basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS
SENIORSERTIFIKAAT-EKSAMEN/ NASIONALE SENIORSERTIFIKAAT-EKSAMEN

TECHNICAL MATHEMATICS P2/*TEGNIESE WISKUNDE V2*
MAY/JUNE/*MEI/JUNIE* 2025
FINAL MARKING GUIDELINES/*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*
ST	Statement/*Bewering*
SF	Substitution in correct formula/*Vervanging in korrekte formule*
ST/RE	Statement with reason/*Bewering met rede*
F	Correct formula/*Korrekte formule*

DATE APPROVED/DATUM GOEDGEKEUR	25 MAY 2025
EXTERNAL/*EKSTERNE* MODERATORS	INTERNAL /*INTERNE* MODERATORS
S. MUTHIGE	**N. TOM**
	

These marking guidelines consist of 28 pages.
Hierdie nasienriglyne bestaan uit 28 bladsye.

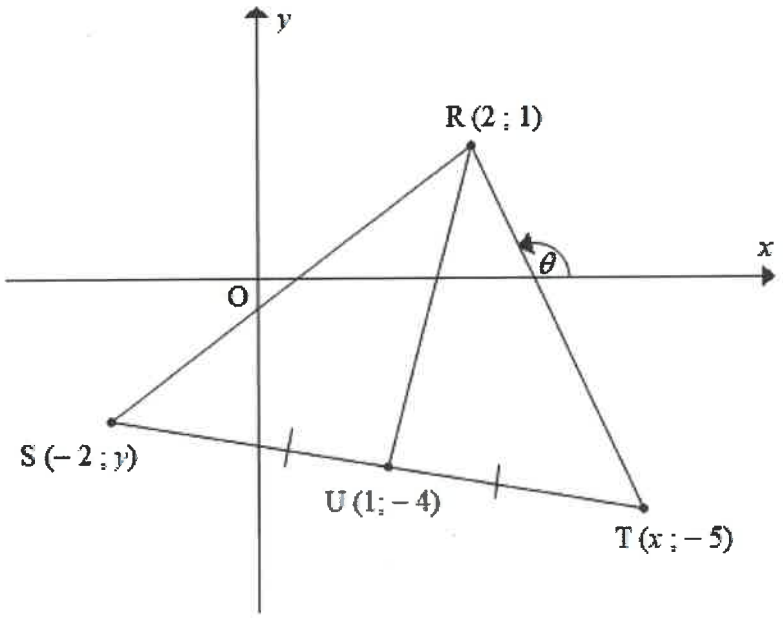
NOTE:
- If a candidate answers a question **TWICE**, only mark the **FIRST** attempt.
- Consistent Accuracy marking must be applied where indicated.
- # Shows question where a Tolerance Range will be applied:

Q 3.2.2 ; Q3.3 ; Q4.3 & Q 11.2.2

LET WEL:
- *Indien 'n kandidaat 'n vraag **TWEE** keer beantwoord, sien slegs die **EERSTE** poging na.*
- *Die nasien van Volgehoue Akkuraatheid moet waar aangedui, toegepas word.*
- *# Toon vrae waar Toleransie wydte (Verdraagsaamheids omvang) toegepas word:*

V 3.2.2 ; V3.3 ; V4.3 & V 11.2.2

QUESTION/*VRAAG* 1

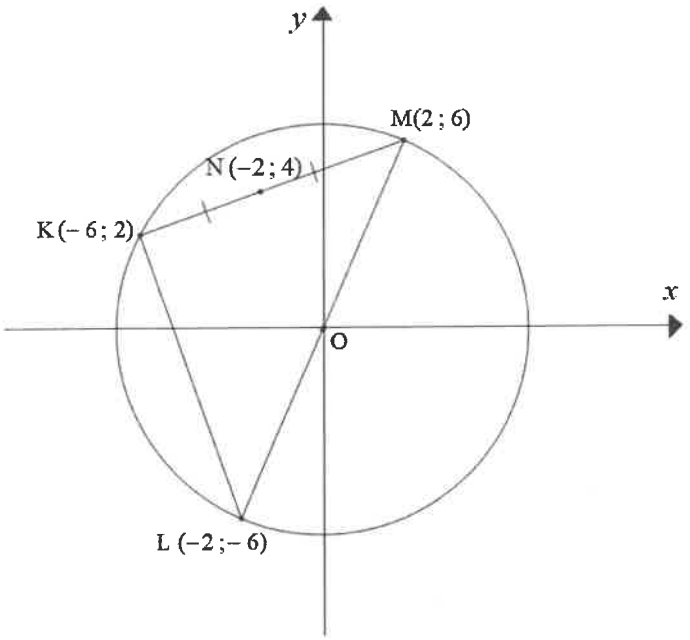


1.1	$RU = \sqrt{(x_R - x_U)^2 + (y_R - y_U)^2}$ $= \sqrt{(2-1)^2 + (1-(-4))^2}$ $= \sqrt{26}$	✓**SF** **A** ✓ length/*lengte* RU **CA** **AO:Full marks/*Volpunte***	(2)
1.2	$1 = \frac{x-2}{2}$ **and/*en*** $-4 = \frac{y-5}{2}$ $x = 2 + 2 = 4$ **and/*en*** $y = -8 + 5 = -3$	✓ value of/*waarde van* x **A** ✓ value of/*waarde van* y **A**	(2)

1.3	$m_{RT} = \frac{y_R - y_T}{x_R - x_T}$ $= \frac{1-(-5)}{2-4}$ $= -3$	✓ **SF** **CA** ✓gradient/*gradiënt* **CA** **AO:Full marks/*Volpunte*** (2)
1.4	$\tan\theta = m_{RT}$ $\tan\theta = -3$ *ref* $\angle = \tan^{-1}(3)$ ref.∠/*verw.∠*: $\approx 71{,}57°$ $\theta = 180° - 71{,}57° = 108{,}43°$	✓ **SF** **CA** ✓ ref.∠/*verw.∠* **CA** ✓ value of/*waarde van* θ **CA** **AO:Full marks/*Volpunte*** (3)
1.5	$x^2 + y^2 = r^2$ $(-2)^2 + (-3)^2 = r^2$ $r^2 = 13$ $\therefore x^2 + y^2 = 13$ OR $y = \pm\sqrt{13 - x^2}$ OR $x = \pm\sqrt{13 - y^2}$	✓**SF** **CA** ✓ equation/*vergelyking* **CA** **AO:Full marks/*Volpunte*** (2)
		[11]

