

# POSSIBLE ANSWERS FOR:

## WELDING AND METALWORKING

### SECTION/AFDELING A

#### Question 1/Vraag 1

1.1	1.1.1	True	Waar
	1.1.2	False	Onwaar
	1.1.3	True	Waar
	1.1.4	False	Onwaar
	1.1.5	True	Waar
	1.1.6	True	Waar
	1.1.7	False	Onwaar
	1.1.8	False	Onwaar
	1.1.9	True	Waar
	1.1.10	True	Waar
	1.1.11	True	Waar
	1.1.12	False	Onwaar
	1.1.13	False	Onwaar
	1.1.14	True	Waar
	1.1.15	True	Waar
	1.1.16	False	Onwaar
	1.1.17	True	Waar
	1.1.18	True	Waar
	1.1.19	True	Waar
	1.1.20	False	Onwaar

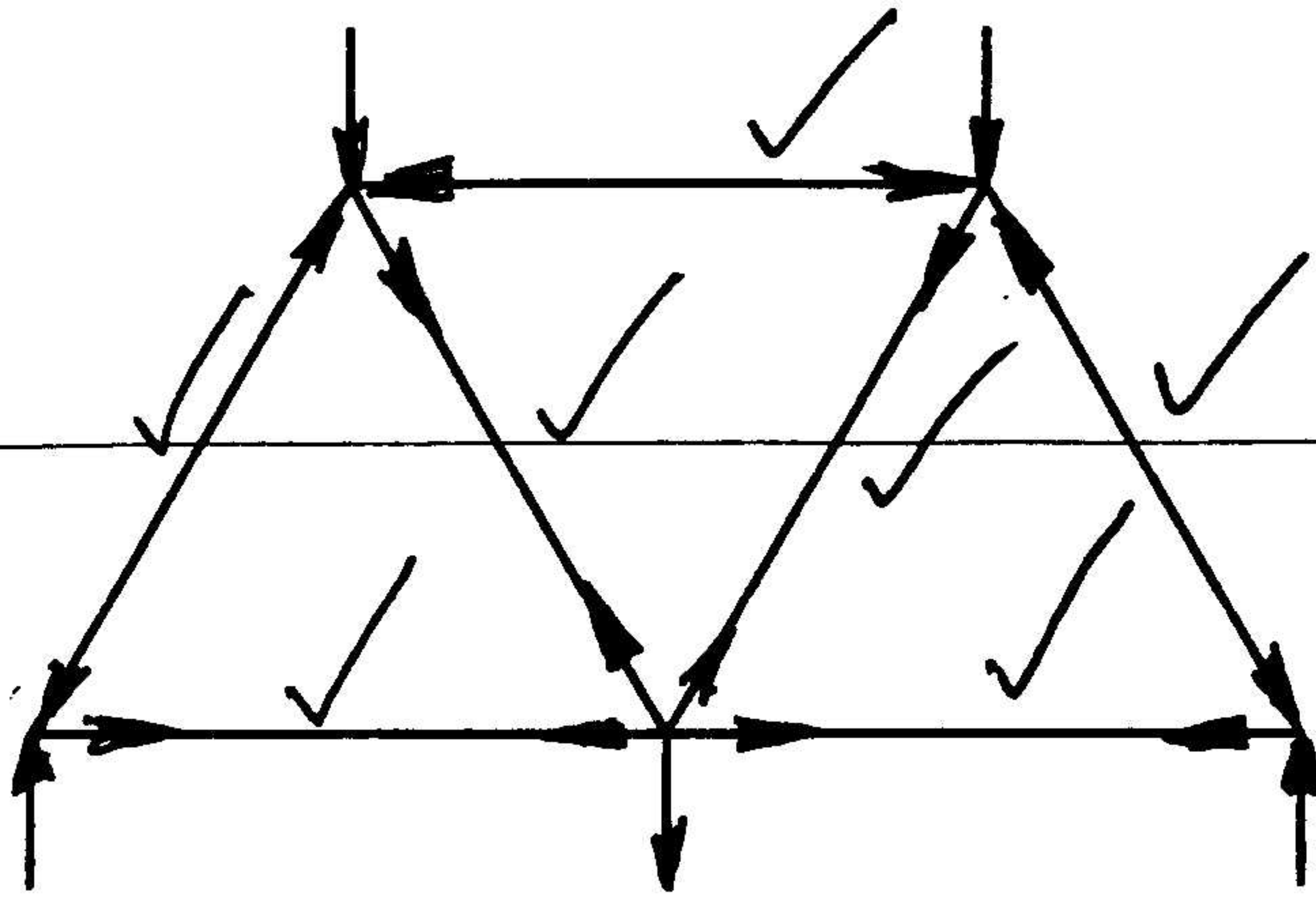
Een punt elk  
One point each (20)

1.2	1.2.1	K
	1.2.2	O
	1.2.3	A
	1.2.4	L
	1.2.5	B
	1.2.6	C
	1.2.7	E
	1.2.8	D
	1.2.9	M
	1.2.10	F
	1.2.11	H
	1.2.12	I
	1.2.13	N
	1.2.14	J
	1.2.15	G
	1.2.16	T
	1.2.17	S
	1.2.18	P
	1.2.19	Q
	1.2.20	R

