higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

18 November 2020

This marking guideline consists of 6 pages.

QUESTION 1

1.1 The main purpose of a roof is to protect a building✓ against the forces of nature like rain, wind, hail or snow.✓ (2)

1.2
- Soundproofing
- Hail resistant
- Water resistant
- The influence of climatic changes
- Reflection and absorption of heat and cold
- Attractiveness
- Roof construction
- Durability
- Mass
- Resistance to rust
- Availability of materials (Any 5 × 1) (5)

1.3 1.3.1 If the body is submersed in a liquid it is subjected to an upward thrust✓ which is equal to the weight of the liquid displaced.✓

1.3.2 The density of a substance is the mass per unit volume of the substance✓ and is expressed in g/cm^3 or kg/m^3.✓ (2 × 2) (4)

1.4 Relative density of lead = $\frac{\text{density of material}}{\text{density of water}}$

$= \frac{15\ 200\ kg/m^3}{1\ 000\ kg/m^3}$✓

= 15.2✓✓ (3)

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QUESTION 2

2.1 Take moments about R_R to calculate the magnitude of R_L

$\sum$ CW moments = $\sum$ ACW moments ✓

$(R_L \times 6) + (20 \times 1) + (40\ X\ 1\ X\ 0.5) = (45 \times 7) + (15 \times 5) + (40 \times 4 \times 2)$✓

$(R_L \times 6) = 315 + 75 + 300 - 20$ ✓

$R_L = \frac{670}{6}$ ✓

R_L = 111.667 kN✓ (5)

2.2 Take moments about R_L to calculate the magnitude of R_R

$\sum$ ACW moments = $\sum$ CW moments ✓

$(R_R \times 6) + (45 \times 1) = (15 \times 1) + (40 \times 4 \times 4) + (20 \times 7) + (40\ X\ 1\ X\ 6.5)$✓

$(R_R \times 6) = 1055 - 45$ ✓

$R_R = \frac{1010}{6}$ ✓

R_R = 168.333 KN✓ (5)

2.3 Test the answer to prove equilibrium:

∑ Upward forces = ∑ Downward forces

(111.667 kN + 168.333 kN)✓ = (45 kN + 15 kN + 200 kN + 20 kN)✓

280 kN = 280 kN ✓ (3)

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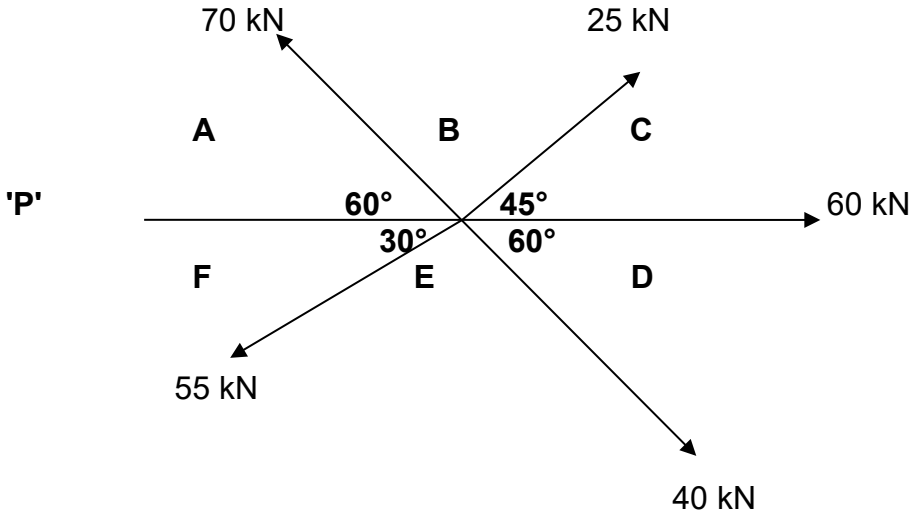
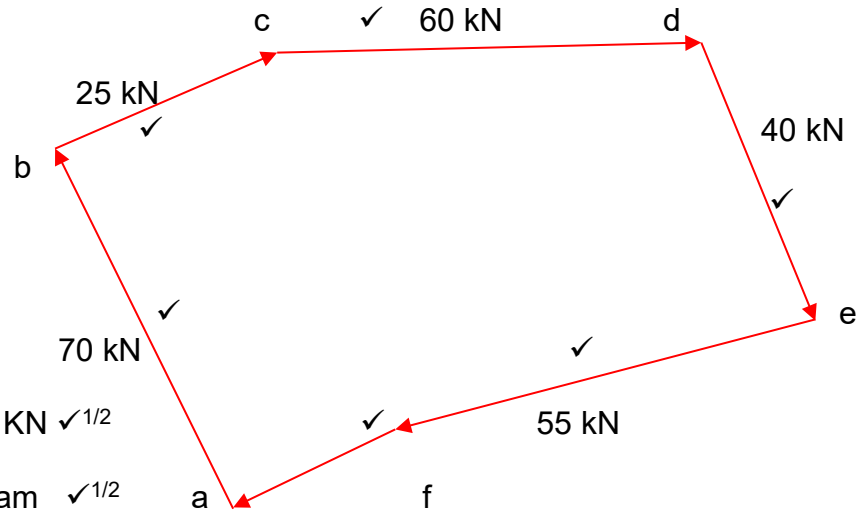
QUESTION 3

