= 140 \text{ kN}✓ \quad (2)
 \end{aligned}$$
- [17]**

QUESTION 3

3.1

$$\begin{aligned} &\text{TMA } R_R \\ &\text{CM} = \text{ACM} \\ &(R_L \times 8) = (20 \times 2) + (30 \times 6) \\ &8R_L = 220 \\ &R_L = 27,5 \text{ kN} \quad \checkmark \end{aligned}$$

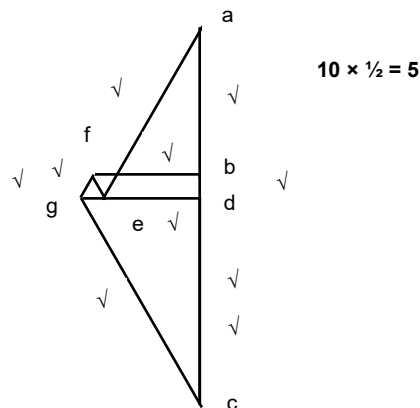
$$\begin{aligned} &\text{TMA } R_L \\ &\text{ACM} = \text{CM} \\ &(R_R \times 8) = (20 \times 6) + (30 \times 2) \\ &8R_R = 180 \\ &R_R = 22,5 \text{ kN} \quad \checkmark \end{aligned}$$



SPACE DIAGRAM
SCALE 1 : 100

(4)

3.2



VECTOR DIAGRAM
SCALE 2 mm : 1 kN

1 mark for
correct scale $\checkmark$

(6)

3.3

MEMBER	MAGNITUDE	NATURE
AE	26,5 kN $\checkmark$	Strut $\checkmark$
BF	14 kN $\checkmark$	Strut $\checkmark$
CG	32 kN $\checkmark$	Strut $\checkmark$
DE	12,5 kN $\checkmark$	Strut $\checkmark$
GD	15 kN $\checkmark$	Tie $\checkmark$
EF	3,5 kN $\checkmark$	Tie $\checkmark$
FG	3,5 kN $\checkmark$	Strut $\checkmark$

(14 $\times$ $\frac{1}{2}$)(7)
[17]

QUESTION 4

4.1

MEMBER	AREA	LEVER ARM DISTANCE	AREA × DISTANCE
1	$50 \times 70 = 3\,500 \text{ cm}^2$	35 cm✓	$3\,500 \text{ cm}^2 \times 35 \text{ cm} = 122\,500 \text{ cm}^3$ ✓
2	$20 \times 20 = -400 \text{ cm}^2$	25 cm✓	$400 \text{ cm}^2 \times 25 \text{ cm} = -10\,000 \text{ cm}^3$ ✓
3	$\frac{1}{2} \times 20 \times 20 = -200 \text{ cm}^2$	51,67 cm✓	$200 \text{ cm}^2 \times 51,67 \text{ cm} = -10\,334 \text{ cm}^3$ ✓
TOTALS	= 2 900 cm²✓✓		= 102 166 cm³✓✓

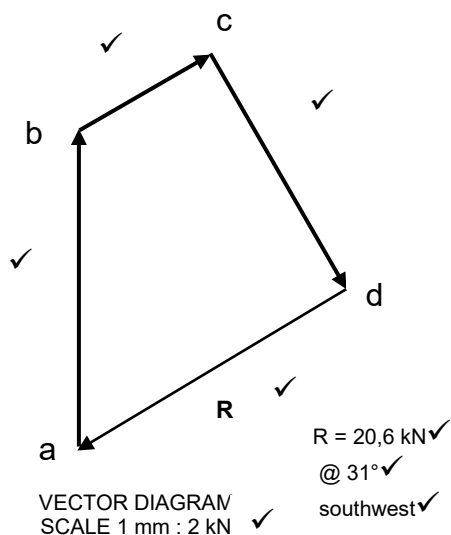
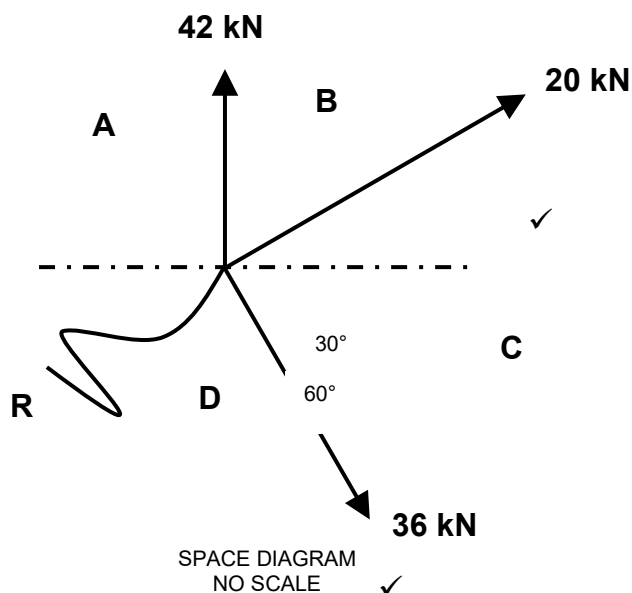
$$\bar{y} = \frac{(\text{total area} \times \text{distance})}{\text{total area}}$$