One point each (20)  
Een punt elk

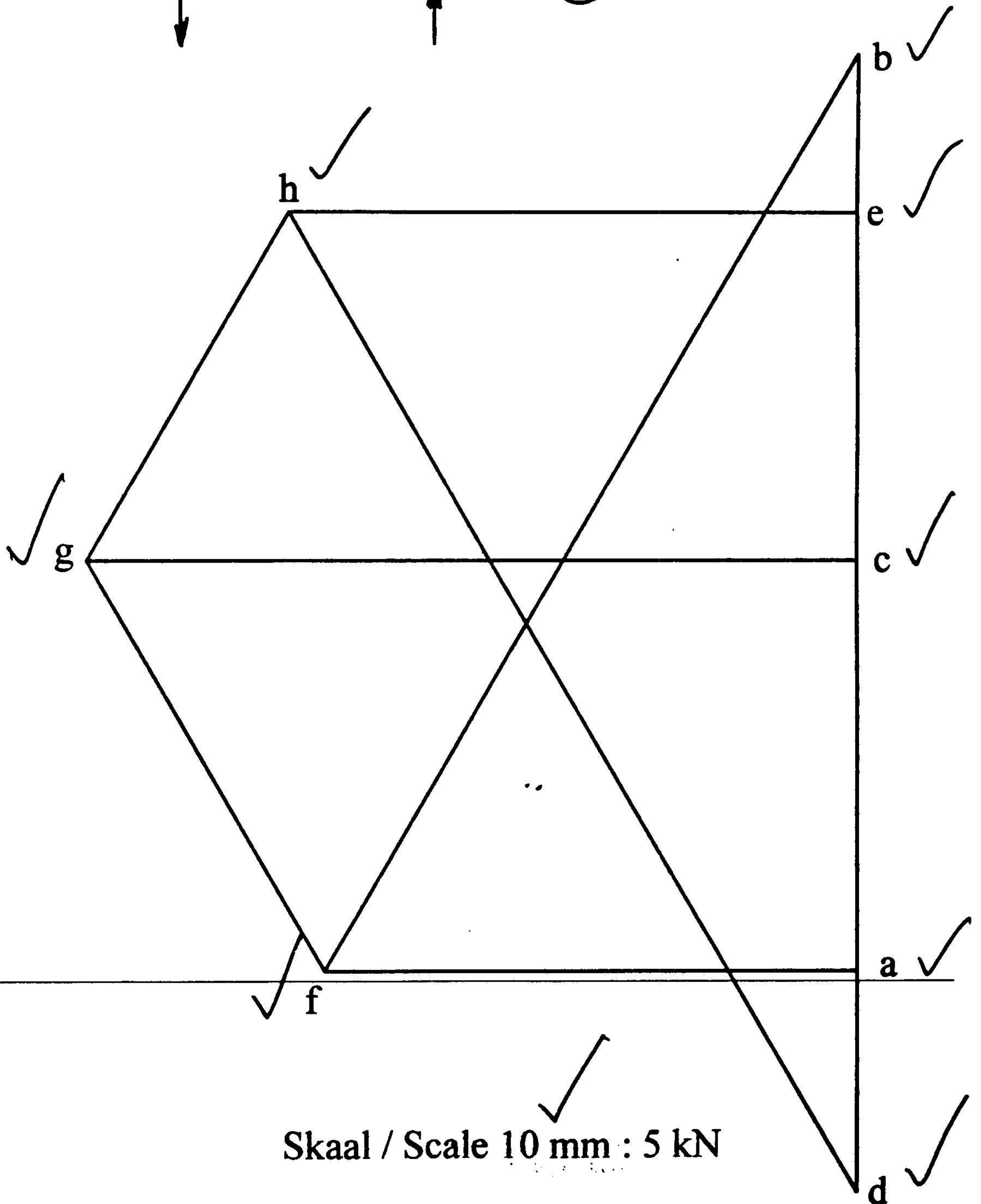
QUESTION 2 / VRAAG 2

2.1.4



(7)

2.1.2



(9)

Skaal / Scale 10 mm : 5 kN



**QUESTION 2**  
**VRAAG 2**

2.1.1 For Left reaction force  
Vir linker reaksiekrag

$$(L \times 4 \text{ m}) = (50 \text{ kN} \times 1 \text{ m}) + (60 \text{ kN} \times 2 \text{ m}) + (40 \text{ kN} \times 3 \text{ m})$$

$$4L \text{ m} = 290 \text{ kNm}$$

$$L = 290 \text{ kNm} / 4 \text{ m}$$

$$L = 72.5 \text{ kN.}$$

(5)

For Right reaction force  
Vir Regter reaksiekrag

$$(R \times 4 \text{ m}) = (40 \text{ kN} \times 1 \text{ m}) + (60 \text{ kN} \times 2 \text{ m}) + (50 \text{ kN} \times 3 \text{ m})$$

$$4R \text{ m} = 310 \text{ kNm}$$

$$R = 310 \text{ kNm} / 4 \text{ m}$$

$$R = 77,5 \text{ kN.}$$

(5)

2.1.3

MEMBER	FORCE – kN		NATURE		
BF	83,5	✓	S	STUT	✓
AF	42	✓	T	STANG	✓
CG	60	✓	S	STUT	✓
FG	37,5	✓	T	STANG	✓
HG	31,5	✓	T	STANG	✓
DH	89	✓	S	STUT	✓
EH	44,5	✓	T	STANG	✓

(14)

[40]

