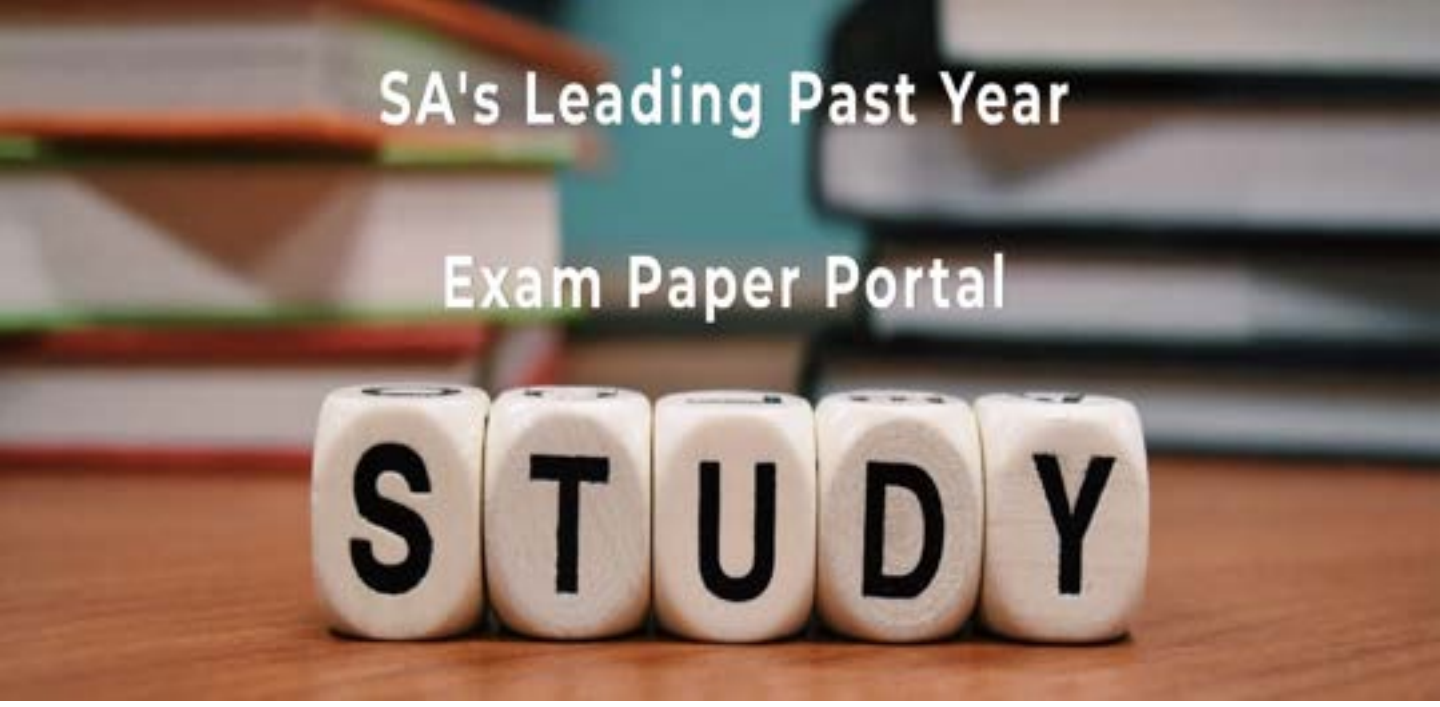

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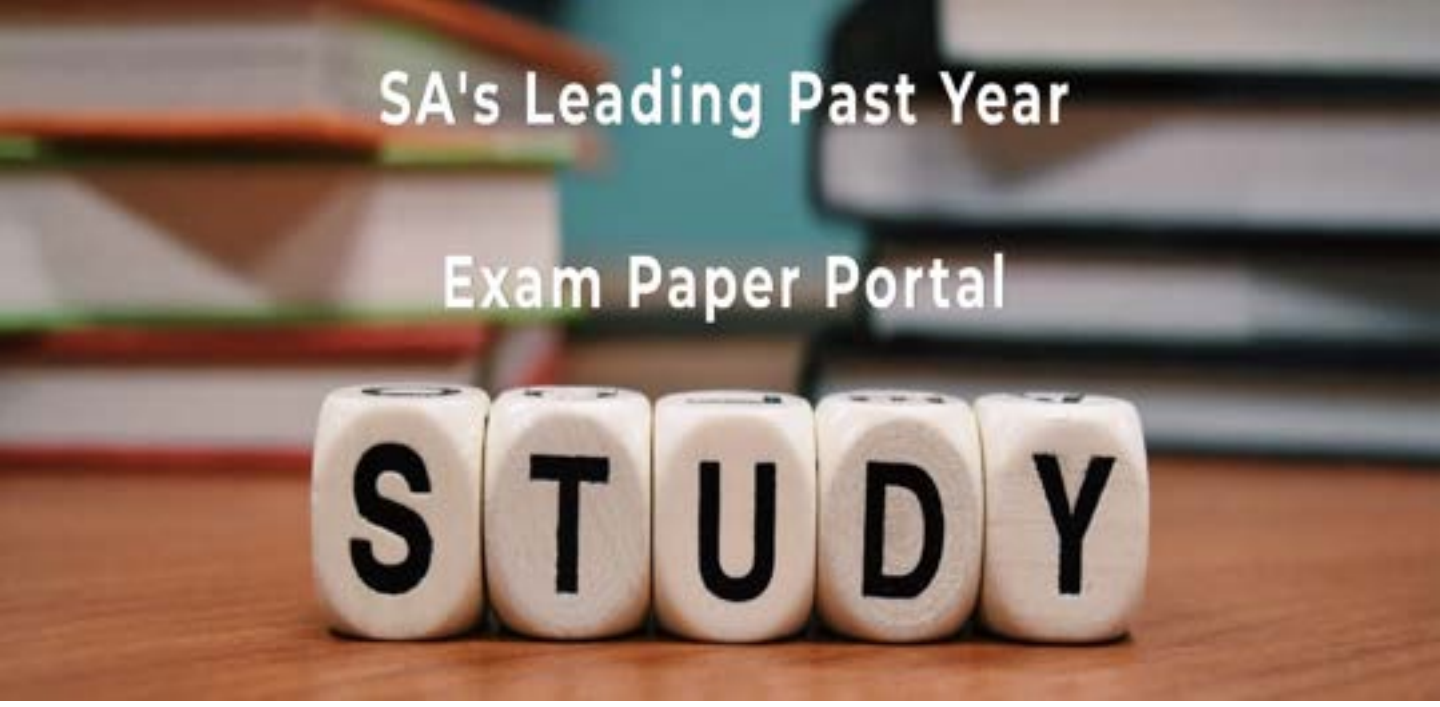

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NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE 12/*GRAAD* 12

TECHNICAL MATHEMATICS P2/*TEGNIESE WISKUNDE V2*

NOVEMBER 2022

FINAL MARKING GUIDELINES/*FINALE NASIENRIGLYNE*

MARKS/PUNTE: 150

CODE/*KODE*	EXPLANATION/*VERDUIDELIKING*
A	Accuracy/*Akkuraatheid*
AO	Answer only/*Slegs antwoord*
CA	Consistent accuracy/*Volgehoue akkuraatheid*
I	Identity/*Identiteit*
M	Method/*Metode*
NPR	No penalty for rounding/*Geen penalisering vir afronding nie*
NPU	No penalty for omitting units/*Geen penalisering vir eenhede weggelaat nie*
R	Rounding/*Afronding*
RE	Reason/*Rede*
S	Simplification/*Vereenvoudiging*
F	Formula/*Formule*
SF	Substitution in correct formula/*Vervanging in korrekte formule*
ST/RE	Statement with reason/*Bewering met rede*

These marking guidelines consist of 26 pages.*Hierdie nasienriglyne bestaan uit 26 bladsye.*

EXTERNAL/*EKSTERNE* MODERATORS	INTERNAL /*INTERNE* MODERATORS
M.A. HENDRICKS	N. TOM
MA HENDRICKS External Moderator UMALUSI	
B.J SHABANGU	N.S MUTHIGE
DATE APPROVED/DATUM GOEDGEKEUR	20 NOVEMBER 2022