'P' = 23kN✓✓@ 29°✓ south of west✓

3.1





Scale 1cm:1KN ✓1/2

Force Diagram ✓1/2

✓ ✓ 1/2 ✓1/2

P = 23 kN due south west @ 29°

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QUESTION 4

4.1

MEMBER	4.1.1 AREA	4.1.2 DISTANCE	4.1.3 AREA × DISTANCE (MOMENTS)
1	60 x 80 = 4800 mm²✓	40mm✓	4800 mm² × 40 mm = 192 000 mm³✓
2	π r² = π (10)² = -314,159 mm²✓	20 mm✓	314,159 mm² × 20 mm = - 6283,18 mm³✓
3	10 × 10 = -100 mm²✓	45 mm✓	100 mm² × 45 mm = -4 500 mm³✓
4	40 × 10 = - 400 mm²✓	65 mm✓	400 mm² × 65 mm = -26 000 mm³✓
TOTAL	**= 3985.841 mm²✓**		**= 155216.82 mm³✓✓**
MARKS	(5)	(4)	(6)

(15)

4.1.4 $\bar{y} = \frac{\Sigma My}{\Sigma A}$ ✓

$\bar{y} = \frac{155216.82\ mm^3}{3985.841\ mm^2}$ ✓

$\bar{y}$ = 38.942 mm 'X-X'✓✓ (4)

4.2 Couple can be defining as two parallel forces,✓ having the same magnitude and acting at any distance in opposite directions on a lever.✓ Centroid is the centre point of a two-dimensional area.✓ The exact centre of an object is called a centroid.✓ (4)

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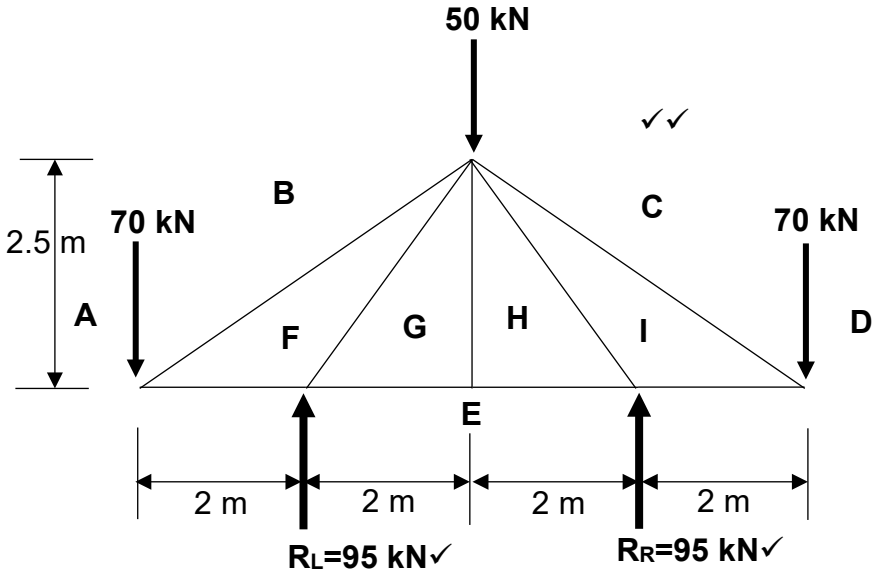
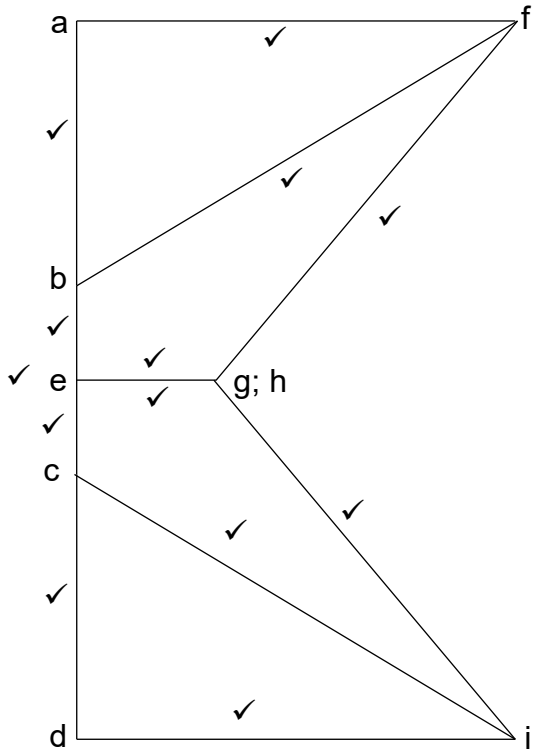
QUESTION 5

5.1 5.1.1



(4)

5.1.2



(13)

5.1.3

MEMBER	MAGNITUDE	NATURE
AF	58 kN✓	Strut✓
BF	68 kN✓	Tie✓
CI	68 kN✓	Tie✓
DI	58 kN✓	Strut✓
EG	18.5 kN✓	Strut✓
EH	18.5 kN✓	Strut✓
FG	62 kN✓	Strut✓
HI	62 kN✓	Strut✓
GH	0k N✓	Strut✓

(18 × ½) (9)

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QUESTION 6

6.1
- Conduction
- Convection
- Radiation (3)

6.2 Apparatus:

Two sheets of metal of equal length and area (one being copper and one being steel)✓
Glass container✓
Boiling water✓

Method:

Tie the copper and steel bars together to form a combined bar.✓
Boil the water and pour it into the glass container.✓
Place the piece of metal into the hot water for at least 20 min.✓

Observations:

When heat is applied the metal strips becomes arched✓ in such a way that copper is on the outer side of the arch.✓

Conclusion:

Different materials expand differently.✓ (9)

6.3 $\Delta L = Lo\ x\ \Delta T\ x\ \alpha$

= 1.35 m × 35 °C × 12 × 10^{-6}✓

= 0.000567 m or = 0.567 mm✓✓ (3)

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TOTAL: 100