

**GAUTENG DEPARTMENT OF EDUCATION  
SENIOR CERTIFICATE EXAMINATION  
GAUTENGSE DEPARTEMENT VAN ONDERWYS  
SENIORSERTIFIKAAT-EKSAMEN**

**WELDING AND METALWORKING SG  
SWEIS EN METAALBEWERKING SG**

**POSSIBLE ANSWERS / MOONTLIKE ANTWOORDE SUPP 2007**

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SECTION / AFDELING A

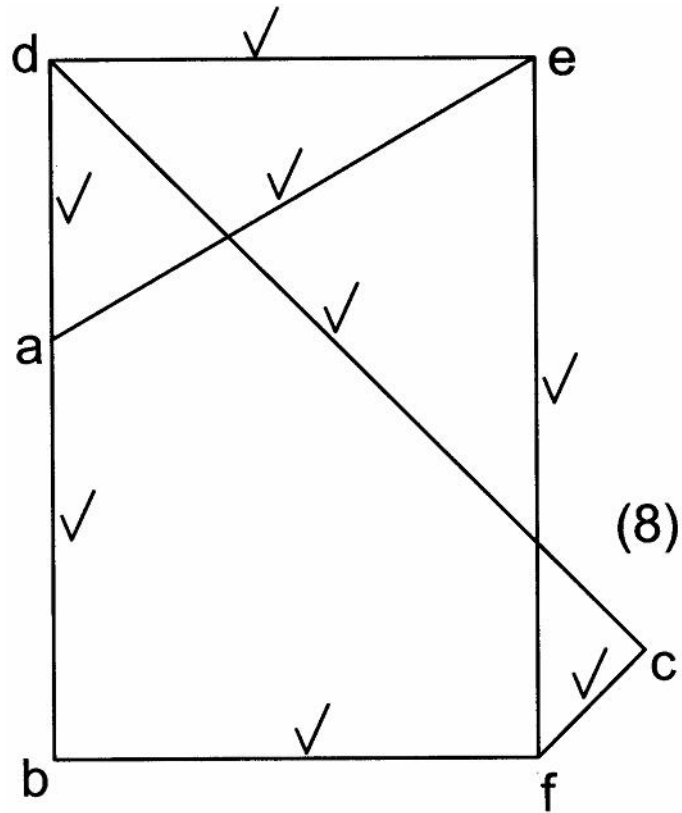
QUESTION / VRAAG 1

1.1	1.1.1	TRUE	WAAR		
	1.1.2	TRUE	WAAR		
	1.1.3	TRUE	WAAR		
	1.1.4	TRUE	WAAR		
	1.1.5	TRUE	WAAR		
	1.1.6	FALSE	ONWAAR		
	1.1.7	FALSE	ONWAAR		
	1.1.8	TRUE	WAAR		
	1.1.9	TRUE	WAAR		
	1.1.10	TRUE	WAAR		
	1.1.11	TRUE	WAAR		
	1.1.12	TRUE	WAAR		
	1.1.13	TRUE	WAAR		
	1.1.14	FALSE	ONWAAR		
	1.1.15	FALSE	ONWAAR		
				1 Mark each / 1 Punt elk	(15)
1.2	1.2.1	P	1.2.11	F	
	1.2.2	A	1.2.12	E	
	1.2.3	R	1.2.13	G	
	1.2.4	T	1.2.14	H	
	1.2.5	I	1.2.15	J	
	1.2.6	C	1.2.16	M	
	1.2.7	O	1.2.17	N	
	1.2.8	L	1.2.18	Q	
	1.2.9	S	1.2.19	D	
	1.2.10	B	1.2.20	K	
					1 Mark each / 1 Punt elk
1.3	1.3.1	D			
	1.3.2	D			
	1.3.3	B			
	1.3.4	B			
	1.3.5	B			
				1 Mark each / 1 Punt elk	(5)

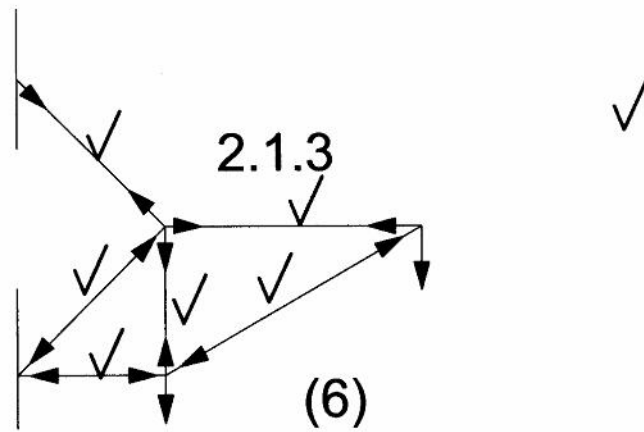
**TOTAL FOR SECTION A / TOTAAL VIR AFDELING A: [40]**