Question 3  
VRAAG 3

For Bending Moment  
Vir Buigmomente

$$3.1.1 \quad \text{BM(e)} (-1\text{kN} \times 0\text{m}) = 0\text{Nm} \quad \checkmark\checkmark \quad (2)$$

$$\text{BM(d)} (-1\text{N} \times 3\text{m}) = -3 \text{ Nm} \quad \checkmark\checkmark \quad (2)$$

$$\text{BM(c)} (-1\text{N} \times 6\text{m}) + (-3\text{N} \times 3\text{m}) = -15 \text{ Nm} \quad \checkmark\checkmark \quad (2)$$

$$\text{BM(b)} (-1\text{N} \times 9\text{m}) + (-3\text{N} \times 6\text{m}) + (-2\text{N} \times 3 \text{ m}) = -33\text{Nm} \quad \checkmark\checkmark \quad (2)$$

$$\begin{aligned} \text{BM(a)} & (-1\text{N} \times 11\text{m}) + (-3\text{N} \times 8\text{m}) + (-2\text{N} \times 5\text{m}) + (-5\text{N} \times 2\text{m}) \\ & \checkmark\checkmark \\ & = -55 \text{ Nm} \quad (2) \quad (10) \end{aligned}$$

For Shearing forces  
Vir skuifkragte

$$3.1.2 \quad \text{SF (A)} 5\text{N}+2\text{N}+3\text{N}+1\text{N} = 11\text{N} \quad \checkmark\checkmark \quad (2)$$

$$\text{SF (B)} 11\text{N} - 5\text{N} = 6\text{N} \quad \checkmark\checkmark \quad (2)$$

$$\text{SF (C)} 6\text{N} - 7 \text{ N} = 4\text{N} \quad \checkmark\checkmark \quad (2)$$

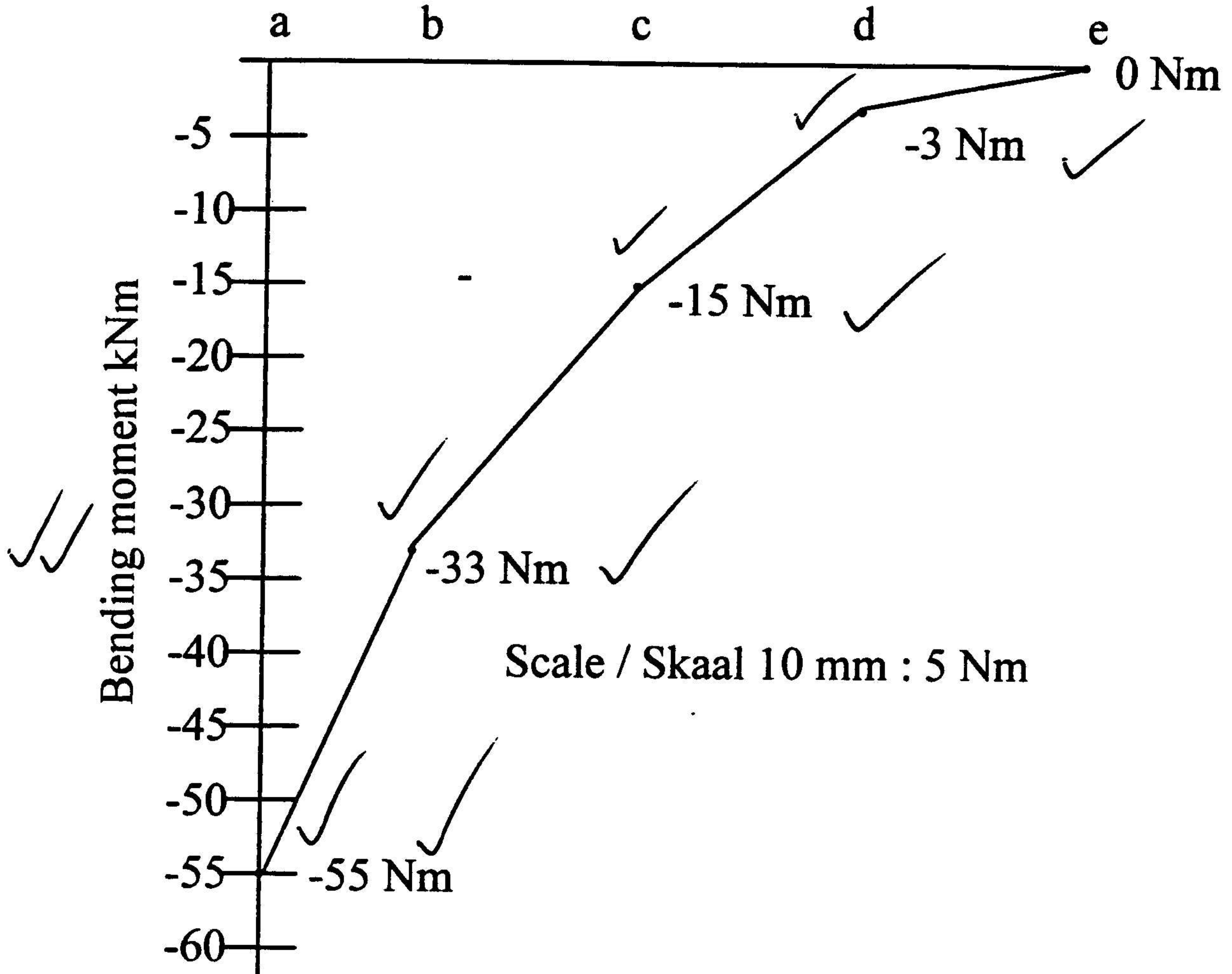
$$\text{SF (D)} 11\text{N} - 10\text{N} = 1\text{N} \quad \checkmark\checkmark \quad (2)$$

$$\text{SK (E)} 11\text{N} - 11\text{N} = 0\text{N} \quad \checkmark\checkmark \quad (2) \quad (10)$$