Please turn over/*Blaai om asseblief*

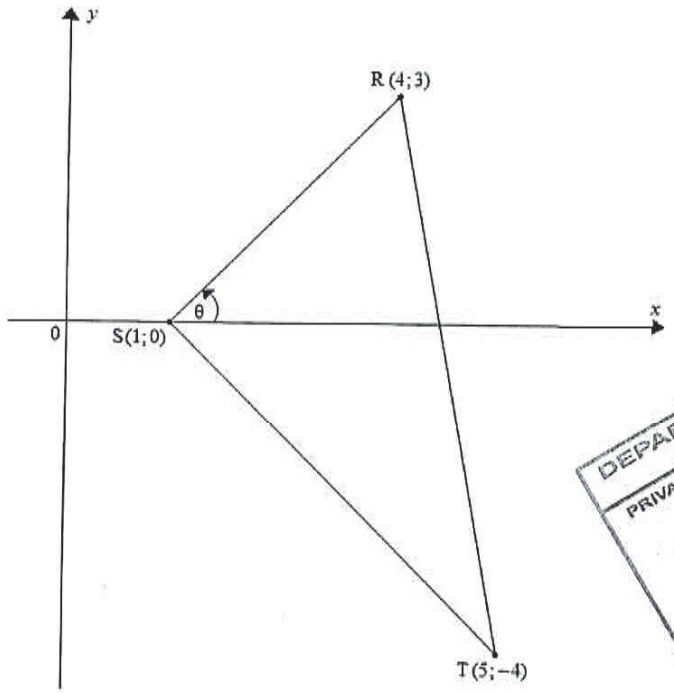
NOTE:

- If a candidate answers a question **TWICE**, only mark the **FIRST** attempt.
- Consistent Accuracy marking to be applied where indicated.
- Penalty for incorrect rounding only in QUESTION 10.2.3
- # Shows questions where Tolerance Range will be applied:. **Q 3.3; Q 4.1.3; Q 10.1.2; Q10.2.3**

LET WEL:

- *Indien 'n kandidaat 'n vraag **TWEE** keer beantwoord, sien slegs die **EERSTE** poging na.*
- *Volgehoue akkuraatheid-nasien moet toegepas word soos aangedui.*
- *Penalisering vir foutiewe afronding slegs in VRAAG 10.2.3*
- *# Toon vrae waar Toleransie wydte toegepas word:. **V 3.3; V 4.1.3; V10.1.2; V 10.2.3***

QUESTION/*VRAAG* 1

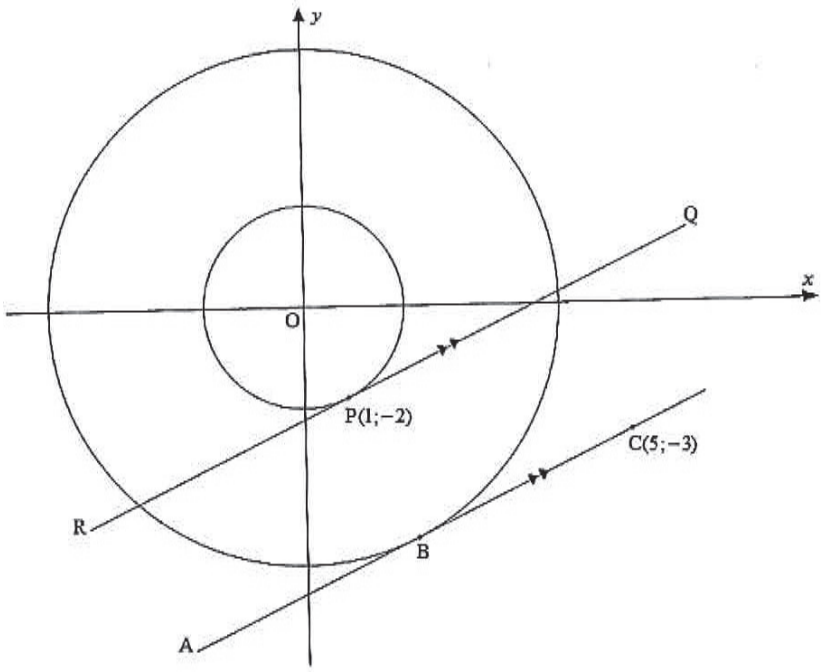


1.1	$m_{RS} = \frac{y_R - y_S}{x_R - x_S} = \frac{3-0}{4-1}$ $= 1$	✓ **SF** **A** ✓gradient **CA** **AO Full marks/ *Volpunte*** (2)
1.2.1	$m = \tan\theta$ **OR/*OF*** $\theta = \tan^{-1}(m)$	✓ **F** **A** (1)

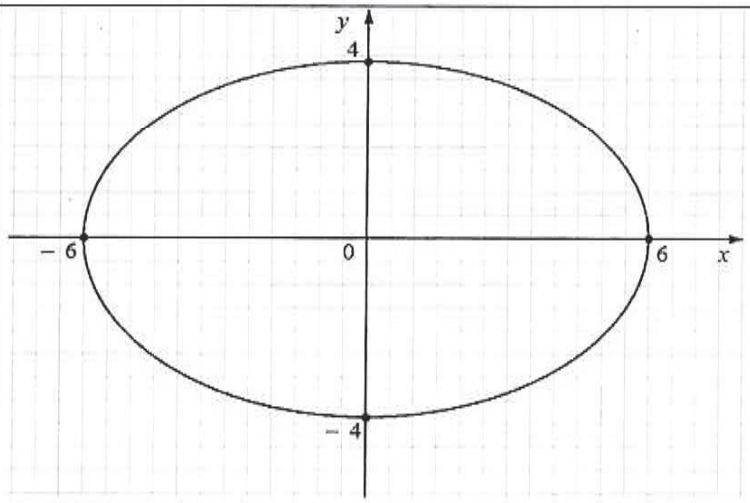
1.2.2	$\tan\theta = 1$ $\theta = 45°$	✓ **SF** ✓ value of / *waarde van* θ **AO Full marks/ *Volpunte***	**CA** **CA** (2)

1.3	$RT = \sqrt{(x_T - x_R)^2 + (y_T - y_R)^2}$ $= \sqrt{(5-4)^2 + (-4-3)^2}$ $= \sqrt{50}$ *or / of* $5\sqrt{2}$	✓ **SF** ✓ **S** **AO Full marks/ *Volpunte***	**A** **CA** (2)
1.4	$M_{ST}\left(\frac{x_S + x_T}{2}; \frac{y_S + y_T}{2}\right)$ $= \left(\frac{5+1}{2}; \frac{-4+0}{2}\right)$ $= (3; -2)$	✓ *x*-value/ *waarde* ✓ *y*-value/ *waarde* **AO Full marks/ *Volpunte***	**A** **A** (2)
1.5.1	Equal/ the same / *gelyk / dieselfde*	✓ answer / *antwoord*	**A** (1)
1.5.2	$m_{\parallel line\ /\ lyn} = 1$ $y = 1x + c$ **OR/*OF*** $y + 2 = 1(x - 3)$ $-2 = 1\times 3 + c$ $y + 2 = x - 3$ $c = -5$ $y = x - 3 - 2$ $\therefore\ y = x - 5$	✓ gradient value/ *waarde* **CA From/*vanaf* Q1.1** ✓**SF** **CA From/*vanaf* Q1.4** ✓equation /*vergelyking*	**CA** **CA** **CA** (3)
			[13]

QUESTION/*VRAAG* 2



2.1.1	$x^2 + y^2 = r^2$ $(1)^2 + (-2)^2 = r^2$ $r^2 = 5$ $\therefore x^2 + y^2 = 5$ **OR/*OF*** $x^2 + y^2 = (1)^2 + (-2)^2$ $= 5$ **OR/*OF*** $x^2 + y^2 = (1)^2 + (-2)^2$ $= 5$ $y = \pm\sqrt{5 - x^2}$ **OR/*OF*** $x = \pm\sqrt{5 - y^2}$	✓ **SF** **A** ✓ equation/*vergelyking* **CA** **OR/*OF*** ✓ **SF** **A** ✓ equation/*vergelyking* **CA** **OR/*OF*** ✓ **SF** **A** ✓ equation/*vergelyking* **CA** **AO Full marks/ *Volpunte*** **(2)**