QUESTION 2 / VRAAG 2

2.1  
2.1.1



2.1.3



2.1.2

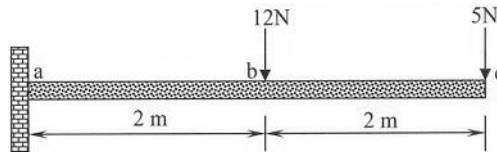
Member Onderdeel	Measurement (mm) (Afmeting (mm))	Force (N) Krag (N)	Nature (tie or strut) Aard (stang of stut)
AE	80 mm	80 N	STRUT STUT
DE	69 mm	69 N	TIE STANG
FE	100 mm	100 N	TIE STANG
FB	69 mm	69 N	STRUT STUT
FC	22 mm	22 N	STRUT STUT
DC	120 mm	120 N	TIE STANG
	(6)	(6)	(6)

## QUESTION 2 / VRAAG 2

2.2

$$2.2.1 \quad \frac{3 \text{ N}}{\text{m}} \times \frac{4 \text{ m}}{1} = 12 \text{ N} \quad (2)$$

2.2.2



$$\text{BM (C)} = (-5 \text{ N} \times 0 \text{ m}) = 0 \text{ Nm} \quad (2)$$

$$\text{BM (B)} = (-5 \text{ N} \times 2 \text{ m}) = -10 \text{ Nm} \quad (2)$$

$$\text{BM (A)} = (-5 \text{ N} \times 4 \text{ m}) + (-12 \text{ N} \times 2 \text{ m}) = -44 \text{ Nm} \quad (2)$$

**[40]**

## QUESTION 3 / VRAAG 3

3.1

$$(\text{LR} \times 12 \text{ m}) = (24 \text{ N} \times 3 \text{ m}) + (6 \text{ N} \times 8 \text{ m})$$

$$\text{LR} \cdot 12 \text{ m} = 72 \text{ Nm} + 48 \text{ Nm}$$

$$\text{LR} = \frac{120 \text{ Nm}}{12 \text{ m}}$$

$$\text{LR} = 10 \text{ N} \quad (2)$$

$$(\text{RR} \times 12 \text{ m}) = (6 \text{ N} \times 4 \text{ m}) + (24 \text{ N} \times 9 \text{ m})$$

$$\text{RR} \cdot 12 \text{ m} = 24 \text{ Nm} + 216 \text{ Nm}$$

$$\text{RR} = \frac{240 \text{ Nm}}{12 \text{ m}}$$

$$\text{RR} = 20 \text{ N} \quad (2)$$

3.2

$$\text{BM (D)} = 20 \text{ N} \times 0 \text{ m} = 0 \text{ Nm}$$

$$\text{BM (C)} = +20 \text{ N} \times 3 \text{ m} = 60 \text{ Nm}$$

$$\text{BM (B)} = (+20 \text{ N} \times 8 \text{ m}) + (-24 \text{ Nm} \times 5 \text{ m}) = 40 \text{ Nm}$$