QUESTION/*VRAAG* 2

2.1



2.1.1

$$m_{OM} = \frac{y_O - y_M}{x_O - x_M}$$
$$= \frac{0-6}{0-2}$$
$$= 3$$

$y - 6 = 3(x - 2)$ **OR/*OF*** $6 = 3(2) + c$

$\therefore y = 3x$

OR/*OF*

$$m_{OM} = \frac{y_O - y_M}{x_O - x_M}$$
$$= \frac{0-6}{0-2}$$
$$= 3$$

$y - (-6) = 3(x - (-2))$ **OR/*OF*** $-6 = 3(-2) + c$

$\therefore y = 3x$

OR/*OF*

✓ **SF** **A**

✓ gradient/*gradiënt* of/*van* OM **CA**

✓equation / *vergelyking* **CA**

OR/*OF*

✓ **SF** **A**

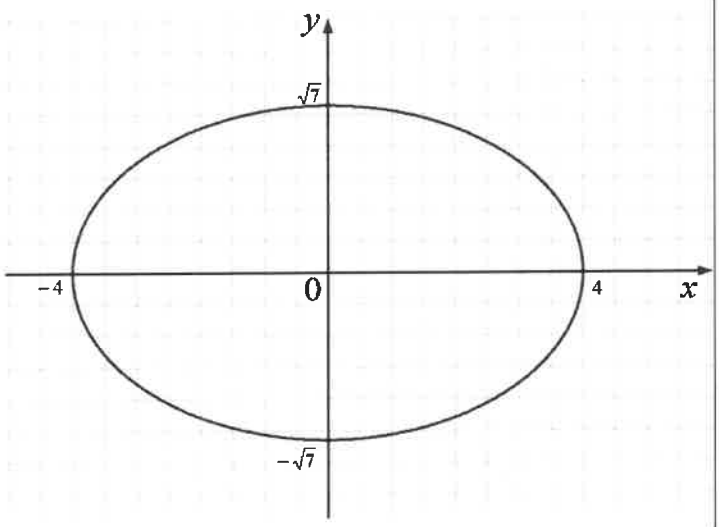
✓ gradient/*gradiënt* of/*van* OM **CA**

✓equation/*vergelyking* **CA**

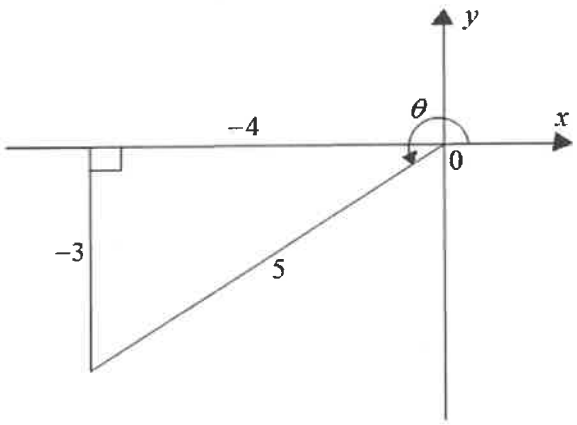
OR/*OF*

	$m_{ML} = \frac{y_M - y_L}{x_M - x_L}$ $= \frac{6-(-6)}{2-(-2)}$ $= 3$ $y-(6)=3(x-2)$ **OR/*OF*** $-6 = 3(-2) + c$ $\therefore\ y = 3x$ **OR/*OF*** $m_{OL} = \frac{y_L - y_O}{x_L - x_O}$ $= \frac{-6-0}{-2-0}$ $= 3$ $y-(-6)=3(x-(-2))$ **OR/*OF*** $0 = 3(0) + c$ $\therefore\ y = 3x$	✓ **SF** **A** ✓ gradient/*gradiënt* of/*van* OM **CA** ✓equation/*vergelyking* **CA** **OR/*OF*** ✓ **SF** **A** ✓ gradient/*gradiënt* of/*van* OM **CA** ✓equation/*vergelyking* **CA** **AO:Full marks/*Volpunte*** (3)

2.1.2	$m_{KL} = \frac{y_K - y_L}{x_K - x_L}$ $= \frac{2-(-6)}{-6-(-2)}$ $= -2$	✓ **SF** ✓gradient/*gradiënt*	**A** **CA**
	$m_{KM} = \frac{y_K - y_M}{x_K - x_M}$ $= \frac{2-6}{-6-2}$ $= \frac{1}{2}$	✓gradient/*gradiënt*	**CA**
	$m_{KL} \times m_{KM} = -2 \times \frac{1}{2} = -1$ $\therefore$ KL $\perp$ KM	✓ **M**	**A**
	OR/*OF*	**OR/*OF***	
	$KL^2 = (x_K - x_L)^2 + (y_K - y_L)^2$ $= (-6-(-2))^2 + (2-(-6))^2$ $= 80$ $KM^2 = (-6-2)^2 + (2-6)^2 = 80$ $\therefore KL^2 + KM^2 = 80 + 80 = 160$	✓ **SF** ✓ KL^2	**A** **CA**
	$ML^2 = (2-(-2))^2 + (6-(-6))^2 = 160$	✓ ML^2	**CA**
	$\therefore KL^2 + KM^2 = ML^2$ $\therefore$ KL $\perp$ KM	✓ **M**	**A** (4)
2.1.3	$ON = \sqrt{(x_O - x_N)^2 + (y_O - y_N)^2}$ $= \sqrt{(0-(-2))^2 + (0-4)^2}$ $= 2\sqrt{5} \approx 4,47$	✓ **SF** ✓ON	**A** **CA**
	$KL = \sqrt{(x_K - x_L)^2 + (y_K - y_L)^2}$ $= \sqrt{(-6-(-2))^2 + (2-(-6))^2}$ $= 4\sqrt{5} \approx 8,94$	✓ KL	**A**
	$\therefore ON = \frac{1}{2}KL$		
	OR/*OF*	**OR/*OF***	

