higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

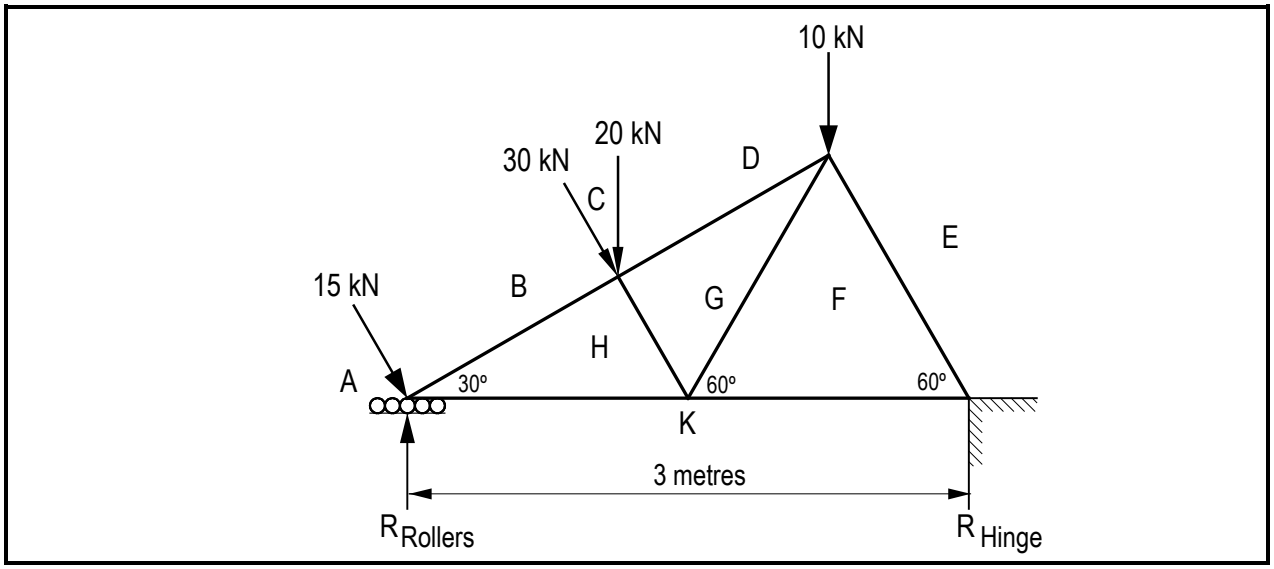
BOU- EN STRUKTUURKONSTRUKSIE N5

30 NOVEMBER 2022

Hierdie nasienriglyn bestaan uit 12 bladsye.

Kopiereg voorbehou

VRAAG 1



Bereken die Reaksies

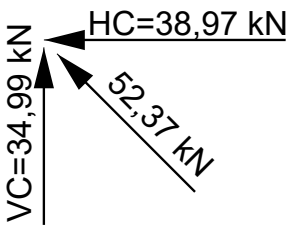
Neem die moment rondom RR
(RH × 3) = (30 Cos 60° × 1,125) + (10 × 2 ,25) + (20 × 1,125) + (30 Cos 60° × 0,65)

RH = 27,993 kN✓

Neem die moment rondom RH
(RR × 3) + (30 Cos° 60 × 0,65) = (20 × 1,875) + (30 Cos° 60 × 1,875) + (10 × 0,75) +
(15 Cos 60° × 3)

RR = 40,978 kN ✓ (2)

RR is op rollers, daarom is die krag vertikaal opwaarts = 40,978 kN
Maar RL is vas; daarom gebruik ons Pithagoras om die Resultante vir Ewewig F te vind



RL = $\sqrt{\Sigma\, VC^2 + \Sigma\, HC^2}$

RL = $\sqrt{\Sigma\, 27{,}993^2 + \Sigma\, 22{,}5^2}$

Horisontale 'Comp'
30 Cos 60° + 15 Cos 60° = F
F= 22,5 kN

Rigting:
$Tan\,\theta = \frac{27{,}993}{22{,}5}$

θ **= 51,208°✓** (4)