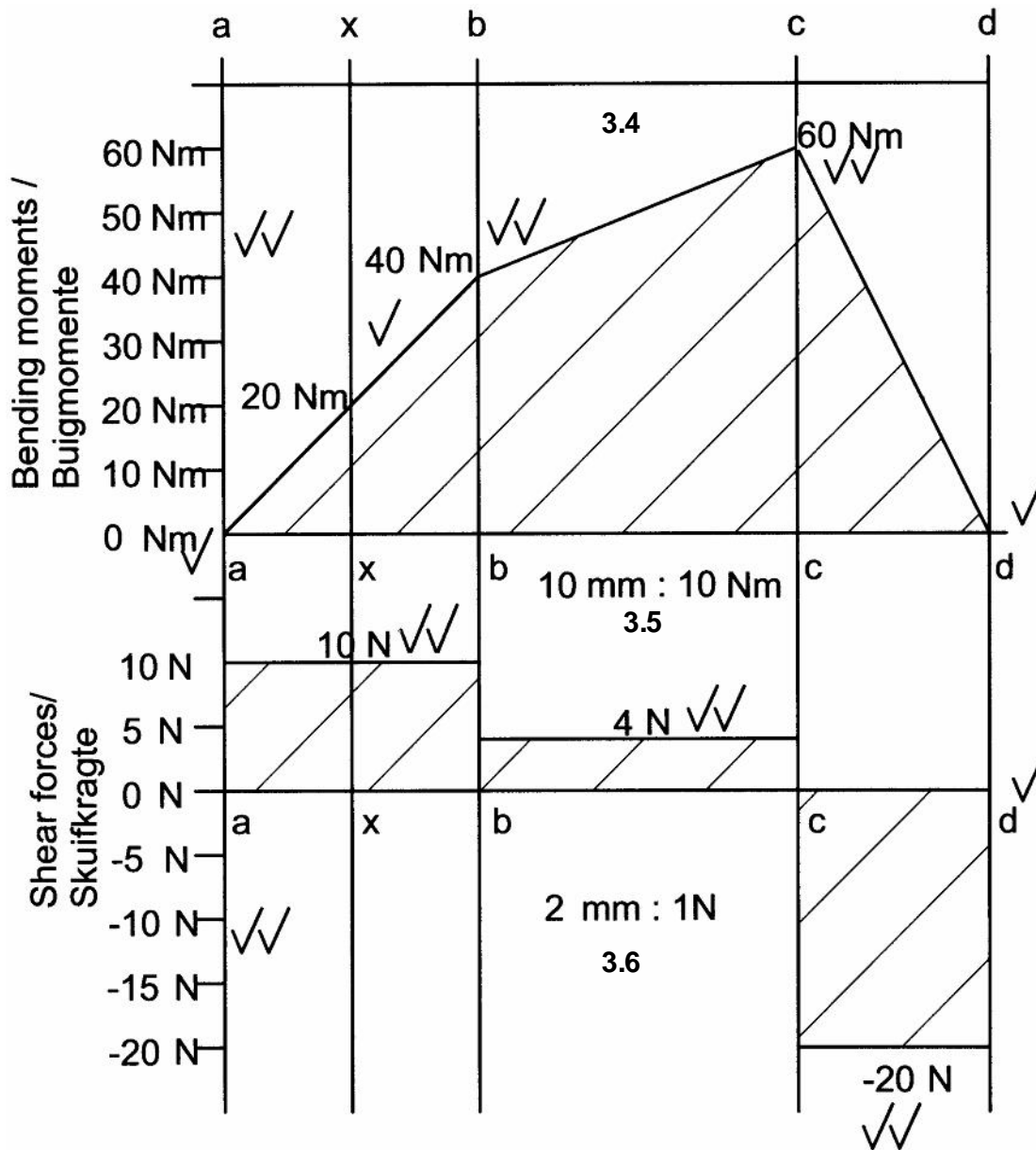
$$\text{BM (X)} = (+20 \text{ Nm} \times 10 \text{ m}) + (-24 \text{ Nm} \times 7 \text{ m}) + (-6 \text{ Nm} \times 2 \text{ m}) = 20 \text{ Nm}$$

$$\text{BM (A)} = (+20 \text{ Nm} \times 12 \text{ m}) + (-24 \text{ Nm} \times 9 \text{ m}) + (-6 \text{ Nm} \times 4 \text{ m}) = 0 \text{ Nm} \quad (8)$$

- 3.3 SF / SK (A) = 10 N  
 SF / SK (B) = 10 N - 6 N = + 4 N  
 SF / SK (C) = 10 N - 6 N - 24 N = - 20 N  
 SF / SK (D) = 10 N - 6 N - 24 N + 20 N = 0 N  
 SF / SK (X) = 10 N - 0 N = 10 N

(8)

3.5 & 3.6



**QUESTION / VRAAG 4**SYMBOLS USED / *GEBRUIKTE SIMBOLE* $\delta$  - Stress / *Spanning*a = Area / *Deursnee-oppervlakte*F = Force / *Belasting of krag*E = Young's Modulus / *Young se Modulus* $\Delta L$  = Change in length / *Verandering in lengte*S = Strain / *Vormverandering*OL = Original length / *Oorspronklike lengte*

4.1.1

$$S = \frac{\Delta L}{OL}$$

$$S = \frac{15 \text{ mm}}{300 \text{ mm}}$$

$$S = 50 \times 10^{-3} \text{ (0,05)}$$

(3)