	KN = NM (Given/*Gegee*) MO = OL (Radii) $\therefore$ ON $= \frac{1}{2}$KL (Midpt theorem/*Midpt stelling*)	✓ **ST** ✓ **ST** ✓ **RE**	**A** **A** **A** (3)
2.2		✓*x*-intercepts/*afsnitte* ✓*y*-intercepts/*afsnitte* ✓elliptical shape/*elliptiese vorm* **Accept** if the *y* value is between 2 and 3 and closer to 3 ***Aanvaar** as die y-waarde tussen 2 en 3 is en nader aan 3 is.* (3)	**A** **A** **CA**
			[13]

QUESTION/*VRAAG* 3

3.1.1	$\tan(A + B)$ $= \tan(103° + 52°)$ $\approx -0,47$	✓ substitution/*vervanging* **A** ✓ **S** **CA** **AO: Full marks / *Volpunte*** **NPR** (2)
3.1.2	$\frac{2\,\text{cosec}\,B}{\cos A}$ $= \frac{2\,\text{cosec}\,52°}{\cos 103°}$ $= \frac{2}{\sin 52°} \div \cos 103°$ $\approx -11,28$	✓ substitution/*vervanging* **A** ✓ $\frac{2}{\sin 52°}$ **I** **A** ✓ **S** **CA** **NPR** (3)
3.2.1	$\text{cosec}\,\theta = -\frac{5}{3}$	✓ $-\frac{5}{3}$ **A** (1)
3.2.2	$(5)^2 - (-3)^2 = x^2$ $x = \pm 4$ $x = -4$  $\cos\theta - \cot\theta$ $= \left(\frac{-4}{5}\right) - \left(\frac{-4}{-3}\right)$ $= -\frac{32}{15}$	✓ **SF** **A** ✓ *x*-value /*waarde* **CA** (negative value / *negatiewe waarde)* ✓ cos ratio/*verhouding* **CA** ✓ cot ratio/*verhouding* **CA** ✓ **S** **CA** (5)

3.3	$\sin 3x = -0,43$ ref.$\angle$ / *verw.*$\angle = 25,47°$	✓ ref.$\angle$ / *verw.*$\angle$	**A**
	$3x = 180° + 25,47°$ or/*of* $3x = 360° - 25,47°$	✓ 3rd quadrant/*kwadrant* ✓ 4th quadrant/*kwadrant*	**A** **A**
	$3x = 205,47°$ or/*of* $3x = 334,53°$ $\therefore x = 68,49°$ or/*of* $x = 111,51°$	✓ x-value/*waarde* ✓ x-value/*waarde*	**CA** **CA** (5)
			[16]

QUESTION/*VRAAG* 4

4.1.1	$\cos^2\alpha$ **OR/*OF*** $(-\cos\alpha)^2$	✓ $\cos^2\alpha/(-\cos\alpha)^2$	**A** (1)
4.1.2	1	✓ 1	**A** (1)
4.2	$\dfrac{\tan(\pi-\alpha)\cdot\sqrt{1-\sin^2\alpha}}{\cos^2(180°+\alpha)+\sin^2(360°-\alpha)}$ $=\dfrac{-\tan\alpha\cdot\sqrt{\cos^2\alpha}}{\cos^2\alpha+(-\sin\alpha)^2}$ $=\left(\dfrac{-\sin\alpha}{\cos\alpha}\cdot\cos\alpha\right)\div\left(\cos^2\alpha+\sin^2\alpha\right)$ $=-\sin\alpha\div 1$ $=-\sin\alpha$	✓ $-\tan\alpha$ ✓ $\sqrt{\cos^2\alpha}$ ✓ $-\sin\alpha/\sin^2\alpha$ ✓ $\dfrac{\sin\alpha}{\cos\alpha}$ ✓ $\cos\alpha$ ✓ **S**	**A** **A** **A** **A** **A** **CA** (6)
4.3	$\sec^2\theta+\operatorname{cosec}^2\theta=\operatorname{cosec}^2\theta\cdot\sec^2\theta$ L.H.S/*LK* $=\sec^2\theta+\operatorname{cosec}^2\theta$ $=\dfrac{1}{\cos^2\theta}+\dfrac{1}{\sin^2\theta}$ $=\dfrac{\sin^2\theta+\cos^2\theta}{\sin^2\theta\cdot\cos^2\theta}$ $=\dfrac{1}{\sin^2\theta\cdot\cos^2\theta}$ $=\dfrac{1}{\sin^2\theta}\cdot\dfrac{1}{\cos^2\theta}$ $=\operatorname{cosec}^2\theta\cdot\sec^2\theta$ = R.H.S/*RK* **OR/*OF*** $\sec^2\theta+\operatorname{cosec}^2\theta=\operatorname{cosec}^2\theta\cdot\sec^2\theta$ R.H.S./*RK* $=\operatorname{cosec}^2\theta\cdot\sec^2\theta$ $=\operatorname{cosec}^2\theta\left(\tan^2\theta+1\right)$ $=\dfrac{1}{\sin^2\theta}\left(\dfrac{\sin^2\theta}{\cos^2\theta}+1\right)$ $=\dfrac{1}{\cos^2\theta}+\dfrac{1}{\sin^2\theta}$ $=\sec^2\theta+\operatorname{cosec}^2\theta$ = L.H.S/*LK* **OR/*OF***	✓ $\dfrac{1}{\cos^2\theta}$ ✓ $\dfrac{1}{\sin^2\theta}$ ✓ **S** ✓ $\dfrac{1}{\sin^2\theta}\cdot\dfrac{1}{\cos^2\theta}$ **OR/*OF*** ✓ $\tan^2\theta+1$ ✓ $\dfrac{1}{\sin^2\theta}$ ✓ $\dfrac{\sin^2\theta}{\cos^2\theta}$ ✓ $\dfrac{1}{\cos^2\theta}+\dfrac{1}{\sin^2\theta}$ **OR/*OF***	**A** **A** **A** **A** **A** **A** **A**