Bereken die krag in elke raamdeel

Vind raamdeel BH

40,978 + BH Sin 30° = 15 Sin 60°

BH = 15 sin 60° – 40,978 / Sin 30°

BH = 55,98 KN (Stut)✓✓

Vind raamdeel HK

BH Cos 30° = 15 Cos 60° + HK

55,98 Cos 30° = 15 Cos 60° + HK

HK = 55,98 Cos 30° – 15 Cos 60°

HK = 40,98KN (Bint)✓✓

Vind raamdeel EF

EF Sin 60° = 36 Sin 51°

EF = 28 / Sin 60°

EF =32,33 KN (Stut)✓✓

Vind raamdeel FK

FK + FE Cos 60° = 36 Cos 51°

FK + 32,33 Cos 60° = 36 Cos 51°

FK = 32,33 Cos 60° + 36 Cos 51°

FK = 6,7 KN (Stut)✓✓

Vind raamdeel DG

DG Cos 30° + HG Cos 60° = 30 Cos 60° + 56 Cos30°

DG Cos 30° = 63, 497 – HG Cos 60°

DG = 73,32 – 0,577 HG…….{1}

DG Sin 30° + 20 + 30 Sin 60° = 56 Sin 30° + HG Sin 60°

DG Sin30 + 45,98 = 28 + 0,866 HG

0,5 (73,32 – 0,577HG) + 45,98 = 28 + 0,866 HG

36,66 – 0,289 HG + 45,98 = 28 + 0,866 HG

82,64 – 0,289 HG = 28 + 0,866 HG

82,64 – 28 = 0,866 HG + 0,289 HG

54,64 = 1,155 HG

HG = 47 kN (Stut)✓✓

En:

DG = 73,32 – 0,577 HG…….{1}

DG = 73,32 – 0,577 (47)