4.1.2

$$E = \frac{d}{S}$$

$$d = 40 \times 10^9 \text{ Pa} \times 50 \times 10^{-3}$$

$$d = 2 \times 10^9 \text{ Pa}$$

$$d = 2 \text{ GPa}$$

(5)

4.1.3

$$d = \frac{F}{a}$$

$$a = \frac{120 \times 10^3 \text{ Nm}^2}{2 \times 10^9 \text{ N}}$$

$$a = 60 \times 10^{-6} \text{ m}^2$$

$$= 60 \text{ mm}^2$$

(6)

4.1.4

$$a = L \times B$$

$$B = \frac{a}{L}$$

$$B = \frac{60 \times 10^{-6} \text{ m}^2}{0,012 \text{ m}}$$

$$B = 5 \times 10^{-3} \text{ m (x 1 000 for mm)}$$

$$B = 5 \text{ mm}$$

(3)

4.2

Convert  $\text{mm}^2$  to  $\text{m}^2$  / Skakel  $\text{mm}^2$  om na  $\text{m}^2$

$$\frac{1\,800\text{ mm}^2}{1\,000 \times 1\,000} = 1\,800 \times 10^{-6} \text{ m}^2$$

$$d = \frac{F}{a}$$

$$d = \frac{144 \times 10^6 \text{ N}}{1\,800 \times 10^{-6} \text{ m}^2}$$

$$d = 80 \times 10^9 \text{ Pa}$$

$$d = 80 \text{ GPa} \quad (6)$$

4.3

$$\Delta L = FL - OL$$

$$\Delta L = 164 \text{ mm} - 150 \text{ mm}$$

$$\Delta L = 14 \text{ mm}$$

$$S = \frac{\Delta L}{OL}$$

$$S = \frac{14 \text{ mm}}{150 \text{ mm}}$$

$$S = 93,33 \times 10^{-3} \quad (5)$$

4.4 Elasticity is the ability of steel to return to its original shape and size if the applied load is removed.

*Elastisiteit is die vermoë waaroor staal beskik om na sy oorspronklike vorm en grootte terug te keer as die toegepaste krag verwyder word.* (3)

4.5 Nick break test  
Bend test  
Tensile test

*Keepptoets*

*Buigtoets*

*Trektoets*

(3)

4.6 X-Ray test  
Dye penetrant  
Ultrasonic  
Magnetic

*X-Straal*

*Kleurstof-indringing*

*Ultrasonies*

*Magneties*

Any / Enige 3 (3)

4.7 Penetration  
Porosity  
Slag inclusion

*Deurdringing*  
*Brosheid*  
*Slakinsluiting*

(3)

**QUESTION / VRAAG 5**

5.1.1

Mark <i>Merk</i>	Quantity <i>Aantal</i>	Material <i>Materiaal</i>	Tot mass per kg <i>Totale massa per kg</i>	Total mass <i>Totale massa</i>	Cost /kg <i>Koste /kg</i>	Amount <i>Bedrag</i>
A	1	10 m	8,8 kg/m	88 kg	R5,70 /kg	R501,60
B	2	11,6 m	8,8 kg/m	102,08 kg	R5,70 /kg	R582,15
C	2	6,8 m	6,49 kg/m	44,132 kg	R4,35 /kg	R191,97
D	2	3,4 m	6,49 kg/m	22,066 kg	R4,35 /kg	R95,99
Welding material / <i>Sweismateriaal</i>						R250,00
Total material cost / <i>Totale materiaalkoste</i>						R1 621,71
						(18)

5.1.2 Labour cost / *Arbeidskoste* = Tariff per hour / *Tarief per uur* X Hours worked /  
*Ure gewerk*

$$\begin{aligned}
 &= \frac{\text{R280}}{\text{per hour / per uur}} \times \frac{9 \text{ hours / ure}}{1} \\
 &= \text{R2 520,00}
 \end{aligned}
 \tag{3}$$

5.1.3 Overhead cost / *Drakoste* = % allowed / *toegelaat* X Labour cost /  
*Arbeidskoste*

$$\begin{aligned}
 &= \frac{95}{100} \times \frac{\text{R1 621,71}}{1} \\
 &= \text{R1 540,62}
 \end{aligned}$$