Please turn over/Blaai om asseblief

$\sec^2\theta + \text{cosec}^2\theta = \text{cosec}^2\theta \cdot \sec^2\theta$

R.H.S/*RK* $= \text{cosec}^2\theta \cdot \sec^2\theta$

$= \dfrac{1}{\sin^2\theta} \cdot \dfrac{1}{\cos^2\theta}$

$= \dfrac{\sin^2\theta + \cos^2\theta}{\sin^2\theta \cdot \cos^2\theta}$ ✓ $\sin^2\theta + \cos^2\theta$ A

$= \dfrac{\sin^2\theta}{\sin^2\theta \cdot \cos^2\theta} + \dfrac{\cos^2\theta}{\sin^2\theta \cdot \cos^2\theta}$ ✓ **S** A

$= \dfrac{1}{\cos^2\theta} + \dfrac{1}{\sin^2\theta}$ ✓ $\dfrac{1}{\cos^2\theta}$ A

$= \sec^2\theta + \text{cosec}^2\theta = \text{LHS}/LK$ ✓ $\dfrac{1}{\sin^2\theta}$ A

OR/*OF*

$\sec^2\theta + \text{cosec}^2\theta = \text{cosec}^2\theta \cdot \sec^2\theta$ **OR/*OF***

R.H.S/*RK* $= \text{cosec}^2\theta \cdot \sec^2\theta$

$= \left(1 + \cot^2\theta\right) \cdot \sec^2\theta$ ✓ $1 + \cot^2\theta$ A

$= \left(1 + \dfrac{\cos^2\theta}{\sin^2\theta}\right) \cdot \dfrac{1}{\cos^2\theta}$ ✓ $\dfrac{\cos^2\theta}{\sin^2\theta}$ A

$= \dfrac{1}{\cos^2\theta} + \dfrac{1}{\sin^2\theta}$ ✓ $\dfrac{1}{\cos^2\theta}$ A

$= \sec^2\theta + \text{cosec}^2\theta = \text{LHS} / LK$ ✓ $\dfrac{1}{\cos^2\theta} + \dfrac{1}{\sin^2\theta}$ A

OR/*OF*

$\sec^2\theta + \text{cosec}^2\theta = \text{cosec}^2\theta \cdot \sec^2\theta$ **OR/*OF***

L.H.S/*LK* $= \sec^2\theta + \text{cosec}^2\theta$

$= 1 + \tan^2\theta + 1 + \cot^2\theta$ ✓ $1 + \tan^2\theta$ A

$= 2 + \tan^2\theta + \cot^2\theta$ ✓ $1 + \cot^2\theta$ A

R.H.S/*RK* $= \left(1 + \cot^2\theta\right)\left(1 + \tan^2\theta\right)$ ✓ **S** A

$= 1 + \tan^2\theta + \cot^2\theta + \cot^2\theta \tan^2\theta$

$= 1 + \tan^2\theta + \cot^2\theta + 1$ ✓ **S** A

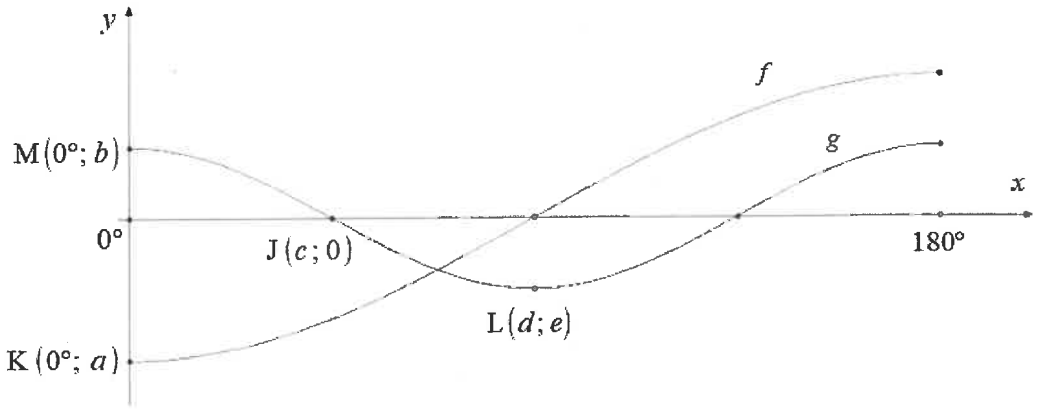
$= 2 + \tan^2\theta + \cot^2\theta$

$\therefore$ L.H.S/*LK* $=$ R.H.S/*RK*

OR/*OF* **OR/*OF***

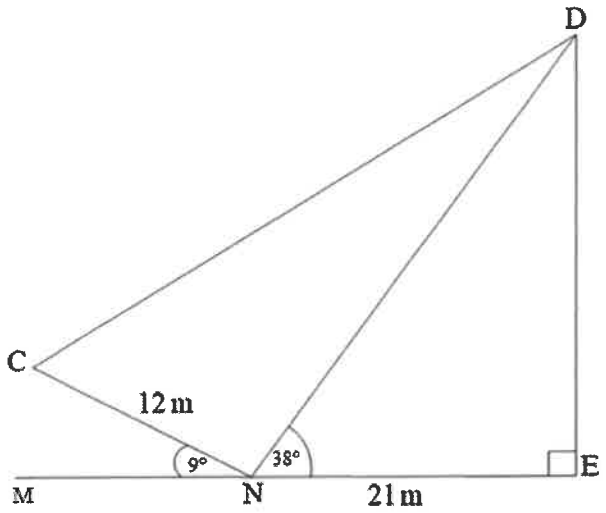
	$\text{L.H.S}/LK = 1 + \tan^2\theta + 1 + \cot^2\theta$	
	$= \tan^2\theta + 2 + \cot^2\theta$	✓ $1+\tan^2\theta$ **A** ✓ $1+\cot^2\theta$ **A**
	$= \dfrac{\sin^2\theta}{\cos^2\theta} + 2 + \dfrac{\cos^2\theta}{\sin^2\theta}$	
	$= \dfrac{\sin^4\theta + 2\sin^2\theta\cdot\cos^2\theta + \cos^4\theta}{\sin^2\theta\cdot\cos^2\theta}$	✓ **S** **A**
	$= \dfrac{(\sin^2\theta + \cos^2\theta)(\sin^2\theta + \cos^2\theta)}{\sin^2\theta\cdot\cos^2\theta}$	✓ factors/*faktore* **A**
	$= \dfrac{(1)(1)}{\sin^2\theta\cdot\cos^2\theta}$	
	$= \text{cosec}^2\theta\cdot\sec^2\theta = \text{RHS} / RK$	(4)
		[12]