DG = 46 kN (Stut)✓✓

Vind raamdeel FG

HG Sin60 = FG Sin60

HG = GF Sin 60 / Sin 60

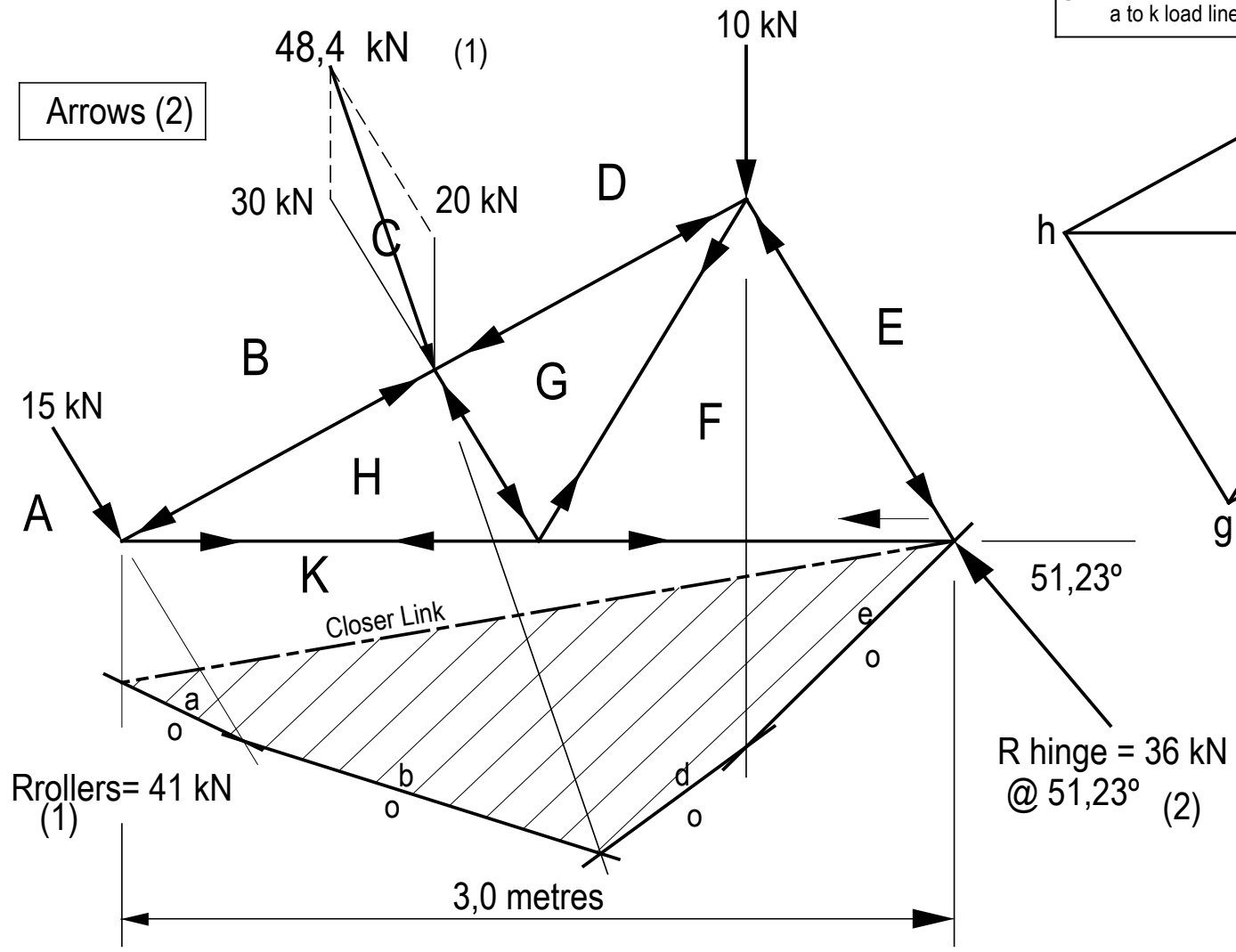
HG = GF

GF = 47 kN (Bint)✓✓ (14)

[18]

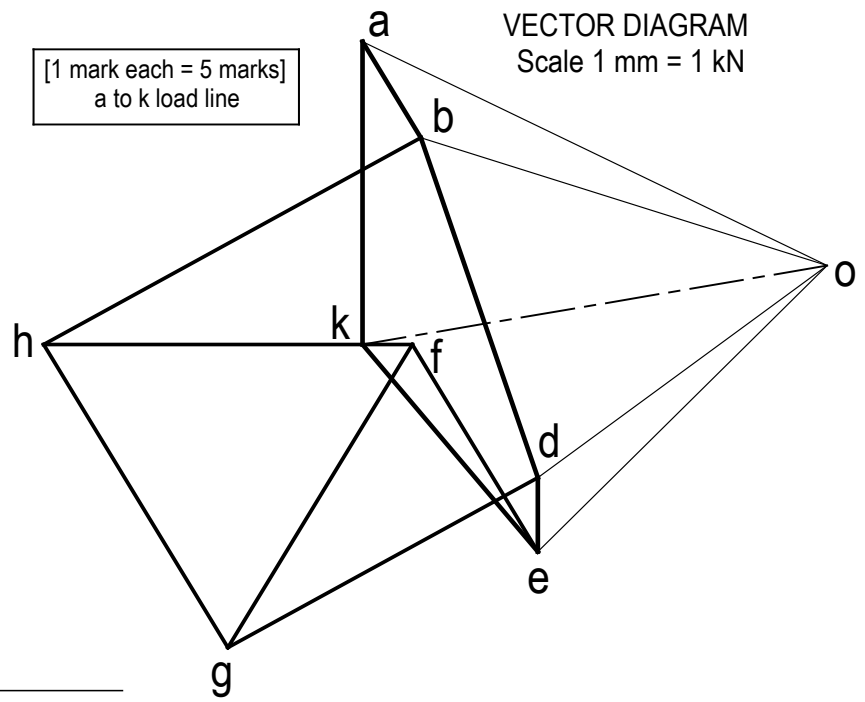
QUESTION 1
(Alternative)