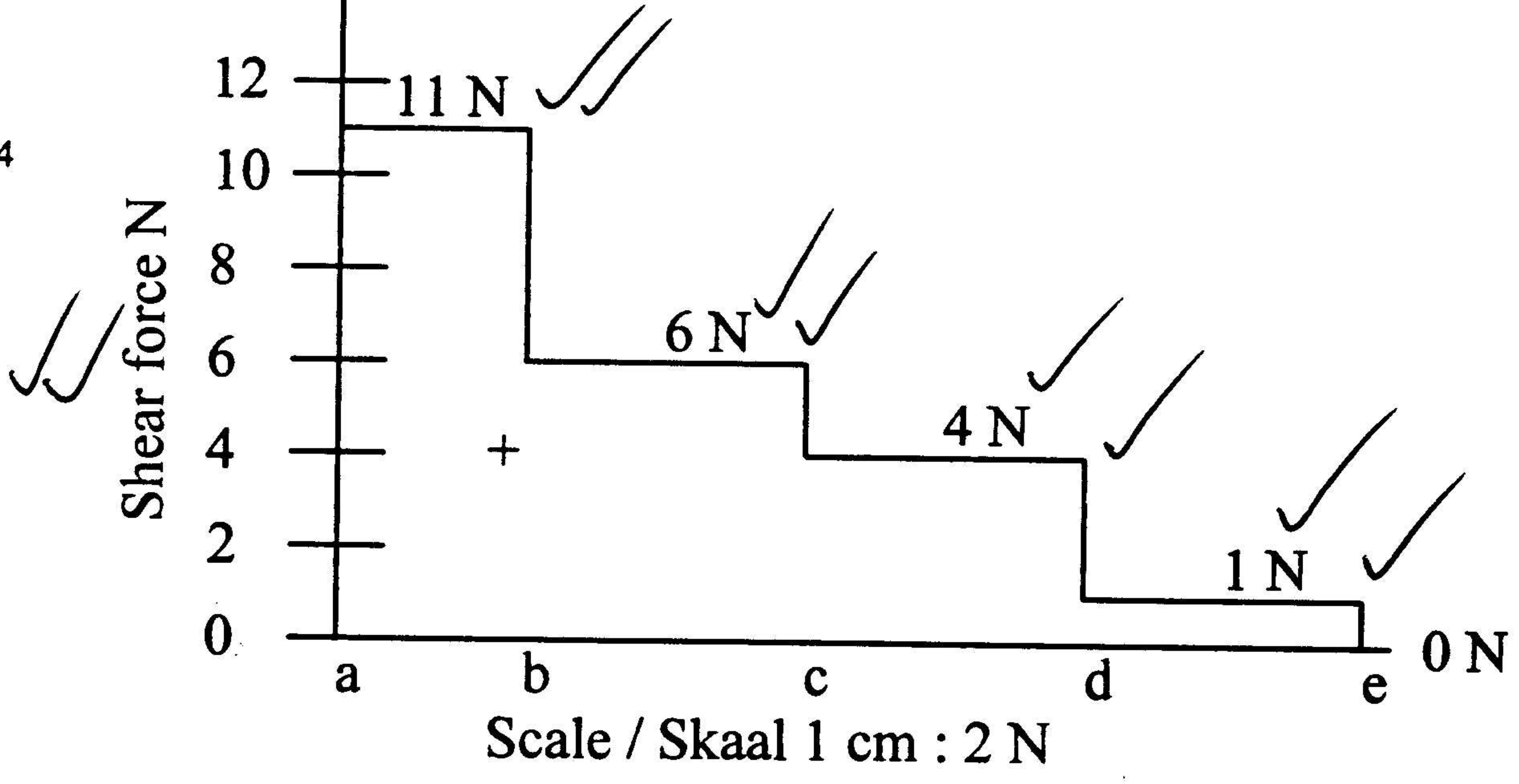


QUESTION 3 / VRAAG 3

3.1.3



3.1.4



QUESTION 4  
VRAAG 4

4.1

4.1.1

$$\text{Strain} = \frac{\text{Change in length}}{\text{Original length}}$$

$$\text{Strain} = \frac{5\text{mm}}{1000\text{mm}} \quad \checkmark \checkmark \checkmark \quad (3)$$

$$\text{Strain} = 5 \times 10^{-3} \quad \checkmark \checkmark \quad (2)$$

4.1.2

$$E \text{ (Pa)} = \frac{\text{Stress (Pa)}}{\text{Strain}}$$

$$180 \text{ GPa} = \frac{\text{Stress (Pa)}}{5 \times 10^{-3}} \quad \checkmark \quad (2)$$

$$\text{Stress (Pa)} = 180 \times 10^9 \text{ Pa} \times 5 \times 10^{-3} \quad \checkmark \checkmark \quad (2)$$

