higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

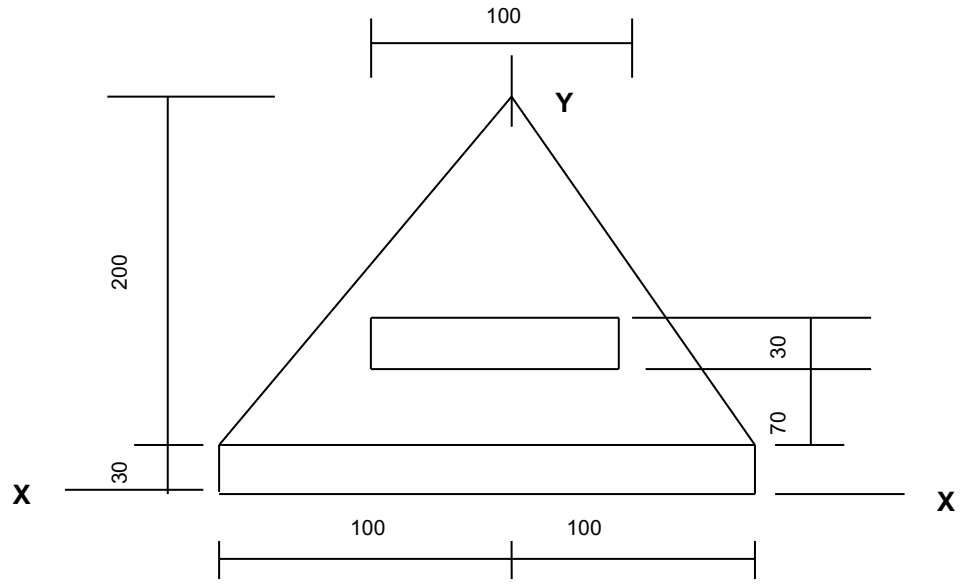
APRIL EXAMINATION

BUILDING SCIENCE N2

APRIL 2016

This marking guideline consists of 8 pages.

QUESTION 1



√√

SECTION	AREA	LEVER ARM DISTANCE	AREA × DISTANCE
1	20 000 mm²	√ 200 mm × ⅓ + 30 mm = 96,67 mm	√ 1 933 400 mm³
2	-3 000 mm²	√ 100 mm	√ -300 000 mm³
3	6 000 mm²	√ 15 mm	√ 90 000 mm³
TOTAL	√√ **23 000 mm²**		√ **1 723 400 mm³**

$Y = \frac{\Sigma YA}{\Sigma A}$ √

$= \frac{1\ 723\ 400\ mm^3}{23\ 000\ mm^3}$ √

= 74,93 mm √ **[14]**

QUESTION 2

2.1 $\Sigma M_{RR} = 0$

Take moments about RR:

RL × 600 = (5 × 400) + (2 × 200) √

600 RL = 2 400

$RL = \frac{2\ 400}{600}$

RL = 4 kN √

$\sum M_{RL} = 0$

Take moments about RL

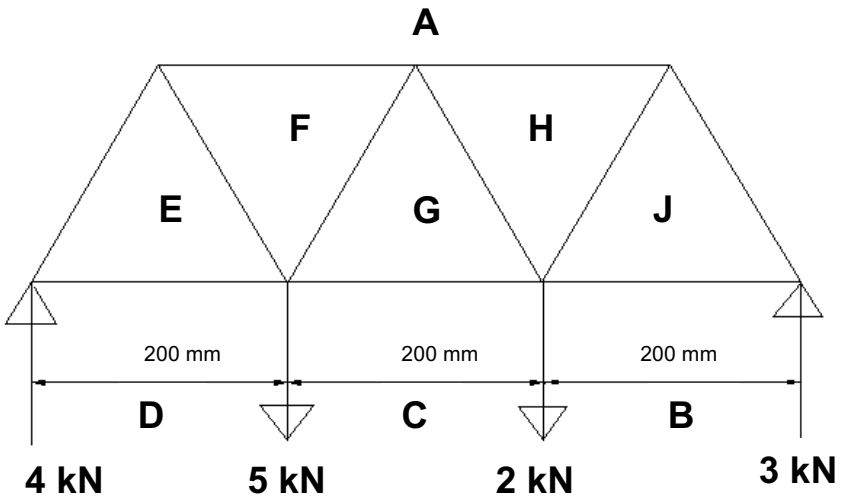
RR × 600 = (5 × 200) + (2 × 400) √

600 RR = 1 000 + 800

600 RR = 1 800

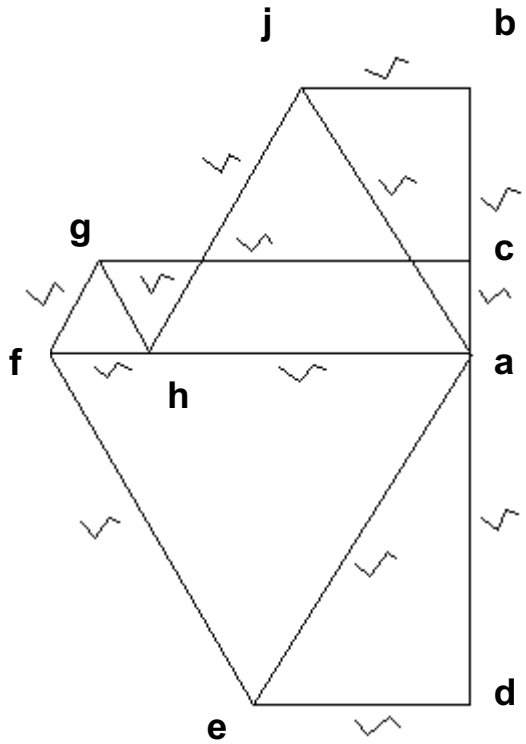
RR = 3 kN √ (4)

2.2



(2)

2.3



(14 × ½) (7)

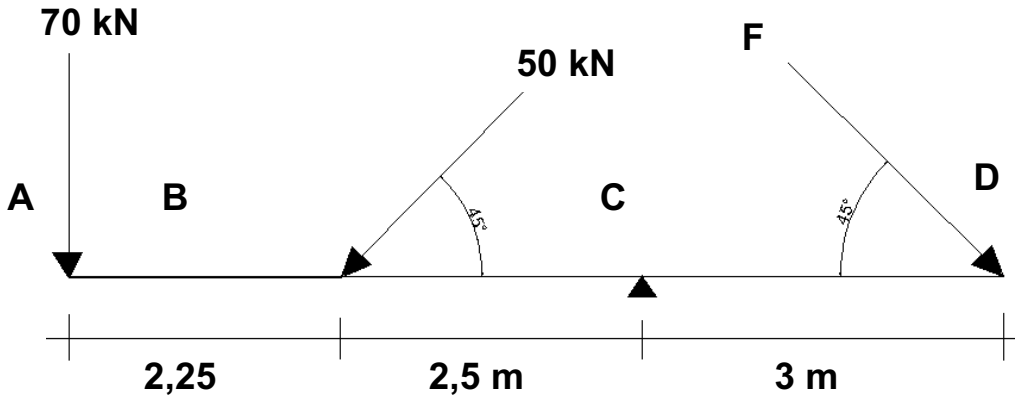
2.4

MEMBER	MAGNITUDE	NATURE
AE	4,62 kN √½	STRUT√½
AF	4,62 kN √½	STRUT√½
AH	3,46 KN √½	STRUT √½
AJ	3,46 kN √½	STRUT √½
GH	1,16 kN √½	STRUT√½
HJ	3,46 kN √½	TIE √½
JB	1,73 kN √½	TIE √½
GC	4,04 kN √½	TIE √½
FG	1,16 kN √½	TIE √½
EF	4,62 kN √½	TIE √½
ED	2,31 kN √½	TIE √½

22 x ½ (11)
[24]

QUESTION 3

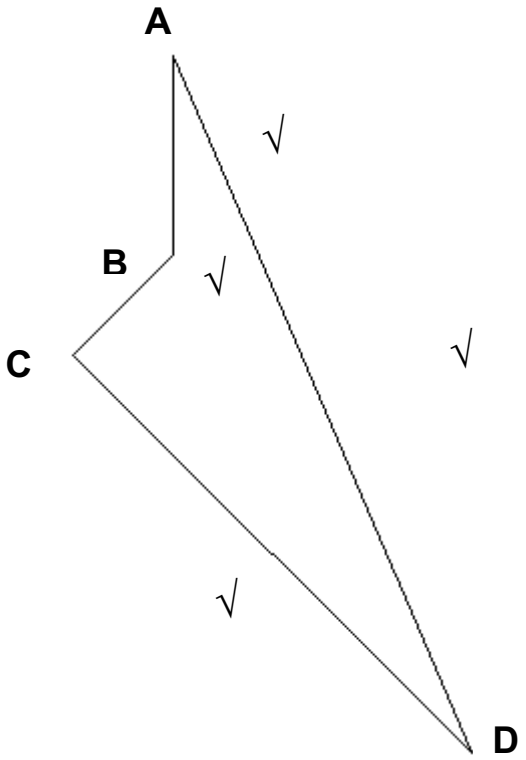
3.1



(2)