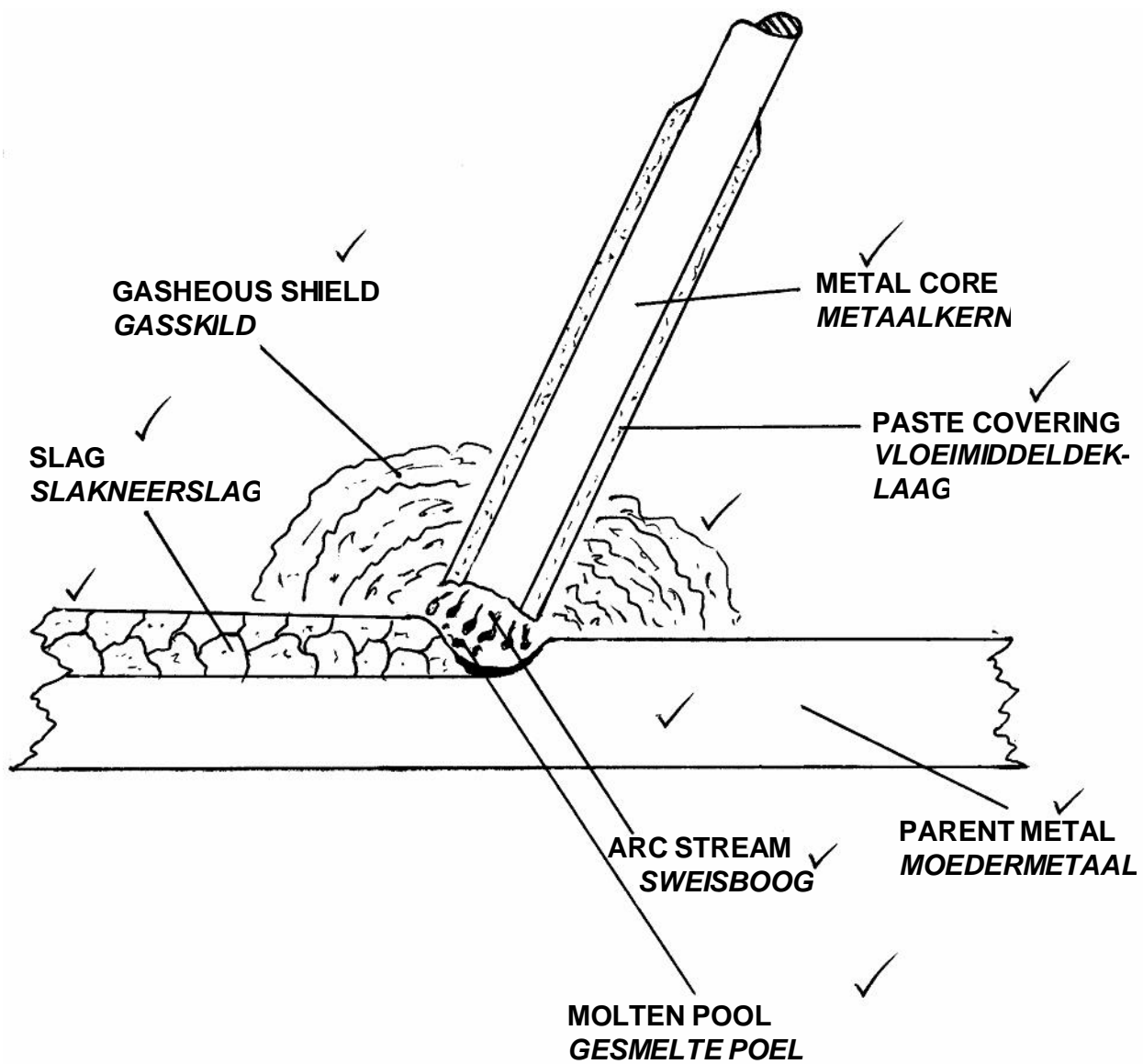
5.1.4 Total Cost = Material cost + Labour cost + Overhead cost  
*Totale koste* = *Materiaalkoste* + *Arbeidskoste* + *Drakoste*

$$= \text{R 1 621,71} + \text{R2 520,00} + \text{R1 540,62}$$

$$= \text{R5 682,33}$$

(4)