$$\text{Stress (Pa)} = 900 \times 10^6 \text{ Pa}$$

$$\text{Stress (Pa)} = 900 \times 10^6 \text{ Pa}$$

$$\text{Stress (Pa)} = 900 \text{ Mpa.} \quad \checkmark \checkmark \quad (2)$$

4.1.3

$$\text{Stress} = \frac{\text{Force}}{\text{Area (m}^2\text{)}}$$

$$900 \text{ MPa} = \frac{80 \text{ kN}}{\text{Area (m}^2\text{)}} \quad \checkmark \checkmark \quad (2)$$

$$\text{Area (m}^2\text{)} = \frac{80 \text{ kN}}{900 \text{ MPa}} \quad \checkmark \quad (1)$$

$$\text{Area (m}^2\text{)} = \frac{80 \times 10^3 \text{ N}}{900 \times 10^6 \text{ Pa}} \quad \checkmark \quad (1)$$

$$88.89 \times 10^{-6} \text{ m}^2 \quad \checkmark \quad (1)$$



4.1.4

$$\text{Area (m}^2\text{)} = \frac{3,143 \times d^2}{4} \quad \checkmark \quad (1)$$

$$88,89 \times 10^{-6} \text{m}^2 = \frac{3,143 \times d^2}{4} \quad \checkmark \quad (1)$$

$$d^2 = \frac{88,89 \times 10^{-6} \times 4}{3,142} \quad \checkmark \quad (3)$$

$$d^2 = 113,16 \times 10^{-6} \text{m}^2$$

$$d = (113,16 \times 10^{-6} \text{m}^2)^{0,5}$$

$$d = 10,63 \times 10^{-3} \text{m}$$

$$d = 10,63 \text{ mm} \quad \checkmark \checkmark$$

(2)

4.2

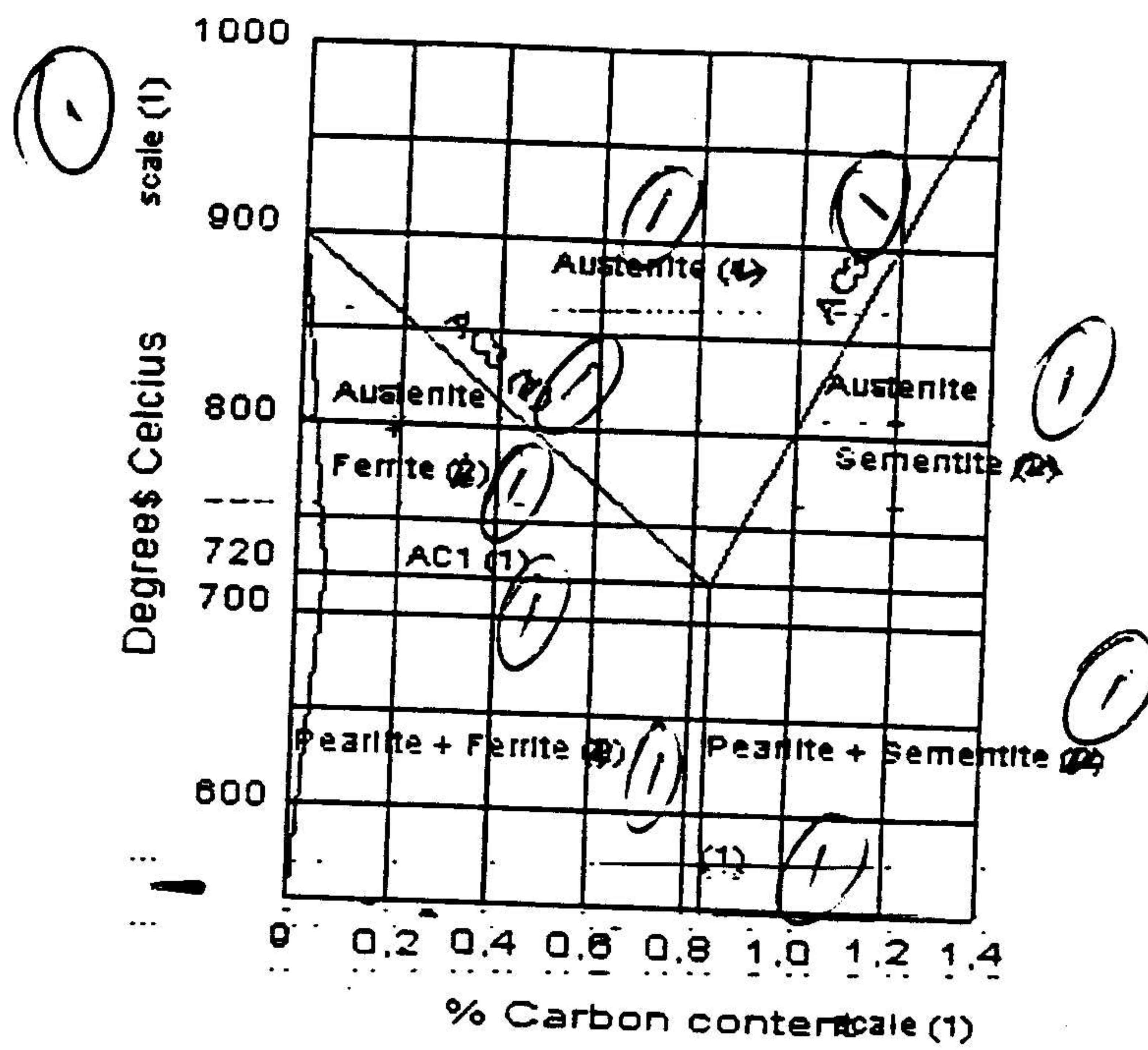
$$\text{Stress Pa} = \frac{\text{Force}}{\text{Area}}$$

$$\text{Force} = \text{Stress Pa} \times \text{Area} \quad \checkmark \checkmark \quad (2)$$

$$\text{Force} = 80 \times 10^3 \text{Pa} \times 2500 \times 10^{-6} \quad \checkmark \checkmark \checkmark \quad (3)$$

$$\text{Force} = 200 \text{ N} \quad \checkmark \checkmark \quad (2)$$

Question 4.3/Vraag 4.3



One mark each (6)

any four (4)