3.2 Take moments about the pivot
Anticlockwise moments = clockwise moments √
70 × 4,75 + 50sin45˚ × 2,5 = Fsin45˚ × 3 √
332,5 + 88,39 = 2,12F √
420,89 = F √
2,12
F = √ 198,53 kN
CD = 198,53 kN (5)

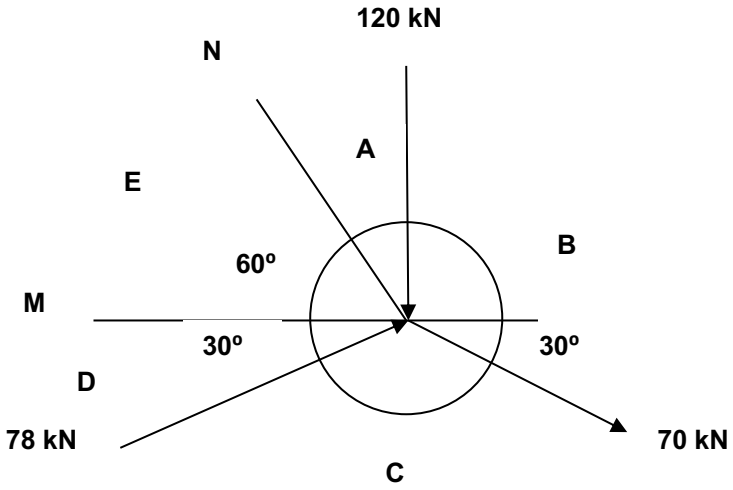
3.3



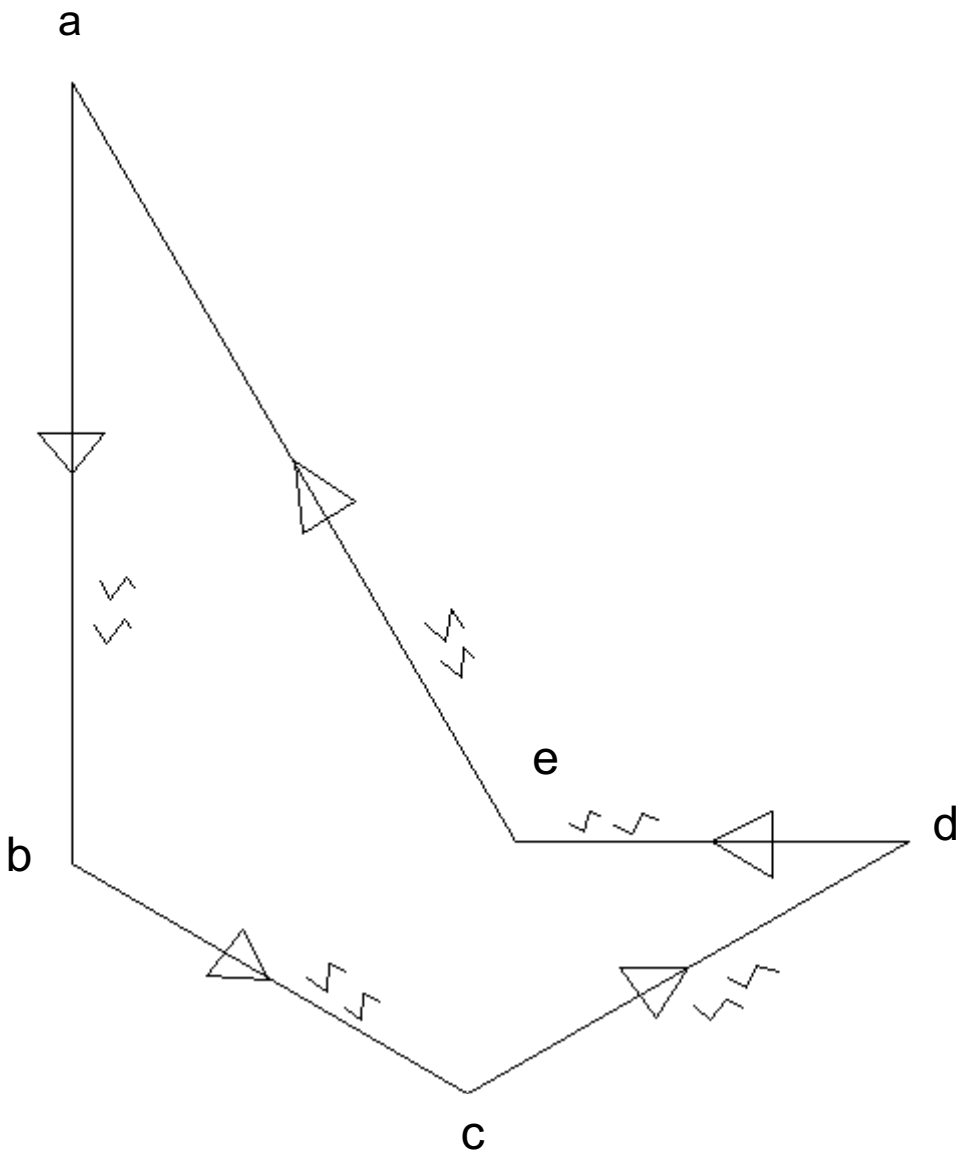
(4)
[11]