2.1.2	$m_{OP} = -2$	✓ gradient of/*van* OP	**A** (1)
2.1.3	Radius/Diameter is perpendicular to tangent *Radius/middellyn is loodreg aan die raaklyn*	✓ **RE**	**A** (1)
2.1.4	$m_{RQ} = \frac{1}{2}$ $\therefore m_{AC} = \frac{1}{2}$ **OR/ *OF*** $m_{AC} \times m_{OP} = -1$ $m_{AC} \times (-2) = -1$ $m_{AC} = \frac{1}{2}$	✓ gradient of/*van* RQ ✓gradient of /*van* AC **AO Full marks/ *Volpunte***	**CA** **CA** (2)
2.1.5	$y - (-3) = \frac{1}{2}(x - 5)$ $y = \frac{1}{2}x - \frac{5}{2} - 3$ $y = \frac{1}{2}x - \frac{11}{2}$ **OR**/*OF* $-3 = \frac{1}{2}(5) + c$ $c = -3 - \frac{5}{2}$	✓ substitution/ *vervanging* ✓ **S** ✓equation/ *vergelyking*	**CA** **CA** **CA** (3)
2.2.1	$\frac{x^2}{6^2} + \frac{y^2}{4^2} = 1$	✓ standard form/*standaard vorm*	**A** (1)
2.2.2		✓x and y –intercepts/ *afsnitte* ✓elliptical shape/ *eliptiese vorm*	**CA** **CA** (2)
			[12]

Please turn over/*Blaai om asseblief*

QUESTION/*VRAAG* 3

3.1.1	$\frac{2}{7}\pi \text{ rad} = \frac{2}{7}\pi \times \frac{180°}{\pi} = \frac{360°}{7}$ **OR/*OF*** $\approx 51,43°$	✓ angle in degrees/*hoek in grade* **A** **NPR** (1)
3.1.2	$\text{cosec P} - \cos \text{Q}$ $= \text{cosec}\,(51,43°) - \cos(37°)$ $\approx 0,48$ **OR/*OF*** $\text{cosec P} - \cos \text{Q}$ $= \text{cosec}\left(\frac{2}{7}\pi\right) - \cos\left(37° \times \frac{\pi}{180°}\right)$ $\approx 0,48$	✓ substitution/*vervanging* **CA** ✓ **S** **CA** **OR/*OF*** ✓ substitution/*vervanging* **CA** ✓ **S** **CA** **NPR** **AO Full marks/ *Volpunte*** (2)
3.2.1	$\left(-\sqrt{5}\right)^2 + k^2 = 3^2$ $\therefore k^2 - 4 = 0$ **OR/*OF*** $k^2 = 4$ $(k-2)(k+2) = 0$ $k = \pm 2$ $k = 2$ or / *of* $k = -2$ $\therefore k = 2$	✓ substitution/*vervanging* **A** ✓ factors or square root /*faktore of vierkantswortel* **CA** ✓ correct value of/ *korrekte waarde van k* **CA** **AO Full marks/ *Volpunte*** (3)
3.2.2	$\sqrt{5}\cot\theta + 1$ *OR / OF* $\sqrt{5}\left(\frac{1}{\tan\theta}\right) + 1$ $= \sqrt{5}\left(-\frac{\sqrt{5}}{2}\right) + 1$ $\sqrt{5}\left(\frac{1}{-\frac{\sqrt{5}}{2}}\right) + 1$ $= -\frac{5}{2} + 1$ $= -\frac{3}{2}$	✓ substitution/*vervanging* **CA** ✓ **S** **CA** ✓ **S** **CA** (3)

3.3	$3\tan x = -0,531$ $\tan x = -0,177$ Ref/ *verw.*$\angle \approx 10,04°$ $x \approx 180° - 10,04°$ or/*of* $x \approx 360° - 10,04°$ $\therefore x \approx 169,96°$ $\therefore x \approx 349,96°$ **OR / *OF*** $3\tan x = -0,531$ $\tan x = -0,177$ $x = 180° - \tan^{-1} 0,177$ **OR/*OF*** $x = 360° - \tan^{-1} 0,177$ $\therefore x \approx 169,96°$ $x \approx 349,96°$	✓ **S** **A** ✓ ref. Angle/*verw. hoek* **CA** ✓ both quadrants/beide kwadrante **A** ✓ both values of/*beide wrde van x* **CA** **OR / *OF*** ✓ **S** **A** ✓ S **CA** ✓ both quadrants/beide kwadrante **A** ✓ both values of/*beide wrde van x* **CA** (4)
		[13]

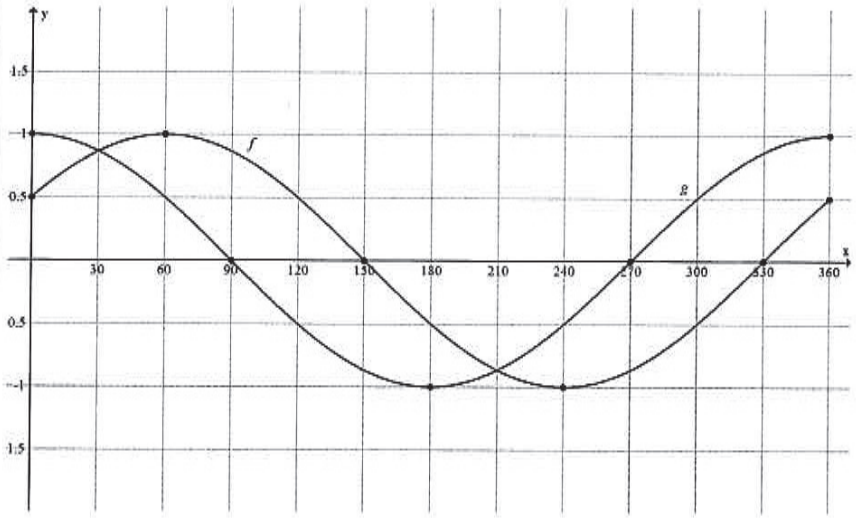
QUESTION/*VRAAG* 4

4.1.1	$-\sin\alpha$	✓ reduction/ *reduksie* **A** (1)
4.1.2	$(-\tan\alpha)^2 = \tan^2\alpha$ **OR/*OF*** $\frac{\sin^2\alpha}{\cos^2\alpha}$	✓ $-\tan\alpha$ **A** ✓ $\tan^2\alpha = \frac{\sin^2\alpha}{\cos^2\alpha}$ **A** **AO Full marks/ *Volpunte*** (2)
4.1.3	$\frac{\sin(360°-\alpha)\cdot\tan(180°-\alpha)\cdot\text{cosec}(2\pi-\alpha)}{\cos(360°+\alpha)\cdot\text{cosec}(180°-\alpha)\cdot\tan^2(\pi-\alpha)}$	**CA *From* Q4.1.1 *and* Q4.1.2** **CA *Vanuit* V4.1.1 *en* V4.1.2**
	$= \frac{(-\sin\alpha)\cdot(-\tan\alpha)\cdot(-\text{cosec}\alpha)}{(\cos\alpha)\cdot(\text{cosec}\alpha)\cdot(\tan^2\alpha)}$	✓ $-\tan\alpha$ **A** ✓ $-\text{cosec}\alpha$ **A** ✓ $\cos\alpha$ **A** ✓ $\text{cosec}\alpha$ **A**
	$= \frac{-\sin\alpha}{(\cos\alpha)\cdot\left(\frac{\sin\alpha}{\cos\alpha}\right)}$	✓ **I** $\frac{\sin\alpha}{\cos\alpha}$ **A**
	$= \frac{-\sin\alpha}{\sin\alpha}$	
	$= -1$	✓ -1 **CA**
	OR/*OF*	**OR/*OF***
	$\frac{\sin(360°-\alpha)\cdot\tan(180°-\alpha)\cdot\text{cosec}(2\pi-\alpha)}{\cos(360°+\alpha)\cdot\text{cosec}(180°-\alpha)\cdot\tan^2(\pi-\alpha)}$	
	$= \frac{(-\sin\alpha)\cdot(-\tan\alpha)\cdot(-\text{cosec}\alpha)}{(\cos\alpha)\cdot(\text{cosec}\alpha)\cdot(\tan^2\alpha)}$	✓ $-\tan\alpha$ **A** ✓ $-\text{cosec}\alpha$ **A** ✓ $\cos\alpha$ **A** ✓ $\text{cosec}\alpha$ **A**
	$= \frac{(-\tan\alpha)(-\tan\alpha)(-1)}{(\tan^2\alpha)}$	✓ **I** $\tan\alpha$ **A**
	$= -1$	✓ -1 **CA** (6)