QUESTION/*VRAAG* 5



5.1	$a = -2$ $b = 1$ $c = 45°$ $d = 90°$ $e = -1$	✓ *a* value/*waarde* ✓ *b* value/*waarde* ✓ *c* value/*waarde* ✓ *d* value/*waarde* ✓ *e* value/*waarde*	**A** **A** **A** **A** **A** (5)
5.2	2	✓ amplitude/*amplitude*	**A** (1)
5.3	180°	✓ period/*periode*	**A** (1)
5.4	Interval 1: $x \in (45°;90°)$ **OR / *OF*** $45° < x < 90°$ **OR / *OF*** $x > 45°$ *and / en* $x < 90°$ **OR / *OF*** between / *tussen* 45° *and / en* 90° Interval 2: $x \in (135°;180°]$ **OR / *OF*** $135° < x \leq 180°$ **OR / *OF*** $x > 135°$ *and / en* $x \leq 180°$ **OR / *OF*** between / *tussen* 135° *and including / en ingesluit* 180°	✓ critical values/*kritieke waardes* ✓ notation/*notasie* ✓ critical values/*kritieke waardes* ✓ notation/*notasie*	**CA** **A** **CA** **A** (4)
			[11]

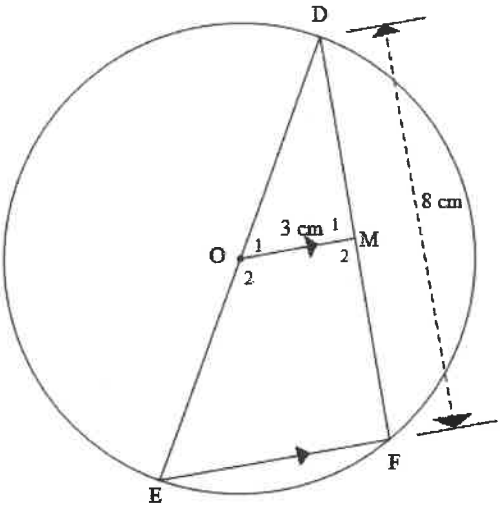
QUESTION/*VRAAG* 6



6.1	$\cos 38° = \frac{21}{ND}$ $ND = \frac{21}{\cos 38°}$ $\approx 26,65\text{ m}$ **OR/*OF*** $DE = 21\tan 38°$ $ND = \sqrt{(21\tan 38°)^2 + (21)^2}$ $= \sqrt{710,1895}$ $\approx 26,65$ **OR/*OF*** $N\hat{D}E = 52°$ Int. $\angle s\ \Delta$ $\sin 52° = \frac{21}{DN}$ $DN = \frac{21}{\sin 52°}$ $DN \approx 26,65\text{ m}$ **OR/*OF*** $\frac{ND}{\sin 90°} = \frac{21}{\sin 52°}$ $ND\sin 52° = 21\sin 90°$ $ND = \frac{21\sin 90°}{\sin 52°}$ $\approx 26,65$	✓ cos ratio/*verhouding* **A** ✓ **S** **CA** ✓ length of/*lengte van* ND **CA** **OR/*OF*** ✓ length of/*lengte van* DE **A** ✓Substitution/ *Vervanging* **CA** ✓ length of/*lengte van* ND **CA** **OR/*OF*** ✓ size of/*grootte van* $N\hat{D}E$ **A** ✓ sin ratio/*verhouding* **CA** ✓ length of/*lengte van* ND **CA** **OR/*OF*** ✓ sin rule/*sin reël* **A** ✓ **S** **CA** ✓ length of/*lengte van* ND **CA** (3)

6.2	$C\hat{N}D = 133°$	✓angle size/*hoekgrootte*	**A** (1)
6.3	$CD^2 = NC^2 + ND^2 - 2 \cdot NC \cdot ND \cos C\hat{N}D$ $= (12)^2 + (26,65)^2 - 2(12)(26,65)\cos 133°$ $= 1\,290,428651$ $\therefore CD \approx 35,92$ m	✓ cos rule/*reël* **A** ✓ substitution in cos rule/ *vervanging in cos-reël* **CA** ✓ **S** **CA** ✓ length of/*lengte van* CD **CA** **NPU** (4)	
6.4	Area of/*van* $\Delta CND = \frac{1}{2} \times NC \times ND \times \sin C\hat{N}D$ $= \frac{1}{2} \times 12 \times 26,65 \times \sin 133°$ $\approx 116,94$ m^2	✓ Area formula/*formule* **A** ✓ substitution/*vervanging* **CA** ✓ Area of ΔNDC **CA** **NPU** (3)	
			[11]