SPACE DIAGRAM
Linear Scale 120 mm = 3 m



[1 mark each = 5 marks]
a to k load line

VECTOR DIAGRAM
Scale 1 mm = 1 kN



Member	Type	Magnitude	
BH	Strut (C)	56 kN	(1)
DG	Strut (C)	46 kN	(1)
EF	Strut (C)	32 kN	(1)
FG	Tie (T)	47 kN	(1)
GH	Strut (C)	47 kN	(1)
KH	Tie (T)	41 kN	(1)
KF	Tie (T)	6,49 kN	(1)

[14 x 0,5 each = 7 marks]

TOTAL MARKS = 18

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VRAAG 2

2.1 Boute se skuifweerstand
Die skroefdraad is buite die skuifvlak

Skuifspanning = Las / Oppervlak

Las = oppervlakte x spanning

Skuifkrag $= \frac{\pi d^2}{4}$ x f_s x n ✓ (deursnee = 12 mm)

$= \frac{\pi 12^2}{4}$ x $150\ N/mm^2$ x 6 ✓✓

= **101,79 kN**✓ (4)

2.2 Boute se drukweerstand

Las = oppervlakte x spanning

Drukkrag = (d x t) x spanning x n

$= (12 \times 10) \times 260\ N/mm^2 \times 6$✓✓

Drukkrag = **187,2 kN**✓ (3)

2.3 Boute se skeurweerstand

Las = oppervlakte x spanning

$F_s = A_t \times f_t \times n$

Krag in skeur = $[(B \times T) - n(d \times t)] \times f_t$

$= [(70 \times 10) - 2(14 \times 10)] \times 200\ N/mm^2$✓

$= [(700) - 2(140)] \times 200\ N/mm^2$

$= [700 - 280] \times 200\ N/mm^2$✓

$= 420 \times 200\ N/mm^2$✓

Krag in skeur = 84 kN✓ (4)

2.4 Die maksimum veilige las is in skeuring = 84 KN (1)
[12]

VRAAG 3

Bereken die Reaksies

3.1 **Neem momente rondom RL:**

$$(RR \text{ x } 9) + (3 \text{ x } 3) + (4 \text{ x } 3 \text{ x } 1{,}5) = (6 \text{ x } 10) + (2 \text{ x } 3 \text{ x } 8{,}5) + (4 \text{ x } 7) + (8 \text{ x } 2)$$

$$+ (4 \text{ x } 2 \text{ x } 1) \checkmark$$

$$RR = \frac{(60 + 51 + 28 + 16 + 8) - (9 + 18)}{9} \quad \left(\frac{163 - 27}{9}\right)$$

RR = 15,11 kN ✓ (2)

Neem momente rondom RR:

$$(RL \text{ x } 9) + (6 \text{ x } 1) + (2 \text{ x } 1 \text{ x } 0{,}5) = (3 \text{ x } 12) + (4 \text{ x } 5 \text{ x } 9{,}5) + (8 \text{ x } 7) + (4 \text{ x } 2)$$

$$= (2 \text{ x } 2 \text{ x } 1) \checkmark$$

$$RL = \frac{(36 + 190 + 56 + 8 + 4) - (6 + 1)}{9} \quad \left(\frac{294 - 7}{9}\right)$$

RL = 38,89 kN✓ (2)

Bereken Skeurkragwaardes

3.2	SF A: -3 kN	-3 kN
	SF B: -3 – (4 × 3)	-15 kN
	SF B: -3 – (4 × 3) + 31,89	**16,89 kN MAKS** ✓
	SF C: 31,89 – 3 – (4 × 5)	8,89 kN
	SF C: 31,89 – 3 – (4 × 5) - 8	0,89 kN ✓
	SF D: 31,89 – 3 – (4 × 5) – 8	0,89 kN
	SF D: 31,89 – 3 – (4 × 5) – 8 - 4	- 3,11 Kn ✓
	SF E: 31,89 – 3 – (4 × 5) – 8 – 4 – (2 × 2)	- 7,11 kN
	SF E: 31,89 – 3 – (4 × 5) – 8 – 4 – (2 × 2) + 15,11	8 kN
	SF F: 31,89 – 3 – (4 × 5) – 8 – 4 – (2 × 2) + 15,11	6 kN (3)