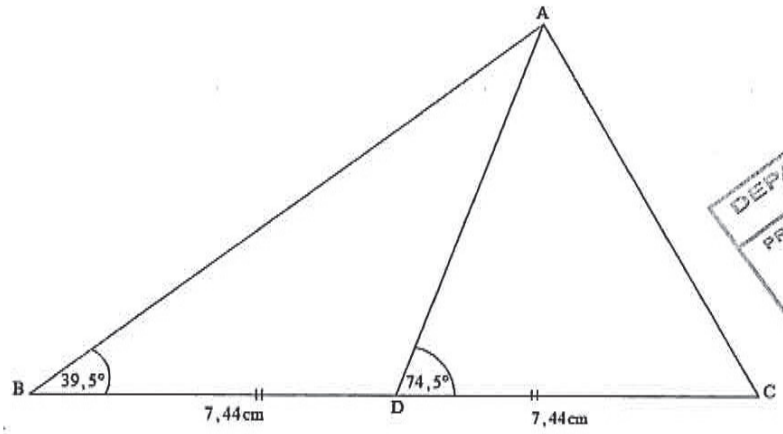
Please turn over/*Blaai om asseblief*

4.2	$\cos^2 x$	✓ **I**	**A** (1)
4.3	$\text{cosec}\, x - \sin x = \cot x \cdot \cos x$		
	LHS/*LK* $= \text{cosec}\, x - \sin x$		
	$= \frac{1}{\sin x} - \sin x$	✓ **I** $\frac{1}{\sin x}$	**A**
		✓ **S**	**CA**
	$= \frac{1-\sin^2 x}{\sin x}$		
	$= \frac{\cos^2 x}{\sin x}$	✓ **I** $\cos^2 x$	**A**
	$= \frac{\cos x}{\sin x} \cdot \cos x$	✓ **I** $\frac{\cos x}{\sin x}$	**A**
	$= \cot x \cdot \cos x = RHS\ /\ RK$		
	OR/ *OF*	**OR / *OF***	
	RHS/R*K* $= \cot x \cdot \cos x$		
	$= \frac{\cos x}{\sin x} \cdot \cos x$	✓ **I** $\frac{\cos x}{\sin x}$	**A**
	$= \frac{\cos^2 x}{\sin x}$		
	$= \frac{1-\sin^2 x}{\sin x}$	✓ **S**	**CA**
	$= \frac{1}{\sin x} - \frac{\sin^2 x}{\sin x}$	✓ **I** $1-\sin^2 x$	**A**
	$= \text{cos ec}\, x - \sin x$	✓ **I** $\frac{1}{\sin x}$	**A**
	$= \text{LHS}\ /\ LK$		
	OR/ *OF*	**OR / *OF***	
	LHS/*LK* $= \text{cosec}\, x - \sin x$		
	$= \frac{1}{\sin x} - \sin x$	✓ **I** $\frac{1}{\sin x}$	**A**
	$= \frac{1-\sin^2 x}{\sin x}$	✓ **S**	**CA**
	$= \frac{\cos^2 x}{\sin x}$	✓ **I** $\cos^2 x$	**A**
	RHS/ *RK* $= \cot x \cdot \cos x = \frac{\cos x}{\sin x} \cdot \cos x$	✓ **I** $\frac{\cos x}{\sin x}$	**A**
	$= \frac{\cos^2 x}{\sin x} = \text{LHS/ } LK$		(4)
			[14]

QUESTION/*VRAAG* 5

5.1.1	360°	✓ period/ *periode* **A** (1)
5.1.2	1	✓ amplitude **A** (1)
5.2		*f*: ✓ shape/*vorm* **A** ✓ *y*-intercept/ *afsnt* **A** ✓ *x*-intercepts/ *afsnt* **A** ✓ end point/ *eindpunt* $(360°;0,5)$ **A** *g*: ✓ shape/*vorm* **A** ✓ *y*-intercept/ *afsnt* **A** ✓ *x*-intercepts/ *afsnt* **A** (7)
5.3	$x \in (180° ; 360°)$ **OR/*OF*** $180° < x < 360°$	✓ Critical values/*kritiese waardes* **CA** ✓ correct notation/*korrekte notasie* **CA** (2)
		[11]

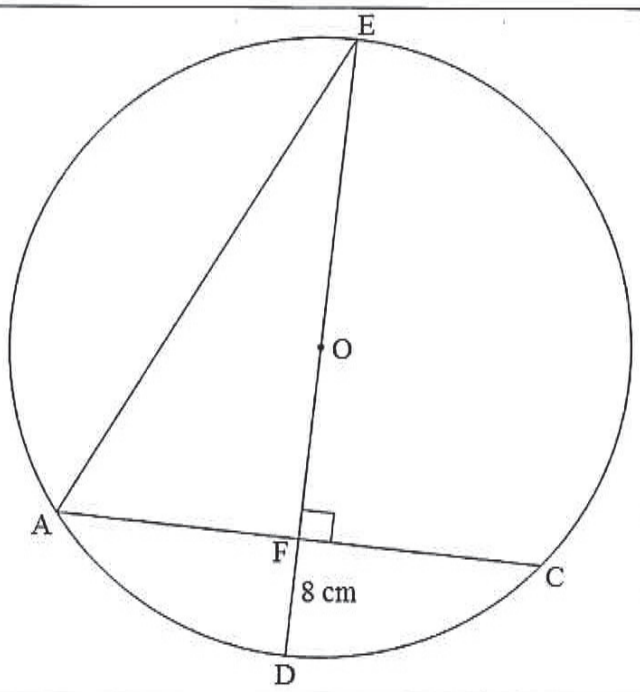
QUESTION/*VRAAG* 6



6.1.1	$B\hat{A}D = 74,5° - 39,5° = 35°$	✓ size/ *grootte* **A** (1)
6.1.2	$A\hat{D}B = 180° - 74,5° = 105,5°$ **OR/*OF*** $A\hat{D}B = 180° - 39,5° - 35° = 105,5°$	✓ size/ *grootte* **A** **OR/*OF*** ✓ size/ *grootte* **A** (1)
6.2.1	$\frac{AB}{\sin B\hat{D}A} = \frac{BD}{\sin B\hat{A}D}$ **OR/*OF*** $\frac{d}{\sin B\hat{D}A} = \frac{BD}{\sin A}$ **OR/*OF*** $\frac{d}{\sin B\hat{D}A} = \frac{BD}{\sin 35°}$	✓ Complete sine rule/*voltooi sinus- reël* **A** (1)
6.2.2	In ΔABD: $\frac{AB}{\sin 105,5°} = \frac{7,44}{\sin 35°}$ $AB = \frac{7,44\sin 105,5°}{\sin 35°}$ $\approx 12,5\,cm$ **OR/ *OF*** In ΔADB: $\frac{AD}{\sin 39,5°} = \frac{7,44}{\sin 35°}$ $AD = \frac{7,44\sin 39,5°}{\sin 35°} \approx 8,25\,cm$ $AB^2 = AD^2 + BD^2 - 2\times AD\times BD\times \cos D$ $AB^2 = 8,25^2 + 7,44^2 - 2\times 8,25\times 7,44\times \cos 105,5°$ $AB \approx 12,5$ cm	✓ **SF** **CA** ✓ length of/ *lengte van* AB **CA** **OR/*OF*** ✓ length of/ *lengte van* AD **CA** ✓ length of/ *lengte van* AB **CA**