QUESTION/*VRAAG* 7

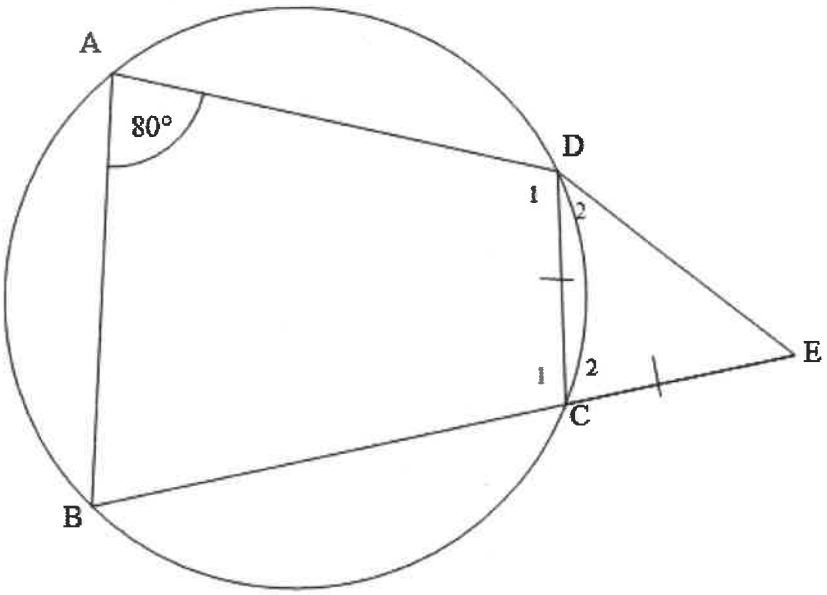


7.1	∠ in semi-circle / *sirkel* **OR / *OF*** ∠subtended by diameter / *ondersp deur middellyn*	✓ **RE**	**A** (1)
7.2	$\hat{M}_1 = 90°$ (Corr ∠s; OM || EF / *Ooreenk ∠e*; OM || EF) **OR/*OF*** $\hat{M}_2 = 90°$ (Co - int ∠s; OM || EF / *Ko – binne ∠e*; OM || EF)	✓ **ST** ✓ **RE** **OR/*OF*** ✓ **ST** ✓ **RE**	**A** **A** **A** **A** (2)
7.3	Line from centre ⊥ chord / *loodlyn vanuit midpt ⊥ op koord* **OR/*OF*** Line from midpt || to 2nd side / *Lyn vanaf midpt || aan 2de sy*	✓ **RE** **OR/*OF*** ✓ **RE**	**A** **A** (1)

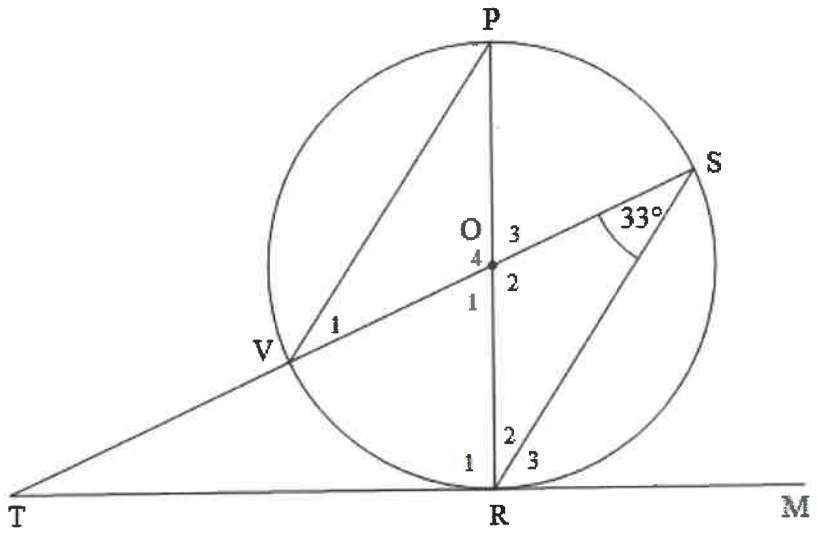
7.4	EF = 6 units / *eenhede* (Midpt th / *Midpt st*)	✓ **ST**	**A**
		✓**RE**	**A**
	$\therefore DE^2 = DF^2 + EF^2$ (Pythagoras)		
	$= (8)^2 + (6)^2$	✓ **SF**	**CA**
	$= 100$		
	$\therefore DE = 10$ units / *eenhede*	✓ DE length/*lengte*	**CA**
	OR/*OF*	**OR/*OF***	
	DM = 4 units / *eenhede* (Line from centre ⊥ chord / *loodlyn uit midpt van sirkel na koord*)	✓ **ST**	**A**
		✓**RE**	**A**
	$\therefore DO^2 = OM^2 + DM^2$ (Pythagoras)		
	$= 3^2 + 4^2$	✓ **SF**	**CA**
	$= 25$		
	$\therefore DO = 5$ units / *eenhede*		
	$\therefore DE = 2DO$ (diameter $= 2\times$radius)		
	$\therefore DE = 10$ units / *eenhede*	✓ length of/*lengte van* DE	**CA** (4)
			[8]

QUESTION/*VRAAG* 8

8.1

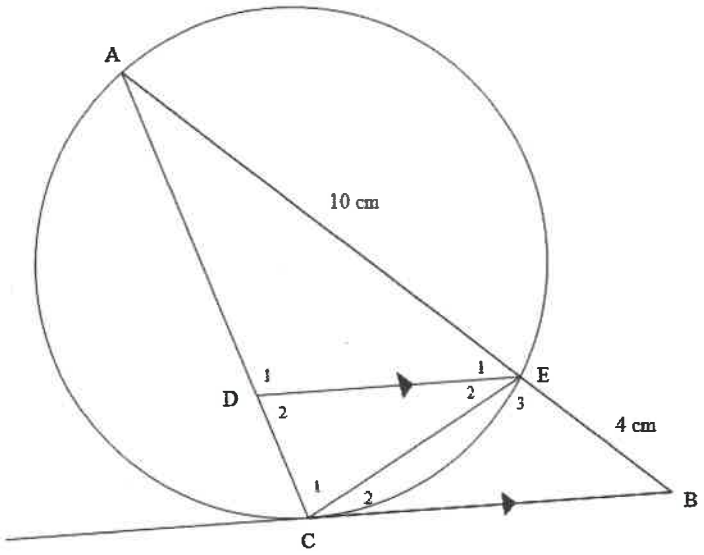


$\hat{C}_2 = 80°$ (ext ∠ of cyclic quad / *buite ∠ van kdvh*)	✓ **ST** ✓ **RE**	**A** **A**
$\therefore \hat{D}_2 + \hat{E} = 100°$ (Int ∠ of Δ / *Binne ∠e Δ*)	✓ **ST** ✓ **RE**	**CA** **A**
$\therefore \hat{E} = 50°$ (∠s opp = sides / *∠e teenoor = sye*)	✓ **ST** ✓ **RE**	**CA** **A**
OR/*OF*	**OR/*OF***	
$\hat{C}_1 = 100°$ (opp ∠s of cyclic quad / *teenoorst ∠e van kdvh*)	✓ **ST** ✓ **RE**	**A** **A**
$\hat{C}_1 = \hat{D}_2 + \hat{E} = 100°$ (Ext ∠ of Δ / *Buite ∠e Δ*)	✓ **ST** ✓ **RE**	**CA** **A**
$\therefore \hat{E} = 50°$ (∠s opp = sides / *∠e teenoor = sye*)	✓ **ST** ✓ **RE**	**CA** **A**
		(6)