Bereken Buigmomentwaardes

BM B: – (3 × 3) – (4 × 3 × 1,5)	-27 kNm (max)✓
BM C: (31,89 × 2) – (3 × 5) – (4 × 5 × 2,5)	-1,22 kNm✓
BM D: (31,89 × 7) – (3 × 10) – (4 × 5 × 7,5) – (8 × 5)	3,23 kNm✓
BM D: (15,11 × 2) – (6 × 3) – (2 × 3 × 1,5)	***3,22 kNm***
BM E: – (6 × 1) – (2 × 1 × 0,5)	7 kNm✓

(4)

Bereken Profielmodules en kies geskikte I-profiel- tapse flens

3.3 $\text{Ze} = \frac{B\ M\ max}{Stress} = \frac{27\ x\ 10^6}{160}$ ✓ $= 168\,750\ \text{mm}^3$ ✓

$\text{Ze} = 168{,}8 \text{ x } 10^{-6}\ \text{m}^3$ ✓

Kies: 178 x 102 x 21,5 kg/m I-Profiel tapse flens ✓ ($\text{Ze} = 170{,}2 \text{ x } 10^{-6}$) (4)

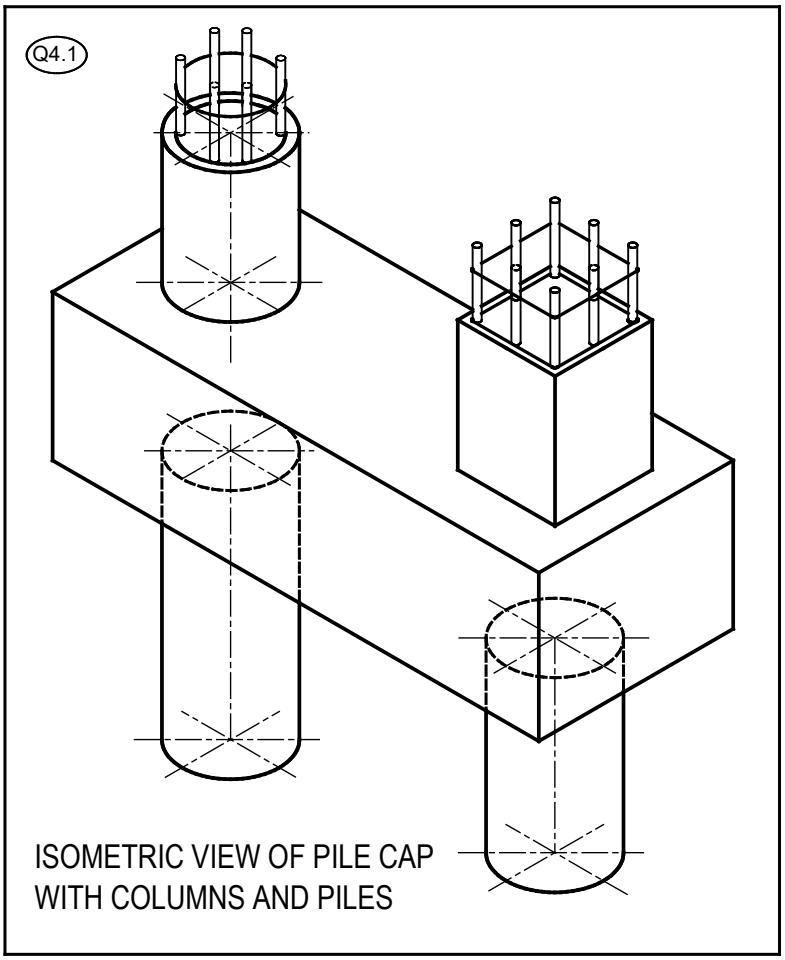
Kontrole vir skuifspanning

3.4 $\text{Skuifspanning} = \frac{S\ F\ max}{D\ x\ t} = \frac{16{,}89\ x\ 10^3}{177.8\ x\ 5{,}3}$ ✓ $= 18\ \text{MPa}$ ✓ (2)