## Question 5

5.1

5.1.1 For  $XX^1$

$$(XX^1)^2 = XX^2 + \text{Height}^2 \quad (2)$$

$$XX^2 = 300^2 + 500^2 \quad (2)$$

$$XX = (300^2 + 500^2)^{0.5} \quad (1)$$

$$XX = 583 \text{ mm} \quad (2)$$

5.1.2 For  $YY^1$

$$(YY^1)^2 = YY^2 + \text{Height}^2 \quad (2)$$

$$YY^2 = 400^2 + 500^2 \quad (2)$$

$$YY = (400^2 + 500^2)^{0.5} \quad (1)$$

$$YY = 640,31 \text{ mm} \quad (2)$$

5.1.3 True length AE

$$AE^2 = 400^2 + 300^2 + 500^2 \quad (5)$$

$$AE = (400^2 + 300^2 + 500^2)^{0.5} \quad (1)$$

$$AE = 707,1 \text{ mm} \quad (2)$$

5.1.4 True length GC

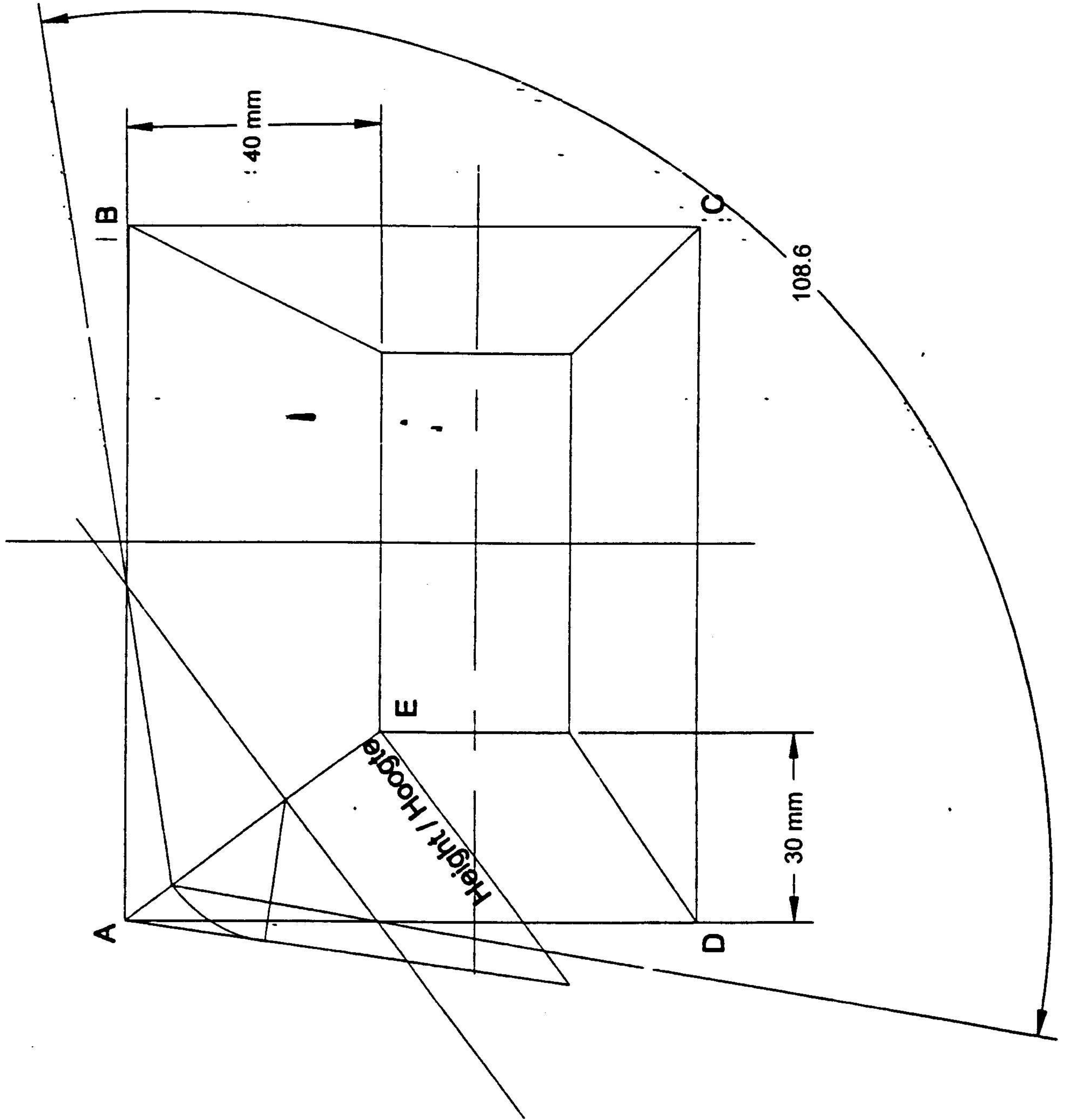
$$GC^2 = 200^2 + 200^2 + 500^2 \quad (5)$$