8.2			
8.2.1 a)	$\hat{P} = 33°$ (∠s in the same segment / *∠e in dies segment*)	✓ **ST** ✓ **RE**	**A** **A** (2)
8.2.1 b)	$\hat{O}_1 = 66°$ (∠ at centre $= 2 \times$ ∠ at circumf / *Midpts∠ $= 2 \times$ Omtreks∠*)	✓ **ST** ✓ **RE**	**A** **A**
	OR/OF	**OR/OF**	
	$\hat{R}_2 = 33°$ (∠s opp = sides / *∠e teenoor = sye*)	✓ **ST**	**A**
	$\hat{O}_1 = 66°$ (ext ∠ of Δ / *buite ∠e van Δ*)	✓ **ST**	**A** (2)
8.2.1 c)	$\hat{R}_1 = 90°$ (Tan/*Raaklyn* ⊥ Rad)	✓ **ST** ✓ **RE**	**A** **A**
	$\therefore \hat{T} = 24°$ (Int ∠ of Δ / *Binne ∠e Δ*)	✓ **ST**	**CA** (3)
8.2.2	$\hat{R}_2 = 33°$ (∠s opp = sides / *∠e teenoor = sye*)	✓ **ST** ✓ **RE**	**A** **A**
	$\therefore$ PV ∥ SR (alt ∠s = / *verw ∠e =*)	✓ **RE**	**A**
	OR/OF	**OR/OF**	

	$\hat{R}_2 = 33°$ $\begin{pmatrix}\text{ext} \angle \text{ of } \Delta / \\ \textit{buite} \angle e \textit{ van } \Delta\end{pmatrix}$	✓ **ST** ✓ **RE**	**CA** **A**
	$\therefore PV \parallel SR$ $\begin{pmatrix}\text{alt} \angle s = / \\ \textit{verw} \angle e =\end{pmatrix}$	✓ **RE**	**A**
	OR/OF	**OR/OF**	
	$\hat{V}_1 = 33°$ $\begin{pmatrix}\angle s \text{ opp} = \text{sides} / \\ \angle e \textit{teenoor} = \textit{sye}\end{pmatrix}$	✓ **ST** ✓ **RE**	**CA** **A**
	$\therefore PV \parallel SR$ $\begin{pmatrix}\text{alt} \angle s = / \\ \textit{verw} \angle e =\end{pmatrix}$	✓ **RE**	**A**
	OR/OF		
	$\hat{R}_2 = \hat{P}$ $\begin{pmatrix}\text{proven above} / \\ \textit{bewys bo}\end{pmatrix}$	✓ **ST** ✓ **RE**	**CA** **A**
	$\therefore PV \parallel SR$ $\begin{pmatrix}\text{alt} \angle s = / \\ \textit{verw} \angle e =\end{pmatrix}$	✓ **RE**	**A** (3)
			[16]

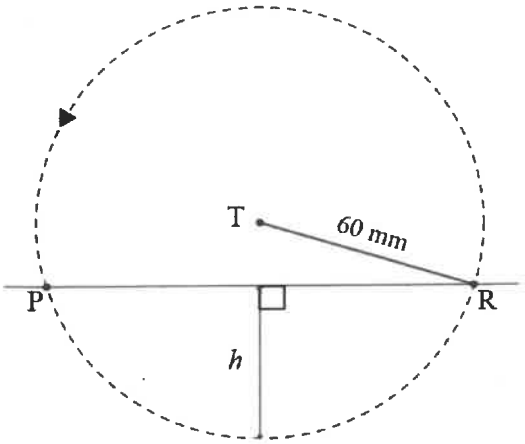
QUESTION/*VRAAG* 9



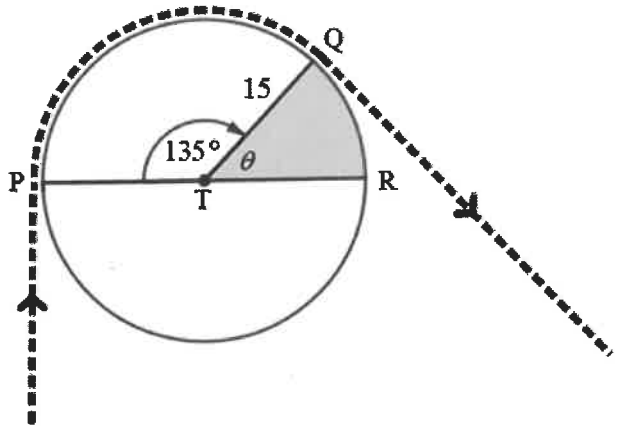
9.1	In Δ ABC and Δ CBE: $\hat{A} = \hat{C}_2$ (tan-chord / *raaklyn-koord*) $\hat{B}$ is common / *gemeenskaplik* $\therefore \Delta ABC \,|||\, \Delta CBE$ $(\angle\angle\angle)$	✓ **ST** **A** ✓ **RE** **A** ✓ **ST** **A** ✓ conclusion/*gevolgtrekking* **OR/*OF*** third pair of equal angles / */derde paar gelyke hoeke* **A** (4)
9.2	$\frac{AB}{CB} = \frac{BC}{BE}$ $(|||\, \Delta s)$ $\therefore BC^2 = AB.BE$	✓ **ST** **A** ✓ **RE** **A** (2)
9.3	$\therefore BC^2 = 14 \times 4 = 56$ $\therefore BC = \sqrt{56} \approx 7{,}48$ cm	✓ subt/*verv.* **A** ✓ length of/*lengte van* BC **CA** (2)