5.2

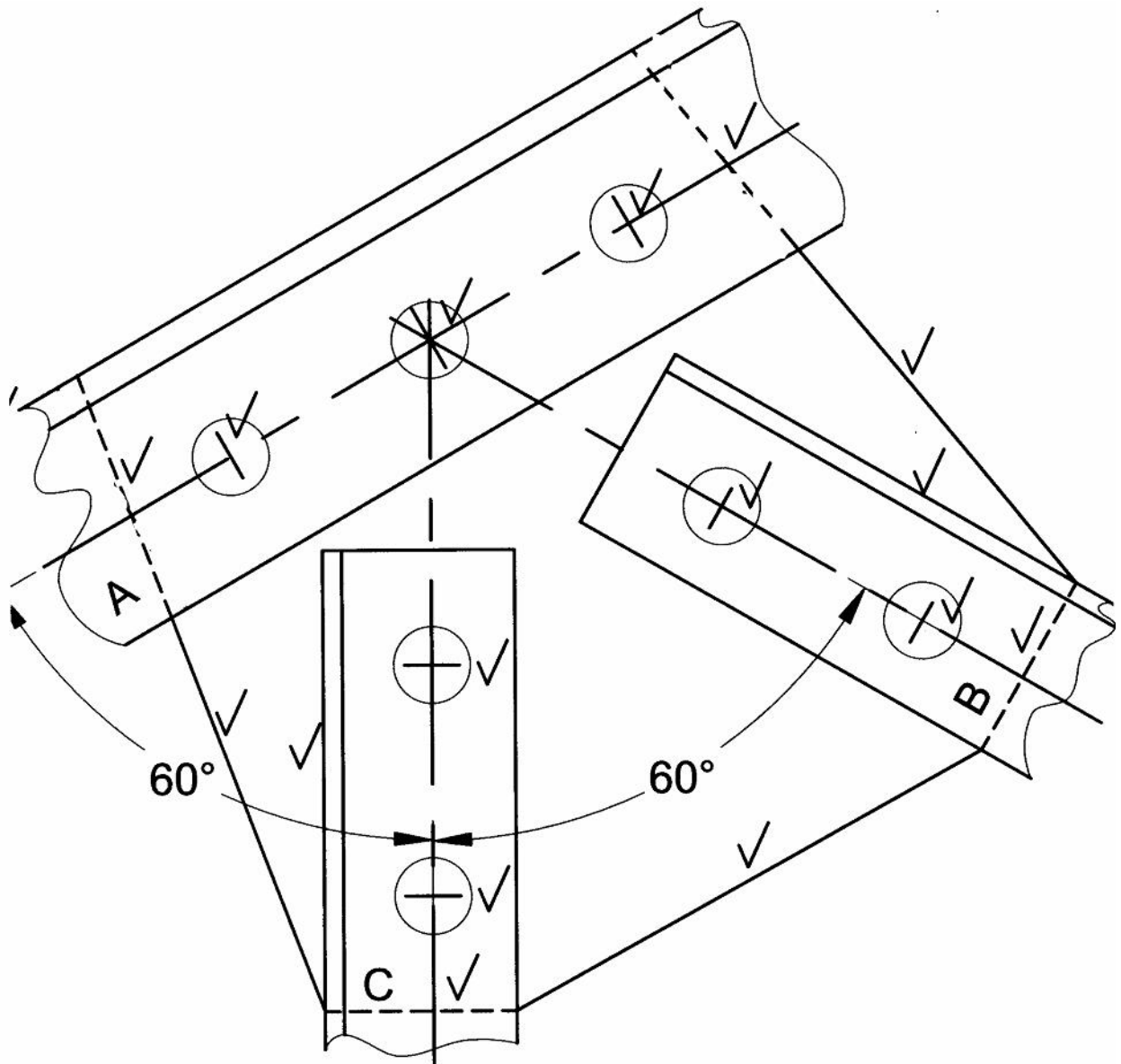


(12)



## QUESTION / VRAAG 6

6.1



(17)

6.2.1

$$EC = \frac{900 - 400}{2}$$

$$EC = 250 \text{ mm} \quad (3)$$

6.2.2

$$BC^2 = BE^2 + EC^2$$

$$BC^2 = \sqrt{(250^2 + 600^2)}$$

$$BC = 650 \text{ mm} \quad (5)$$

6.2.3

$$GC = \frac{BC \times FC}{EC}$$

$$GC = \frac{650 \times 450}{250}$$

$$GC = 1\,170 \text{ mm} \quad (7)$$

6.2.4

$$GC = GB + BC$$

$$GB = GC - BC$$

$$EC = 1\,170 \text{ mm} - 650 \text{ mm}$$

$$EC = 520 \text{ mm} \quad (5)$$

6.2.5

$$p \times D$$

$$\frac{12}{1\,170 \text{ mm}}$$

$$= \frac{12}{306,3 \text{ mm}} \quad (3)$$

**[40]****TOTAL / TOTAAL: 200**