$$GC = (200^2 + 200^2 + 500^2)^{0.5} \quad (1)$$

$$GC = 574.5 \text{ mm} \quad (2)$$

## Question 5.2/Vraag 5.2

VRAAG 5.2 / QUESTION 5.2





## QUESTION 6

6.1

6.1.1

MARK	NUMBER REQUIRED	MATERIAL REQUIRED	Mass/m length	Tariff per kg	Total mass in kg	R	C	
A	1	70X70X8 = 5,8 m	5,8 kg/m	R2,35 ✓	33,64	79,05	✓	
B	1	70X70X8 = 11,5 m	5,8 kg/m	R2,35 ✓	66,70	156,75	✓	
C	1	70X70X8 = 10,5 m	5,8 kg/m	R2,35 ✓	60,90	143,12	✓	
D	1	60X60X6 = 5 m	4,47 kg/m	R2,10 ✓	22,35	46,94	✓	
E	1	60X60X6 = 5 m	4,47 kg/m	R2,10 ✓	22,35	46,94	✓	
F	1	60X60X6 = 2,5 m	4,47 kg/m	R2,10 ✓	11,18	23,48	✓	
						Welding material cost	65,00	✓
						Material cost	561,28	✓

6.1.2 Labour cost Arbieds koste ✓

Tariff per hour x hours worked [Tarief per uur x aantal ure gewerk]

= R14,08/hour [uur] x 8 hours [uur] ✓

= R 112,64. ✓

6.1.3 Overhead cost [oorhoofse koste] ✓

= 95% x labour cost

= 95% x R112,64 ✓

= R107,00 ✓

6.1.4 Total cost [totale koste]

Material cost [material koste] + labour cost [arbeidskoste] + overhead cost [oorhoofse koste]