$\text{Ze} = 18 < 150\ \text{MPa}$ ✓ (1)

[18]

VRAAG 4.1



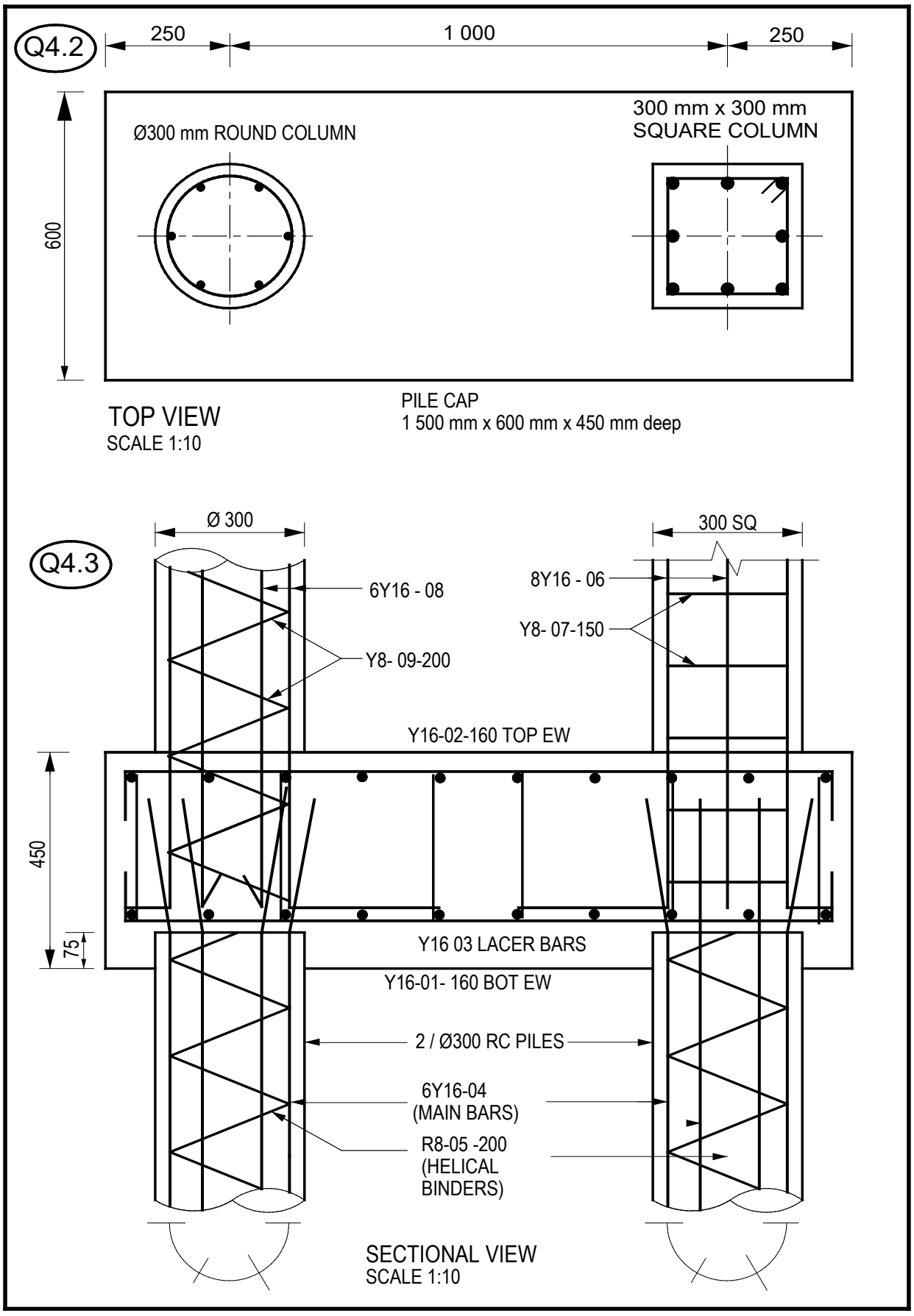
QUESTION 4.1 ISOMETRIC VIEW	
Iso freeh sketch	1
Drawn in good proportn	1
All members in place	2
All Reinforcement	1
Total	5

