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:

$\sum$ CW moments = $\sum$ 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 kN✓✓ (6)

2.2.2 Take moments about R_L to calculate the magnitude of R_R:

$\sum$ ACW moments = $\sum$ 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 kN✓✓ (6)

2.2.3 Test the answer to prove equilibrium:

$\sum$ Upwards forces = $\sum$ Downwards forces
(102,5 kN + 37,5 kN) = (60 kN + 20 kN +30 kN + 30 kN)✓
140 kN = 140 kN✓ (2)

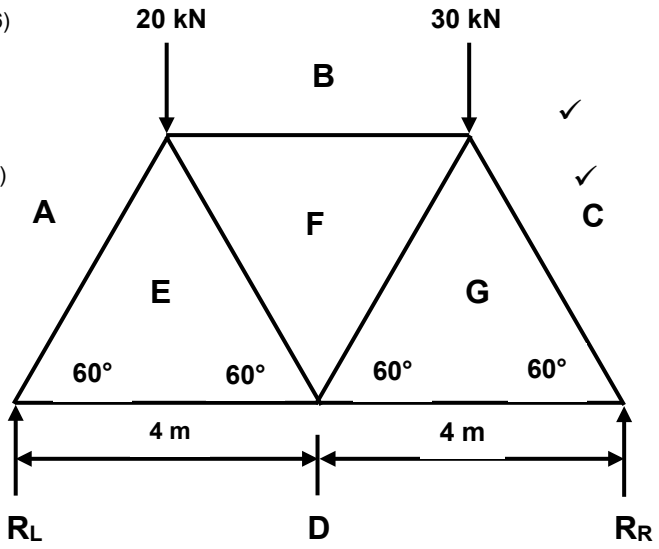
[17]

QUESTION 3

3.1

TMA R_R
CM = ACM
$(R_L \times 8) = (20 \times 2) + (30 \times 6)$
$8R_L = 220$
R_L = **27,5 kN** ✓

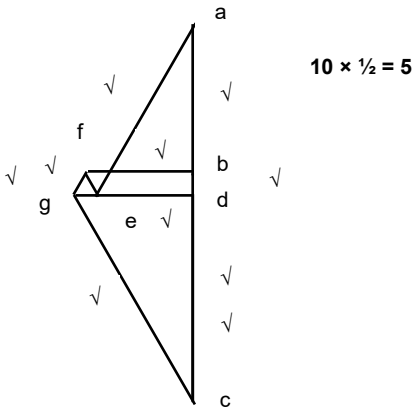
TMA R_L
ACM = CM
$(R_R \times 8) = (20 \times 6) + (30 \times 2)$
$8R_R = 180$
R_R = **22,5 kN** ✓



SPACE DIAGRAM
SCALE 1 : 100

(4)

3.2



10 × ½ = 5

VECTOR DIAGRAM
SCALE 2 mm : 1 kN

1 mark for correct scale ✓

(6)

3.3

MEMBER	MAGNITUDE	NATURE
AE	26,5 kN√	Strut√
BF	14 kN√	Strut√
CG	32 kN√	Strut√
DE	12,5 kN√	Strut√
GD	15 kN√	Tie√
EF	3.5 kN√	Tie√
FG	3.5 kN√	Strut√

(14 × ½) (7)

[17]

QUESTION 4

4.1

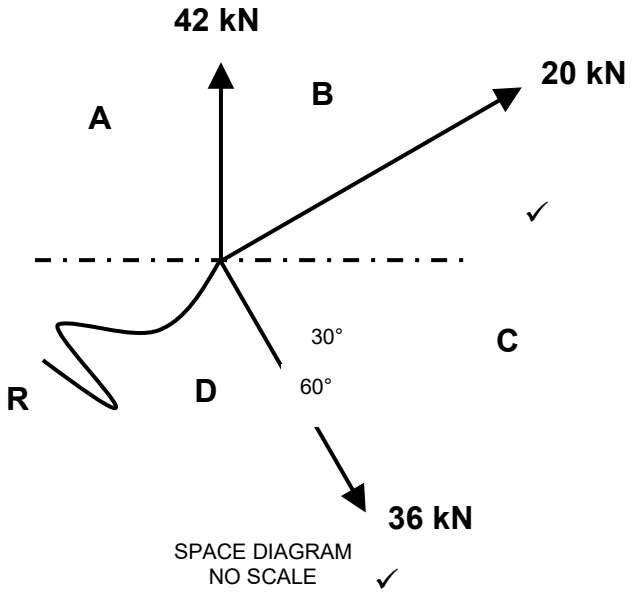
MEMBER	AREA	LEVER ARM DISTANCE	AREA × DISTANCE
1	50 × 70 = 3 500 cm^2	35 cm✓	3 500 cm^2 × 35 cm = 122 500 cm^3✓
2	20 × 20 = -400 cm^2	25 cm✓	400 cm^2 × 25 cm = -10 000 cm^3✓
3	½ × 20 × 20 = -200 cm^2	51,67 cm✓	200 cm^2 × 51,67 cm = -10 334 cm^3✓
TOTALS	**= 2 900 cm^2**✓✓		= **102 166 cm^3**✓✓