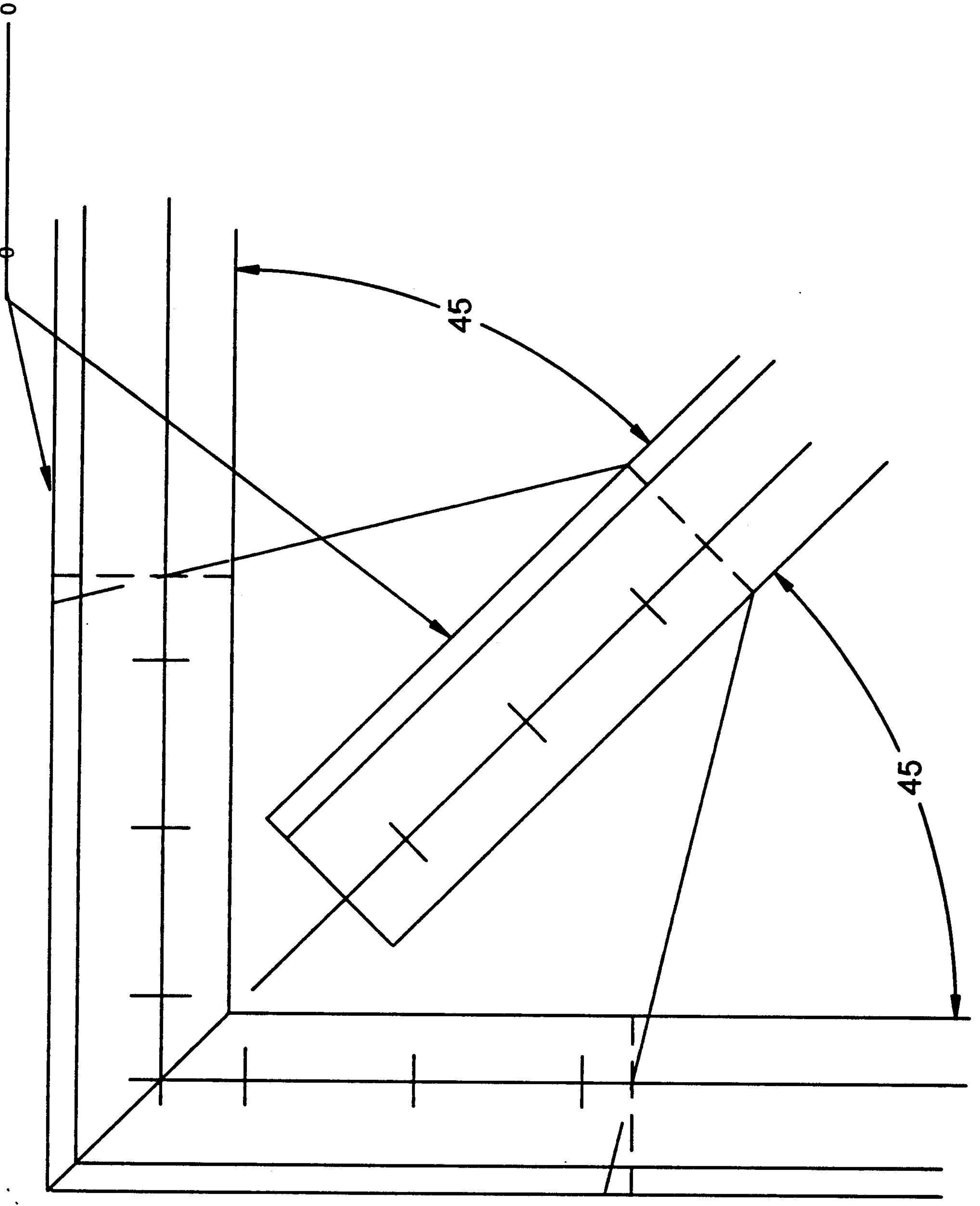
= R561,28 + R112,64 + R107,00 ✓

= R780,92 ✓

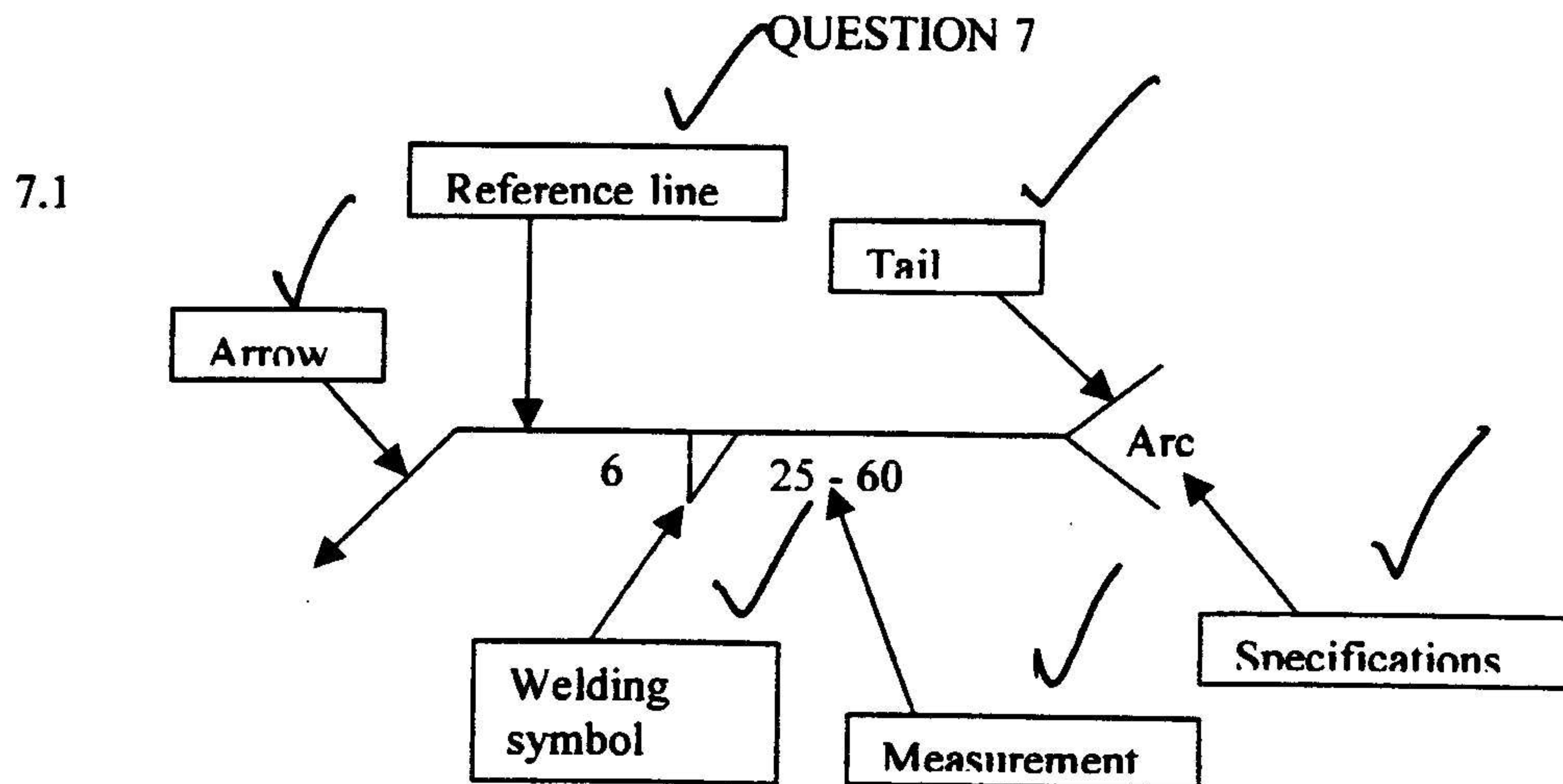


QUESTION. 6.2.

32 x 32 x 5







- 7.2 Too small a root gap  
 Current setting to low  
 Flame too small  
 Incorrect welding technique  
 Electrode or filler rod too large (5)
- 7.3 It is used to refine the grain  
 Remove internal stress  
 To soften the steel so that it can be machined or cold worked (3)
- 7.4 To give metal a hard surface whilst the core remains soft (2)  
 The hardened surface will resist wear and friction (2)  
 The soft core will resist shock (2)
- 7.5 Chromium  
 Nickel  
 Manganese  
 Tungsten  
 Silicon
- 7.6 Size and shape of bead  
 Appearance of bead  
 Appearance of slag  
 Undercut  
 Overlap  
 Location of craters
- 7.7 Current setting too high  
 Wrong electrode  
 Wrong polarity  
 Too large an electrode  
 Wrong electrode angle  
 Arc blow

7.8