		(2)
6.3	In ΔABC: $AC^2 = BC^2 + AB^2 - 2BC \times AB\cos B$ $= 14,88^2 + 12,5^2 - 2(14,88)(12,5)\cos 39,5°$ $= 90,62005498$ $\therefore AC \approx 9,52$ cm **OR / *OF*** In ΔABD: $\frac{AD}{\sin 39,5°} = \frac{7,44}{\sin 35°}$ $AD = \frac{7,44\sin 39,5°}{\sin 35°} \approx 8,25$ cm $\therefore$ In ΔADC: $AC^2 = AD^2 + DC^2 - 2AD \times DC \times \cos D$ $AC^2 = 8,25^2 + 7,44^2 - 2 \times 8,25 \times 7,44 \times \cos 74,5°$ $AC^2 = 90,60991695$ $\therefore AC \approx 9,52$ cm	✓ **M** cosine rule/*reël* **A** ✓ **SF** **CA** ✓ length of/ *lengte van* AC **CA** **OR / *OF*** ✓ length of AD **A** ✓ **M** cosine rule/*reël* **A** ✓ length of/ *lengte van* AC **CA** (3)
6.4	Area of/*Oppervlakte van* $\Delta ABC = \frac{1}{2}AB \times BC\sin B$ $= \frac{1}{2}(12,5)(14,88)\sin 39,5°$ $\approx 59,16$ cm^2 **OR/OF** Height/*Hoogte* $= 12,5\sin 39,5° \approx 7,95$ $= \frac{1}{2}bh = \frac{1}{2}AC \times h$ $\approx \frac{1}{2}(14,88)(7,95)$ $\approx 59,16$ cm	✓ **M** area rule/ *oppervlakte reël* **A** ✓ **SF** **CA** ✓ Area / *oppervlakte* **CA** **OR/OF** ✓ **M** area rule/ *oppervlakte reël* **A** ✓ **SF** **CA** ✓ Area / *oppervlakte* **CA** (3)
		[11]

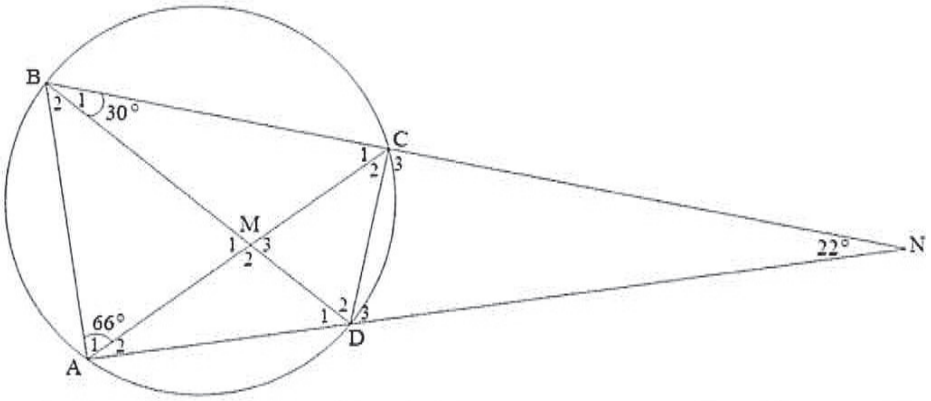
QUESTION/*VRAAG* 7

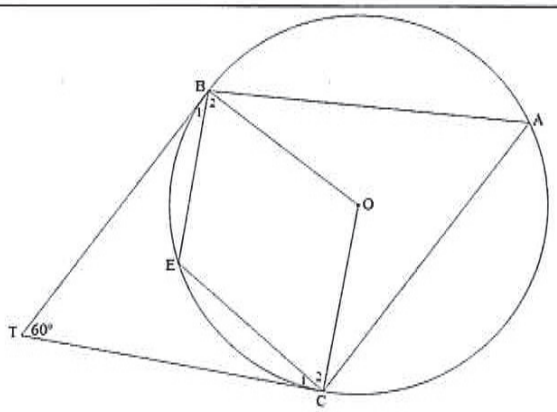
7.1	Perpendicular bisector / *middelloodlyn*...	✓	**A** (1)
7.2			
	$AF = 15$ cm (line from centre ⊥ chord / *lyn vanaf middelpt* ⊥ *koord*)	✓ **ST** ✓ **RE**	**A** **A**
	$EF = 34\text{ cm} - 8\text{ cm} = 26\text{ cm}$	✓ **ST** length of / *lengte van* EF	**A**
	$AE = \sqrt{AF^2 + EF^2} = \sqrt{26^2 + 15^2}$ (Pythagoras) $= \sqrt{901}$ or / *of* $\approx 30{,}02$ cm	✓ **ST** ✓ **ST**	**CA** **CA**
	OR / *OF*	**OR / *OF***	
	$AF = 15$ cm (line from centre ⊥ chord / *lyn vanaf middelpt* ⊥ *koord*)	✓ **ST** ✓ **RE**	**A** **A**
	$EF = 34\text{ cm} - 8\text{ cm} = 26\text{ cm}$	✓ **ST** length of / *lengte van* EF	**A**
	$AE^2 = AF^2 + EF^2 - 2(AE)(EF)\cos 90°$ $= (15)^2 + (26)^2 - 2(15)(26)\cos 90°$	✓ **ST**	**CA**
	$AE = \sqrt{901}$ or / *of* $\approx 30{,}02\,cm$	✓ **ST**	**CA**
	OR / *OF*	**OR / *OF***	

	$AF = 15$ cm ($\begin{pmatrix}\text{line from centre } \perp \text{ chord /}\\ \textit{lyn vanaf middelpt } \perp \textit{ koord}\end{pmatrix}$)	✓ **ST** ✓ **RE**	**A** **A**
	$EF = 34\text{ cm} - 8\text{ cm} = 26\text{ cm}$ $\tan E = \frac{AF}{FE} = \frac{15}{26}$	✓ **ST** length of / *lengte van* EF	**A**
	$\hat{E} \approx 29{,}98°$	✓ **ST**	**CA**
	$\sin E = \frac{AF}{AE}$ $AE \approx \frac{15}{\sin 29{,}98°}$ $\approx 30{,}02$ cm	✓ **ST**	**CA**
			(5)
			[6]