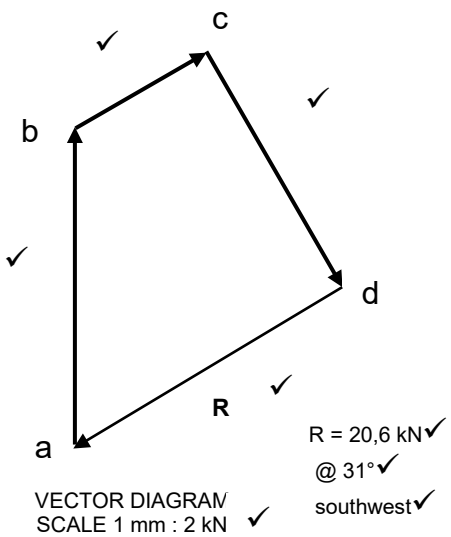
$$\bar{y} = \frac{\text{(total area} \times \text{distance)}}{\text{total area}}$$

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

$\bar{y}$ = 35,23 cm✓✓ (14)

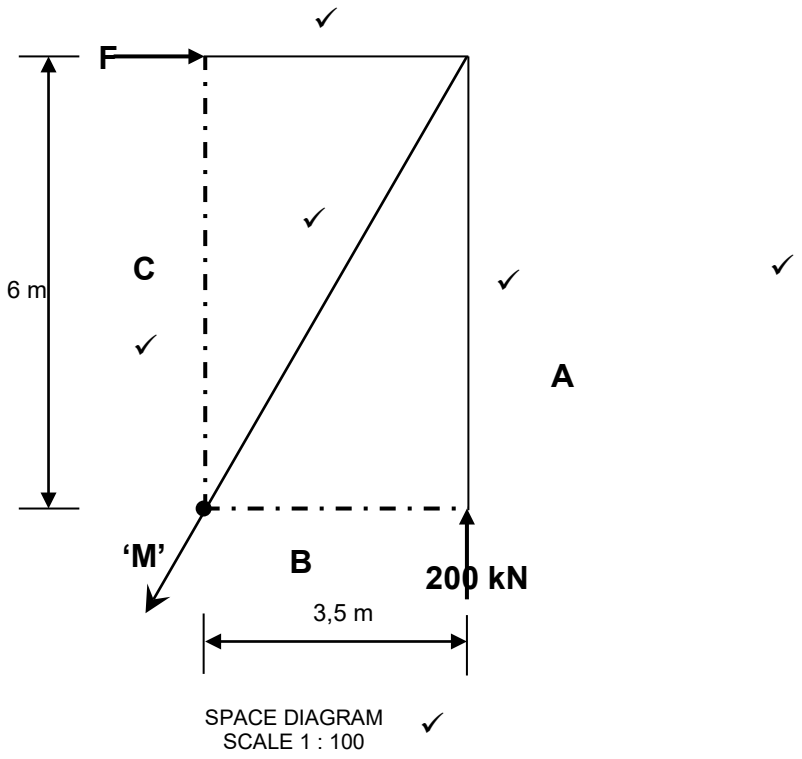
4.2



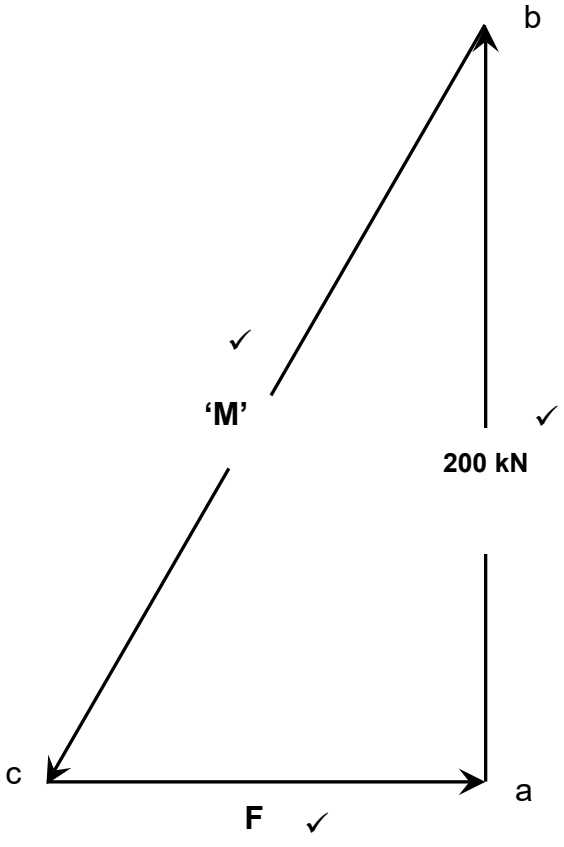


(10)
[24]

QUESTION 5



SPACE DIAGRAM
SCALE 1 : 100



VECTOR DIAGRAM
SCALE 1 mm = 2 kN

F = 58 kN✓ due east✓
M = 116 kN✓@ 60°✓ south of west✓ **[15]**

QUESTION 6

6.1
- Fuel
- Heat
- Oxygen (3)

6.2 Heat required = m × ∆t × SHC
= 6 kg × (285 °C – 200 °C) × 0,46 kJ/kg.°C✓
= 6 kg × 85 °C × 0,46 kJ/kg.°C✓
Heat energy required = 234,6 kJ✓
Reward once for use of SI units✓ (4)

6.3 $L_u = L_o \times \alpha \times \Delta t$
0,144 = 60 × 0,000012 × (t – 10)
0,144 = 0,00072t – 0,0072✓
0,144 + 0,0072 = 0,00072t✓
0,1512 = 0,00072t✓
t = 210 °C✓✓ (5)

6.4 Volume of a beam = L × B × H
V = 4,8 m × 0,055 m × 0,114 m✓
V = 0,03 m^3✓

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$
$$= \frac{76,5}{0,03}\checkmark$$
= 2 550 kg/m^3✓✓ (5)
[17]

TOTAL: 100