QUESTION 4

4.1



(2)



(5)

de = M = 61 kN due west √
ae = N = 133,3 kN @ 60˚ N of W √ (2)

4.2

↑+ → +	(HC = F × COSα)	(VC = F × SINα)
FORCE	**HORIZONTAL COMPONENT**	**VERTICAL COMPONENT**
120 kN due S	**0 √**	**S – 120 √**
70 kN @ 30˚ S of E	**E + 60,62 √**	**S – 35 √**
78 kN @ 30˚ N of E	**E + 67,55 √**	**N + 39 √**
Σ	**E + 128,17 √**	**S – 116 √**

(8)

4.3 $R = \sqrt{HC^2 + VC^2}$

$= \sqrt{128,17^2 + 116^2}$ √

$= 172,87$ kN √

$TAN\alpha = \frac{\sum VC}{\sum HC}$

$TAN\alpha = \frac{116}{128,17}$ √

α = 42,15˚ S of E √ or below horizontal to the right (4)
[21]

QUESTION 5

5.1 $\sum M_{RL} = 0$
RR × 11 = (17 × 3 × 1,5) + (67 × 4) + (12 × 4 × 7) + (83 × 9) + 209 x 5,5 √
11RR = 76,5 + 268 + 336 + 747 + 1 149,5 √
$\frac{11RR}{11} = \frac{2\,577}{11}$
RR = 234,27 kN √ (3)

5.2 $\sum M_{RR} = 0$
RL × 11 = (83 × 2) + (12 × 4 × 4) + (67 × 7) + (17 × 3 × 9,5) + 209 x 5,5 √
11RL = 166 + 192 + 469 + 484,5 + 1 149,5 √
$\frac{11RL}{11} = \frac{2\,461}{11}$
RL = 223,73 kN √ (3)

5.3 ↓ = ↑
51 + 67 + 48 + 83 + 209 = 234.27 kN + 223,73 kN √
458 kN = 458 kN √ (2)
[8]

QUESTION 6

6.1 Specific gravity = $\frac{\text{mass of solid}}{\text{mass of equal volume of water}}$ √

$= \frac{19}{19 - 13}$

$= \frac{19}{6}$

$= 3{,}17$ (3)

6.2 150 metric tons of water = 150 × 1 000 = 150 000 litres of water
Thus: 150 000 litres of water will be replaced √

Volume = $\frac{\text{mass}}{\text{density}}$√
Vol. = $\frac{150\ 000}{1\ 000}$ √
Vol. = 150 m^3 √

Volume = l × b × h √

Thus: h = $\frac{V}{l \times b}$ √
h = $\frac{150}{16 \times 6}$ √

h = 1,56 m √

The raft will sink 1,56 m deeper into the water.√ (9)
[12]

QUESTION 7

7.1
- Through conduction.✓✓ Transfer of heat from a hotter solid to a colder solid.
- Through convection.✓✓ Transfer of heat from a hotter liquid to a colder liquid.
- Through radiation.✓✓ Transfer of heat from heat waves/rays that travel through space (6)

7.2
- Expansion = Lo × a × (t_2 - t_1) √
- Expansion = 2 × 1 000 × 25 × 10^{-6} × (46 – 7) √
- Allowance to be made = 1,950 m √√ (4)

[10]

TOTAL: 100