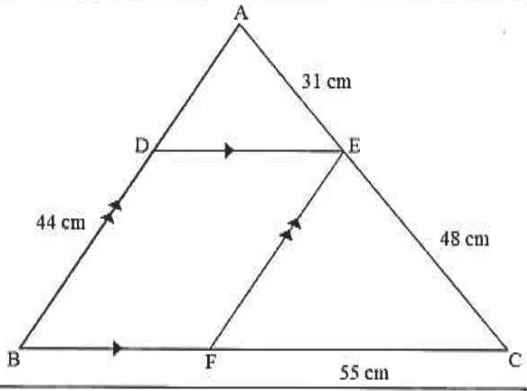
MA HENDRICKS
External Moderator
UMALUSI

QUESTION/*VRAAG* 8

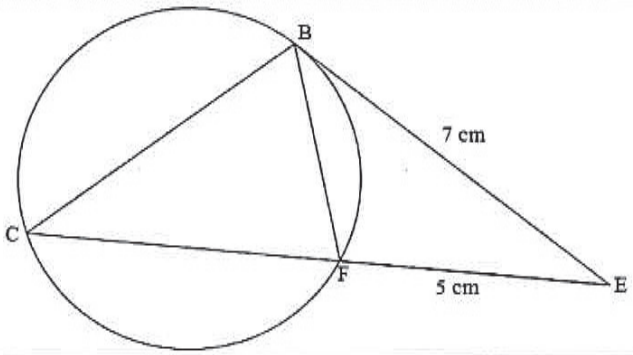
8.1	Interior opposite angle / *teenoorstaande binnehoek*	✓	**A** (1)
8.2			
8.2.1 a)	$\hat{A}_2 = 30°$ (∠s in the same segment / ∠e in dieselfde segment)	✓ **ST** **A** ✓ **RE** **A**	(2)
8.2.1 b)	$\hat{C}_1 = 52°$ (ext ∠ of Δ / *buite ∠ van Δ*)	✓ **ST** **CA** ✓ **RE** **A**	(2)
8.2.1 c)	$\hat{C}_3 = 96°$ (ext ∠ of cyclic quad / *buite ∠ van kdvh*)	✓ **ST** **CA** ✓ **RE** **A**	(2)
8.2.2	$\hat{M}_3 = 82°$ (ext ∠ of Δ / *buite ∠ van Δ*)	✓ **ST** **CA**	
	$\hat{M}_3 + \hat{N} = 82° + 22° = 104° \neq 180°$ ∴ MCND is NOT cyclic / *NIE siklies NIE* (opp∠s NOT suppl/ *teenoorst ∠e NIE suppl*)	✓ **RE** **A** **OR/*OF***	
	OR/*OF*	✓ **ST** **CA**	
	From/*vanaf* Q/V8.2.1 b) $\hat{C}_1 = 52° \neq M\hat{D}N = 128°$ ∴ MCND is NOT cyclic / *NIEsiklies NIE* (ext ∠≠ int opp ∠/ *buite ∠e ≠ teen.binne ∠*)	✓ **RE** **A** **OR/*OF***	
	OR/*OF*	✓ **ST** **CA** ✓ **RE** **A**	(2)
	$\hat{M}_2 = 98° \neq \hat{N} = 22°$ ∴ MCND is NIE cyclic / *NIE siklies NIE* (ext ∠≠ int opp ∠/ *buite ∠e ≠ teen.binne ∠*)		

8.3		
8.3.1	$O\hat{B}T = 90°$ $O\hat{C}T = 90°$ tan/*raaklyn* ⊥ rad	✓ $O\hat{B}T$ **A** ✓ $O\hat{C}T$ **A** ✓ **RE**..... ....**A** (3)
8.3.2 a)	$B\hat{O}C = 120°$ (sum of int ∠s of a quad / *som vd binne ∠e van 'n vhk*) $\hat{A} = 60°$ (∠at centre = 2 × ∠ at circum / *midpts ∠ = 2 × omtreks ∠*) **OR/ *OF*** TBOC is cyclic/*siklies* (CONVERSE opp ∠s of cyclic quad / *OMGEKEERDE teenoorst ∠e van kdvh*) $B\hat{O}C = 120°$ (opp ∠s of cyclic quad / *teenoorst ∠e van kdvh*) $\hat{A} = 60°$ (∠ at centre = 2 × ∠ at circum / *midpts ∠ = 2 × omtreks ∠*)	✓ **ST** **A** ✓ **RE** **A** ✓ **ST** **CA** ✓ **RE** **A** **OR/ *OF*** ✓ **RE** **A** ✓ **ST** **A** ✓ **ST** **CA** ✓ **RE** **A** (4)
8.3.2 b)	$\hat{E} = 120°$ (opp ∠s of cyclic quad / *teenoorst ∠e van kdvh*) **OR/ *OF*** reflex /*inspringend* $B\hat{O}C = 240°$ (Revolution /*omwenteling*) $\hat{E} = 120°$ (∠ at centre = 2 × ∠ at circm / *midpts∠ = 2 × omtreks∠*)	✓ **ST** **CA** ✓ **RE** **A** **OR/ *OF*** ✓ **RE** **A** ✓ **ST** **CA** (2)
		[18]

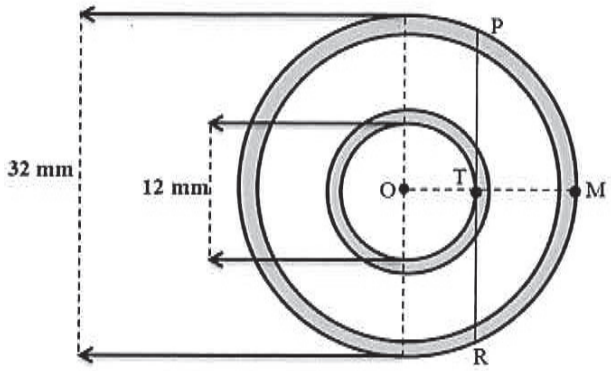
QUESTION/*VRAAG* 9

9.1	In proportion/ Proportionally / *In verhouding/ eweredig*	✓	**A** (1)
9.2			
9.2.1	• Both pairs of opposite sides are equal / *beide pare teenoorst sye is gelyk* • Both pairs of opposite angles are equal / *beide pare teenoorst hoeke is gelyk* • Diagonals bisect each other / *Hoeklyne halveer mekaar*	✓ **RE** ✓ **RE** Any two / *enige twee*	**A** **A** (2)
9.2.2	$\frac{AD}{DB}=\frac{AE}{EC}$ (prop th / *ewer st*; DE ‖ BC **OR** / *OF*; line ‖ one side of Δ / *lyn* ‖ *een sy van* Δ) $\therefore \frac{AD}{44}=\frac{31}{48}$ $\therefore AD=\frac{341}{12}$ or / *of* $\approx 28{,}42$ cm **OR/*OF*** $\frac{AD}{AB}=\frac{AE}{AC}$ (prop th /*ewer st*; DE ‖BC **OR/*OF***; line ‖ one side of Δ/ *lyn* ‖ *eensy van* Δ) $\frac{AD}{AD+44}=\frac{31}{79}$ $79\,AD = 31\,AD + 1364$ $48\,AD = 1364$ $AD=\frac{1364}{48}$ or / *of* $\approx 28{,}42$ cm	✓ **ST** ✓**RE** ✓ **ST** **OR/*OF*** ✓ **ST** ✓**RE** ✓ **ST**	**A** **A** **OR/*OF*** **A** **CA** (3)

9.2.3	$\frac{BF}{FC}=\frac{AE}{EC}$ (prop th / *ewer st*; FE ∥ AB **OR** / ***OF*** line ∥ one side of Δ / *lyn* ∥ *een sy van* Δ)	
	$\frac{BF}{55}=\frac{31}{48}$	✓ **ST** proportion/eweredig **A**
	$BF=\frac{31\times 55}{48}=\frac{1705}{48}$	✓ **ST** value of/ waarde van BF **CA**
	$DE=\frac{1705}{48}$ or / *of* $\approx 35{,}52\,\text{cm}$	✓ **ST** value of/ waarde van DE **CA**
	OR/*OF*	**OR/*OF***
	$\frac{BC}{FC}=\frac{AC}{EC}$ (prop th / *ewer st*; FE ∥ AB OR/OF line ∥ one side of Δ / *lyn* ∥ *een sy van* Δ)	✓ **ST** proportion/eweredig **A**
	$\frac{BC}{55}=\frac{79}{48}$	
	$\therefore BC=\frac{4345}{48}$	
	$\therefore BF=\frac{1705}{48}\,\text{cm}$	✓ **ST** value of/ waarde van BF **CA**
	$\therefore DE=\frac{1705}{48}$ or / *of* $\approx 35{,}52\,\text{cm}$	✓ **ST** value of/ waarde van DE **CA**
	OR / *OF*	**OR / *OF***
	$\frac{DE}{BC}=\frac{AE}{AC}$ (∥∥ Δ's/*e*)	✓ **ST** proportion/eweredig **A**
	$\frac{DE}{DE+55}=\frac{31}{79}$	✓ **SF** **CA**
	$79DE=31DE+1705$	
	$48DE=1705$	
	$DE=\frac{1705}{48}$ or / *of* $\approx 35{,}52\,\text{cm}$	✓ **ST** value of/ waarde van DE **CA** (3)