$$\bar{y} = \frac{102\,166 \text{ cm}^3}{2\,900 \text{ cm}^2}$$

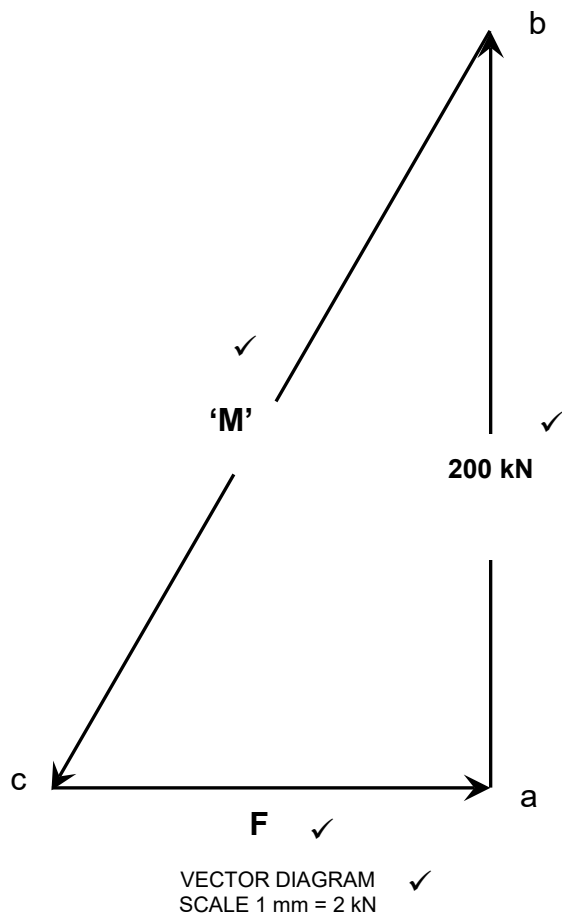
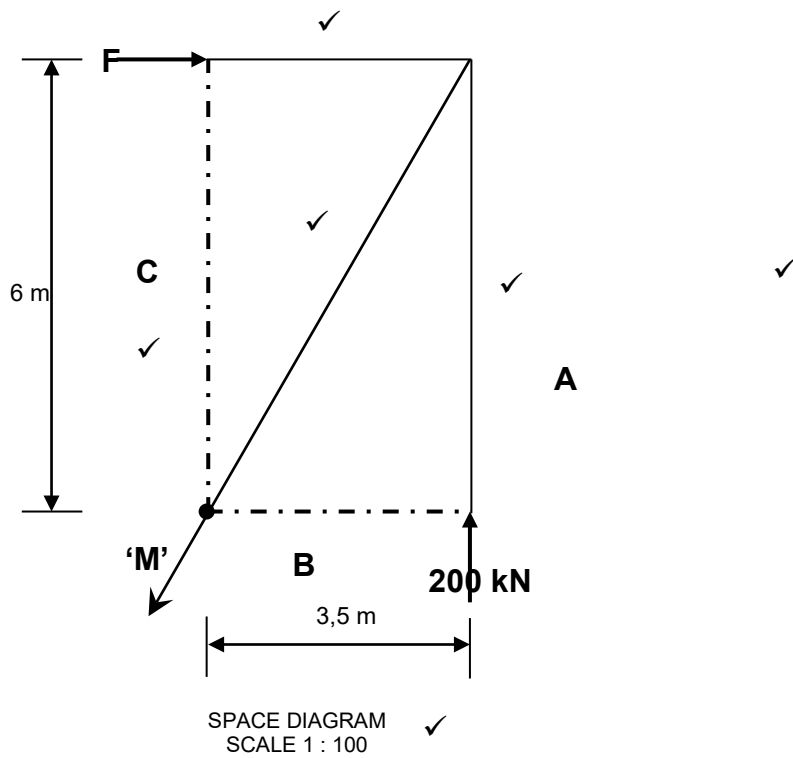
$$\bar{y} = 35,23 \text{ cm}✓✓$$

(14)

4.2

(10)
[24]

QUESTION 5



$$F = 58 \text{ kN} \checkmark \text{ due east} \checkmark$$

$$M = 116 \text{ kN} \checkmark @ 60^\circ \checkmark \text{ south of west} \checkmark$$

QUESTION 6

- 6.1
- Fuel
 - Heat
 - Oxygen
- (3)

- 6.2
- Heat required = $m \times \Delta t \times \text{SHC}$
 $= 6 \text{ kg} \times (285^\circ\text{C} - 200^\circ\text{C}) \times 0,46 \text{ kJ/kg} \cdot ^\circ\text{C} \checkmark$
 $= 6 \text{ kg} \times 85^\circ\text{C} \times 0,46 \text{ kJ/kg} \cdot ^\circ\text{C} \checkmark$
 Heat energy required = $234,6 \text{ kJ} \checkmark$
 Reward once for use of SI units $\checkmark$
- (4)

- 6.3
- $L_u = L_o \times \alpha \times \Delta t$
 $0,144 = 60 \times 0,000012 \times (t - 10)$
 $0,144 = 0,00072t - 0,0072 \checkmark$
 $0,144 + 0,0072 = 0,00072t \checkmark$
 $0,1512 = 0,00072t \checkmark$
 $t = 210^\circ\text{C} \checkmark \checkmark$
- (5)

- 6.4
- Volume of a beam = $L \times B \times H$
 $V = 4,8 \text{ m} \times 0,055 \text{ m} \times 0,114 \text{ m} \checkmark$
 $V = 0,03 \text{ m}^3 \checkmark$
- Density = $\frac{\text{Mass}}{\text{Volume}}$
 $= \frac{76,5 \checkmark}{0,03}$
 $= 2\,550 \text{ kg/m}^3 \checkmark \checkmark$
- (5)
[17]

TOTAL: 100