QUESTION 4.2 TOP VIEW	
Pile cap drawn to corr dims	1
Columns corr.	2
Column Reinforcmnt corr.	2
Dimensions	1
Title & Scale	1
Total	7

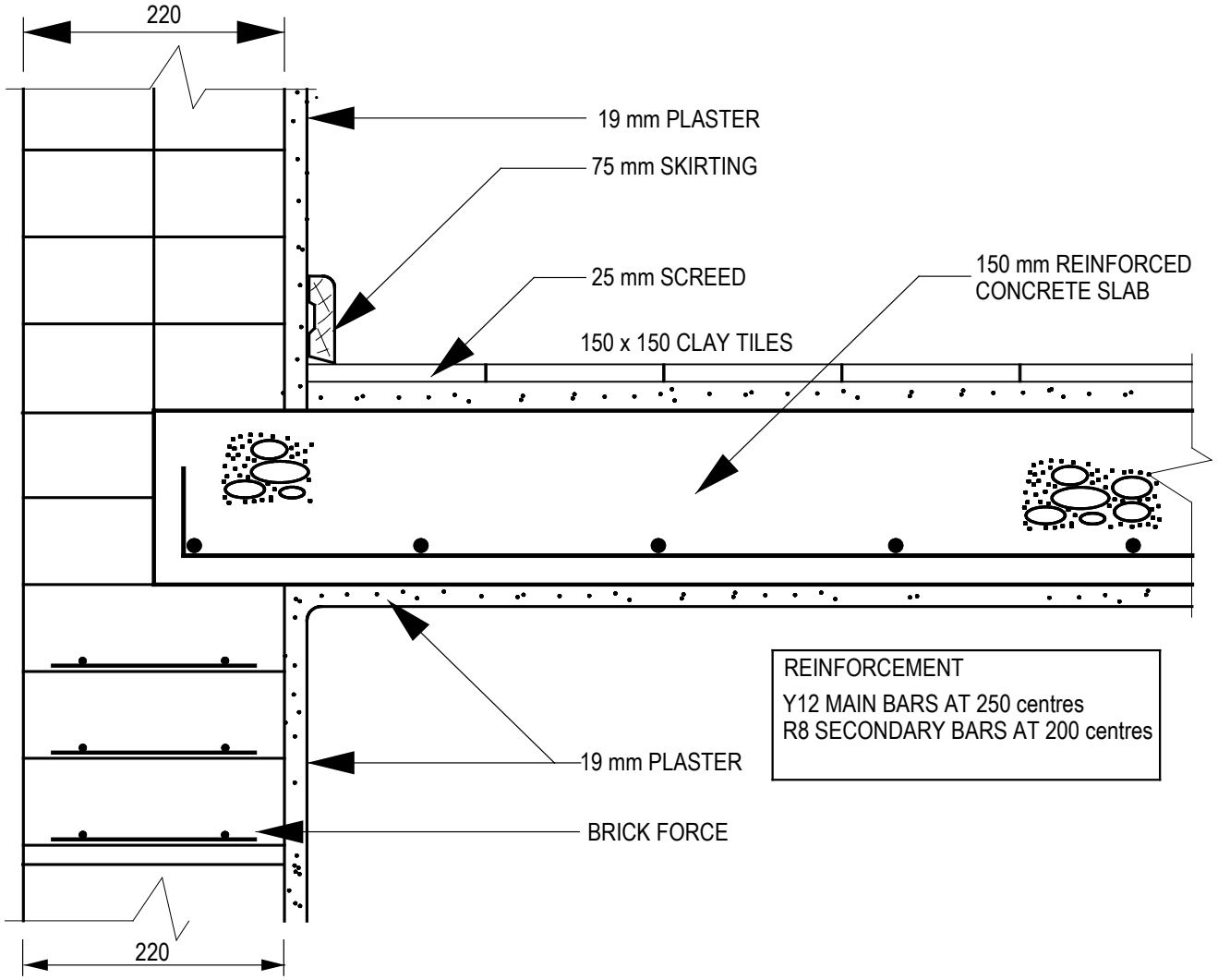
QUESTION 4.3 SECTIONAL VIEW	
Pile cap drawn to corr dims	1
Piles drawn corr.	2
Columns corr.	2
All reinforcement	5
Dimensions	2
Labels	2
Title & Scale	1
Total	15