9.3			
9.3.1	In Δ EBF and/*en* Δ ECB : $\hat{E}$ is common / *gemeen* $E\hat{B}F = E\hat{C}B$ (tan - chord / *raaklyn - koord*) $\therefore B\hat{F}E = C\hat{B}E$ (int $\angle$s of Δ / *binne* $\angle$*e van* Δ) $\therefore \Delta EBF \;|||\; \Delta ECB$ ($\angle\angle\angle$) **OR / *OF*** In Δ EBF and/*en* Δ ECB : $\hat{E}$ is common / *gemeen* $E\hat{B}F = E\hat{C}B$ (tan - chord / *raaklyn - koord*) $\therefore \Delta EBF \;|||\; \Delta ECB$ ($\angle\angle\angle$)	✓ **ST** **A** ✓ **ST** **A** ✓**RE** **A** ✓ **ST / RE** **A** **OR / *OF*** ✓ **ST** **A** ✓ **ST** **A** ✓**RE** **A** ✓ **ST/RE** **A** (4)	
9.3.2	$\frac{EB}{EC} = \frac{EF}{EB}$ $\therefore EB^2 = EF \times EC$	✓ **ST** proportion/ *eweredigheid* **A** (1)	
9.3.3	from/*vanuit* 9.3.2 $\therefore 7^2 = (CF+5).5$ $\therefore CF + 5 = \frac{49}{5}$ $\therefore CF = 4,8$ cm **OR/*OF*** $\therefore 7^2 = EC \times 5$ $\therefore EC = 9,8$ $\therefore CF = EC - 5$ $= 9,8 - 5 = 4,8$ cm	$\therefore 7^2 = (CF+5).5$ $\therefore 49 = 5CF + 25$ $\therefore 5CF = 24$ $\therefore CF = \frac{24}{5}$ $\therefore CF = 4,8$ cm	✓ **ST** EC = CF + 5 **A** ✓ **ST** substitution/ *vervanging* **CA** ✓ **ST** length of CF/ *lengte van CF* **CA** **OR / *OF*** ✓ **ST** $7^2 = EC \times 5$ **A** ✓ **ST** length of EC/ *lengte van EC* **CA** ✓ **ST** length of CF/ *lengte van CF* **CA** (3)
			[17]

QUESTION/*VRAAG* 10

10.1		
10.1.1	$D = 32 \div 1000 = 0,032\,\text{m}$ $n = \frac{5000}{60} = \frac{250}{3}$ *or / of* 83,33 rev/s / *omw/s* $v = \pi D n$ $= \pi \times 0,032 \times \frac{250}{3}$ $= \frac{8}{3}\pi$ or / *of* $\approx 8,38$ m/s **OR/*OF*** $v = \pi D n$ $= \pi \times 32 \times 5000$ $= 160\,000\pi$ mm/ min $\approx \frac{160\,000}{60\,000}\pi = \frac{8}{3}\pi$ or / *of* $\approx 8,38$ m/s **OR/*OF*** $v = \omega r$ $= \frac{2\pi \times 5000 \times 0,016}{60}$ $= \frac{8}{3}\pi$ or / *of* $\approx 8,38$ m/s	✓**M** both Conversions/ *beide herleidings* **A** ✓**F** **A** ✓**SF** **CA** ✓circ.velocity/ *omtrksnelhd***CA** **OR/*OF*** ✓**F** **A** ✓**SF** **CA** ✓**M** both Conversion/ *beide herleidings* **A** ✓circ.velocity/ *omtrksnelhd***CA** **OR/*OF*** ✓**F** **A** ✓**SF** **CA** ✓**M** both Conversion/ *beide herleidings* **A** ✓circ.velocity/ *omtrksnelhd***CA** **NPU/NPR** (4)

10.1.2	Radius of the larger circle/ *Radius van die grootter sirkel* = 16mm Radius of the smaller circle/ *Radius van die kleiner sirkel* = 6 mm $TM = OM - OT$ $= 16 - 6$ **OR/*OF*** $TM = \frac{32-12}{2}$ $= 10\,mm$ $= 10\,mm$ $h = 10\,mm$ and/*en* $d = 32\,mm$ $4h^2 - 4dh + x^2 = 0$ $4(10)^2 - 4(32)(10) + x^2 = 0$ $400 - 1280 + x^2 = 0$ $x^2 = 880$ $x = 4\sqrt{55}$ or/*of* $\approx 29,66\,mm$ $PR = 4\sqrt{55}$ or/*of* $\approx 29,66\,mm$ **OR/*OF*** **Using the half chord of /** ***Gebruik halfkoord van*** **RQ** $OP^2 = OT^2 + PT^2$ $16^2 = (6)^2 + PT^2$ $PT^2 = 220$ $PT = \sqrt{220}$ $PR = 2 \times \sqrt{220}$ $PR \approx 29,66$ mm **OR/*OF*** Height of major segment = 22 mm $4h^2 - 4dh + x^2 = 0$ $4(22)^2 - 4(32)(22) + x^2 = 0$ $x^2 = 880$ $x = 4\sqrt{55}$ or/*of* $\approx 29,66\,mm$ $PR = 4\sqrt{55}$ or/*of* $\approx 29,66\,mm$ **OR/*OF***	✓both Radii/*beide radiusse* **A** ✓length/*lengte* **CA** ✓**F** **A** ✓**SF** **CA** ✓Length/*lengte* **CA** **OR/*OF*** ✓both Radii/*beide radiusse* **A** ✓ Pythagoras **A** ✓ **SF** **CA** ✓ Length of/*Lengte van* **PT** **CA** ✓ length/*lengte* **CA** **OR / *OF*** ✓ Height / *Hoogte* **A** ✓**F** **A** ✓**SF** **CA** ✓ **S** **CA** ✓Length/*lengte* **CA** **OR/*OF***

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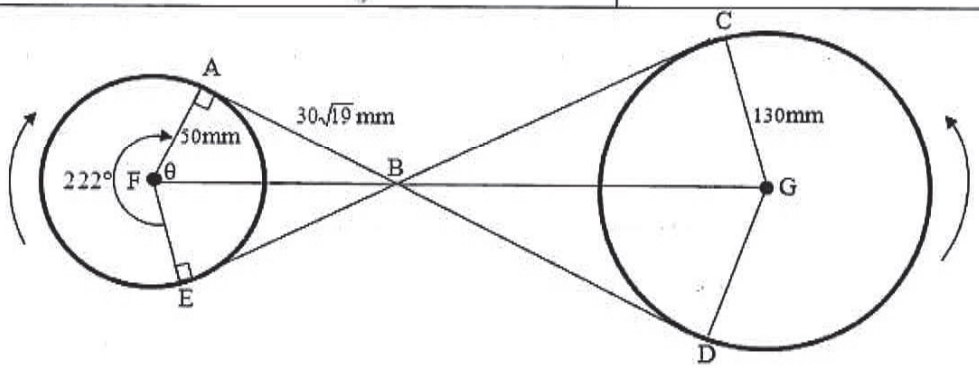
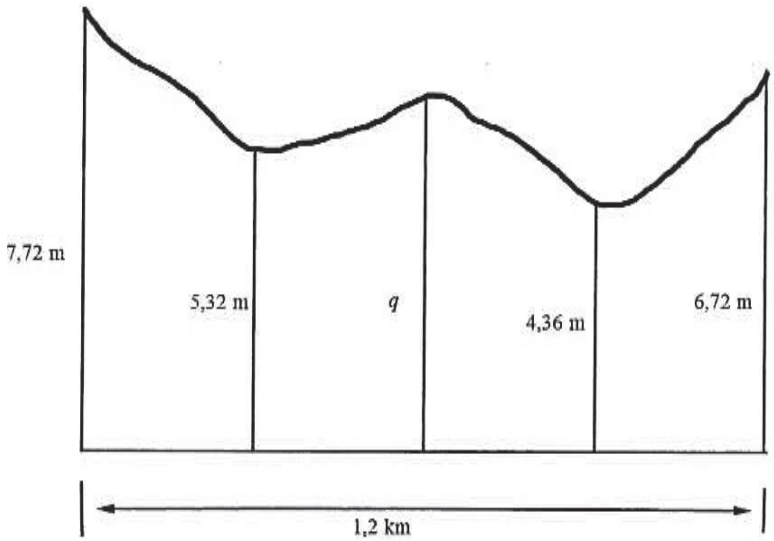
	In ΔOTP $\cos \hat{POT} = \frac{6}{16}$ $\hat{POT} = \cos^{-1}\left(\frac{6}{16}\right)$ $\approx 67,98°$ $\therefore \tan 67,98° = \frac{PT}{6}$ $PT = 6\tan 67,98°$ $\approx 14,83$ $PR \approx 2(14,83)$ $\approx 29,66\text{ mm}$	✓ trig ratio / *verh* **A** ✓ size of / *grootte van* ∠ **CA** ✓ trig ratio / *verh* **CA** ✓ Length/*lengte* PT **CA** ✓Length/*lengte* PR **CA** **NPU/NPR** (5)
10.2		
10.2.1	$222° \times \frac{\pi}{180°} = \frac{37}{30}\pi$ or / *of* $\approx 3,87$ rad.	✓Conversion/ *herleiding* **A** **NPR NPU** **AO Full marks/ *Volpunte*** (1)
10.2.2	$A = \frac{\theta}{360°}\pi r^2$ $= \frac{222°}{360°}\pi (50)^2$ $\approx 4843,29\text{ mm}^2$ **OR/*OF***	✓Formula/ *formule* **A** ✓**SF** **CA** ✓ Area of sector/ *oppervlakte van sektor* **CA** **OR/*OF***

	$A = \frac{r^2\theta}{2}$ $= \frac{(50)^2\left(\frac{37}{30}\pi\right)}{2}$ $= \frac{4625}{3}\pi$ or/*of* $\approx 4843,29\ mm^2$ **OR/*OF*** $s = r\theta$ $= (50)\left(\frac{37}{30}\pi\right)$ $= \frac{185}{3}\pi$ or/*of* $\approx 193,73 mm$ $A = \frac{rs}{2}$ $= \frac{(50)\left(\frac{185}{3}\pi\right)}{2}$ $= \frac{4625}{3}$ $\approx 4843,29 mm^2$	✓Formula/ *formule* A ✓**SF** **CA** ✓ Area of sector/ *oppervlakte van sektor* **CA** **OR/*OF*** ✓arc length/ *booglengte* **CA** ✓Formula/ *formule* **A** ✓Area of sector/ *oppervlakte van sektor* **CA NPU** (3)

10.2.3	$BG^2 = BC^2 + CG^2$ $BC^2 = BG^2 - CG^2$ $BC^2 = (360)^2 - (130)^2$ $BC = 70\sqrt{23} \approx 335,71\text{ mm}$	✓ length/ *lengte* BG **A** ✓ length / *lengte* BC **CA**
	$s = r\theta$ $= (50)\left(\frac{37}{30}\pi\right)$ $AE = \frac{185}{3}\pi$ or / *of* $\approx 193,73\text{ mm}$	✓**F** **A** ✓**SF** **CA** ✓$\frac{185}{3}\pi$ **CA**
	LENGTH OF BELT/ *LENGTE VAN BAND* $= AE + AB + BC + CD + BD + BE$ $= \frac{185}{3}\pi + 30\sqrt{19} + 70\sqrt{23} + 503 + 70\sqrt{23} + 30\sqrt{19}$ $\approx 1629,68\text{ mm}$	✓**M** **A** ✓ length/*lengte* **CA**
	OR/*OF* $\Delta ABF \,|||\, \Delta DBG$ $\frac{AB}{DB} = \frac{AF}{DG}$ $\frac{30\sqrt{19}}{DB} = \frac{50}{130}$ $DB \approx 339,99$	**OR / *OF*** ✓ Similarity/*gelykvormig* **A** ✓ Proportion/ *verhouding* **A** ✓ **SF** **A** ✓ length / *lengte* DB **CA**
	LENGTH OF BELT / *LENGTE VAN BAND* $= AE + 2\times AB + 2\times BC + CD$ $= \frac{185}{3}\pi + 2\times 30\sqrt{19} + 2\times 339,99 + 503$ $\approx 1638,25\text{ mm}$	✓**M** **A** ✓**SF** **CA** ✓ length/*lengte* **CA**
		Penalty for rounding/ ***Penalisering vir afronding***
		(7)
		[20]

QUESTION/*VRAAG* 11

11.1		
11.1.1	$1,2 \text{ km} \times \frac{1000 \text{ m}}{1 \text{ km}} = 1200 \text{ m}$	✓ **A** (1)
11.1.2	$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + \ldots + o_{n-1}\right)$ $6948 = \frac{1200}{4}\left(\frac{7,72 + 6,72}{2} + 5,32 + q + 4,36\right)$ $= 300(16,9 + q)$ $16,9 + q = 23,16$ $q = 6,26 \text{ m}$ **OR/*OF*** $A_T = a(m_1 + m_2 + m_3 + \ldots + m_n)$ $6948 = \frac{1200}{4}\left(\frac{7,72 + 5,32}{2} + \frac{5,32 + q}{2} + \frac{q + 4,36}{2} + \frac{4,36 + 6,72}{2}\right)$ $6948 = 300\left(6,52 + \frac{9,68 + 2q}{2} + 5,54\right)$ $23,16 = 12,06 + \frac{9,68 + 2q}{2}$ $\frac{9,68 + 2q}{2} = 11,1$ $9,68 + 2q = 22,2$ $2q = 12,52$ $q = 6,26 \text{ m}$	✓ **F** **A** ✓ value of/*waarde van a* **CA** ✓ **SF** **CA** ✓ **S** **CA** ✓ value of/*waarde van q* **CA** **OR/*OF*** ✓ **F** **A** ✓ value of/*waarde van a* **CA** ✓ **SF** **CA** ✓ **S** **CA** ✓ value of/*waarde van q* **CA** (5)

11.2.1	$A_{cylinder/silinder} = 2\pi r^2 + 2\pi rh$ $= 2\pi(1{,}5\text{ m})^2 + 2\pi(1{,}5\text{ m})(10)$ $= 108{,}38\text{ m}^2$ cost/*koste* $= \text{R}\,8{,}93 \times 108{,}38\text{ m}^2$ $= \text{R}\,967{,}83 < \text{R}1000$	✓formula/*formule* **A** ✓**SF** **A** ✓ value of/ *waarde van* A **CA** ✓Cost not exceeding R1000/ *Koste* nie meer as R1000 **CA** **NPR** (4)
11.2.2	Airspace for cylindrical tank/ *lugruimte vir silindriese tenk* $= 70{,}69\text{ m}^3 - 68\text{ m}^3$ $= 2{,}69\text{ m}^3$ percentage/ persentasie $= \frac{2{,}69\text{ m}^3}{70{,}69\text{ m}^3} \times 100 = 3{,}81\%$ Airspace for car tank/ *lugruimte vir kar tenk* $= 55\,\ell - 52\,\ell$ $= 3\,\ell$ percentage / *persentasie* $= \frac{3}{55} \times 100 = 5{,}45\%$ The car fuel tank has a bigger percentage airspace/ *die kar brandstoftenk het 'n groter persentasie lugruimte.* **OR / *OF*** percentage/ persentasie $= \frac{68\text{ m}^3}{70{,}69\text{ m}^3} \times 100\% = 96{,}19\%$ percentage / *persentasie* $= \frac{52}{55} \times 100\% = 94{,}55\%$ The car fuel tank has a bigger percentage airspace/ *die kar brandstoftenk het n groter persentasie lugruimte.*	✓ **M** **A** ✓percentage/*persentasie* **CA** ✓ **M** **A** ✓percentage/*persentasie* **CA** ✓ conclusion/ *gvltgtreknng* **CA** **OR / *OF*** ✓ **M** **A** ✓percentage/*persentasie* **CA** ✓ **M** **A** ✓percentage/*persentasie* **CA** ✓ conclusion/ *gvltgtreknng* **CA** (5) **[15]**

TOTAL/*TOTAAL*: 150

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