Total = 27 marks

VRAAG 4.2 en 4.3

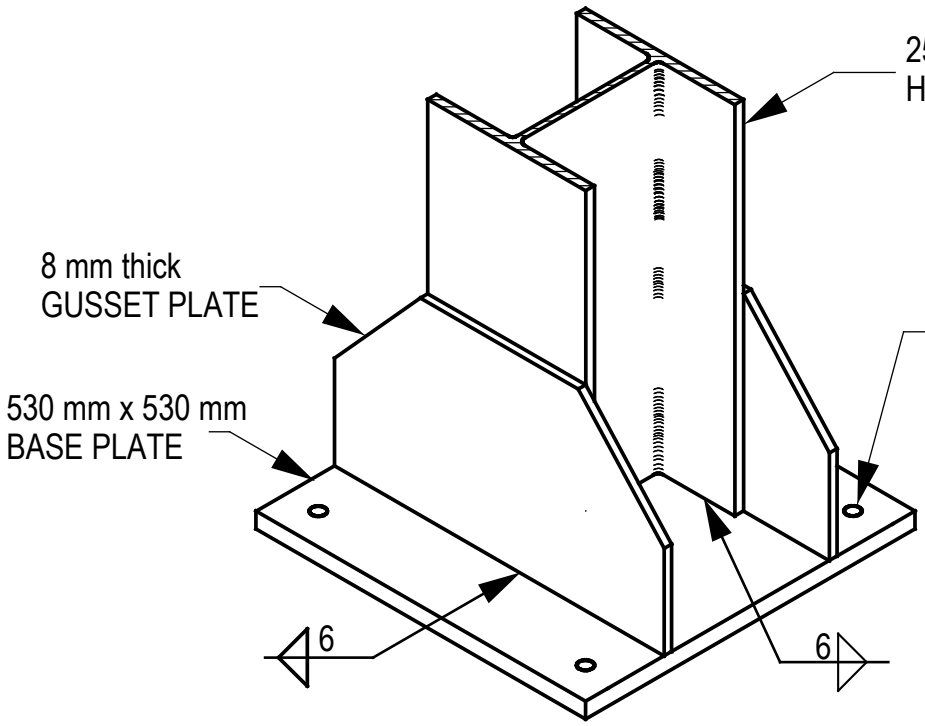


QUESTION 5



QUESTION 5		
MARK ALLOCATION		
CORRECTNESS:		10
Brick wall corr.	2	
RC Slab	2	
Reinforcement	2	
Floor finishes	2	
Plaster	2	
Accuracy		3
Labels		1
Total		14

QUESTION 6



ISOMETRIC VIEW OF STEEL COLUMN

MARK ALLOCATION

QUESTION 6	
Steel column	2
Base plate	1
Flange plates	2
Welding symbols	2
Bolt holes	1
Accuracy	3
Total	11

TOTAAL: 100

Kopiereg voorbehou