9.4.1	$\frac{AD}{AC}=\frac{AE}{AB}$ $\left(\begin{array}{l}\text{prop th; DE} \parallel \text{CB/}\\ ewerdig.st; DE \parallel CB\end{array}\right)$/ **OR / OF** $\left(\begin{array}{l}\text{line} \parallel \text{one}\\ \text{side of } \Delta/\\ lyn \parallel aan\ een\ sy\\ van\ \Delta\end{array}\right)$ $\therefore \frac{AD}{AC}=\frac{10}{14}=\frac{5}{7}$	✓ **ST** ✓ **RE** ✓ **ST**	**A** **A** **CA** (3)
9.4.2	$\frac{AC}{CE}=\frac{AB}{BC}=\frac{BC}{BE}$ $(\parallel\parallel \Delta s)$ **OR/OF** $\frac{AB}{BC}=\frac{14}{\sqrt{56}}$ $(\parallel\parallel \Delta s)$ $\therefore \frac{AC}{CE}=\frac{7,48}{4}\approx 1,87$	✓ **ST** ✓ **RE** ✓ ratio value/ *verhouding waarde*	**A** **A** **CA** (3)
			[14]

QUESTION/*VRAAG* 10

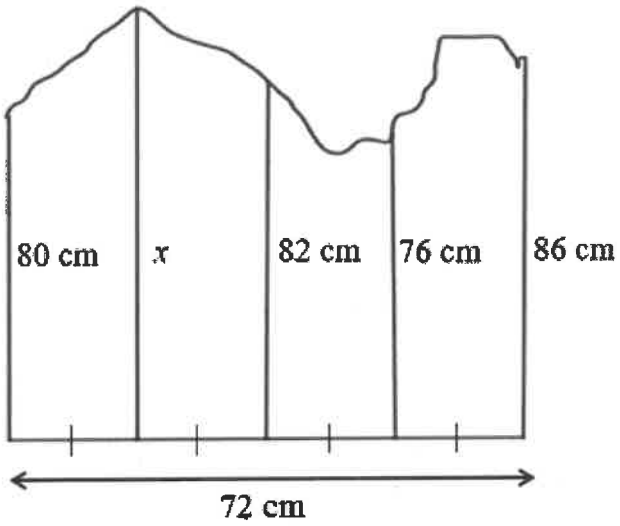
10.1			
10.1.1	0,06 m	✓ 0,06 m	**A** (1)
10.1.2	0,12 m	✓ 0,12 m	**CA** (1)
10.1.3	$\frac{1200 \div 100}{60}$ $= \frac{1}{5} = 0,2$ m/s	✓ **M** ✓ $\frac{1}{5}$ or $0,2$	**A** **A** (2)
10.1.4	$\omega = \frac{v}{r}$ $= \frac{0,2}{0,06}$ $= \frac{10}{3} \approx 3,33$ rad/s **OR/*OF*** $v = \pi D n$ $0,2 = \pi \times (0,12) \times n$ $n = \frac{5}{3\pi}$ **OR/*OF*** $\approx$ 0,53 rev/s $\omega = 2\pi n$ $= 2\pi \times \left(\frac{5}{3\pi}\right)$ $= \frac{10}{3}$ **OR/*OF*** $\approx 3,33$ rad/s	✓ **F** ✓ **SF** ✓ angular velocity/*hoeksnelheid* **OR/*OF*** ✓ **SF** ✓ **F** ✓ angular velocity/*hoeksnelheid*	**A** **CA** **CA** **CA** **A** **CA** (3)

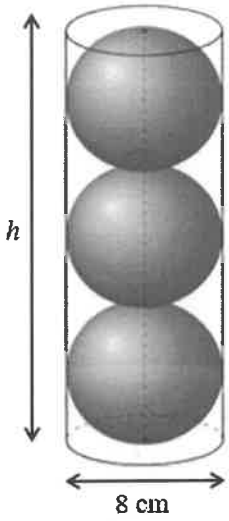
10.1.5	$4h^2 - 4dh + x^2 = 0$	✓ **F**	**A**
	$4h^2 - 4(120)h + (115)^2 = 0$	✓ **SF**	**CA**
	$4h^2 - 480h + 13\,225 = 0$		
	$h = \dfrac{-(-480) \pm \sqrt{(-480)^2 - 4(4)(13225)}}{2(4)}$	✓ **SF**	**CA**
	$h = 42{,}86$ mm or/*of* $h \neq 77{,}14$ mm		
	$\therefore h = 42{,}86$ mm	✓ value of / *waarde van h*	**CA**
	OR/*OF*	**OR/*OF***	
	Let the length from T to the chord be x/ *Laat die lengte vanaf* T *na die koord* x *wees*		
	$x = \sqrt{(60)^2 - (57{,}5)^2}$	✓ Pyth. Theorem/*stelling*	**A**
	$x = 17{,}1391365$	✓ value of/*waarde van* x	**CA**
	$h = 60 - 17{,}1391365$	✓ **M**	**A**
	$h \approx 42{,}86$ mm	✓ value of / *waarde van h*	**CA**
	OR/*OF*	**OR/*OF***	
	$4h^2 - 4dh + x^2 = 0$	✓ **F**	**A**
	$4h^2 - 4(0{,}12)h + (0{,}115)^2 = 0$	✓ **SF**	**CA**
	$4h^2 - 0{,}48 + 0{,}013225 = 0$		
	$h = \dfrac{-(-0{,}48) \pm \sqrt{(-0{,}48)^2 - 4(4)(0{,}013225)}}{2(4)}$	✓ **SF**	**CA**
	$h \neq 0{,}077\,\text{m}$ *or* $h = 0{,}04286\,\text{m}$		
	$h = 42{,}86\,\text{mm}$	✓ value of / *waarde van h*	**CA**
			(4)

10.2			
10.2.1	$135° = 135° \times \frac{\pi}{180°} = \frac{3\pi}{4}$ **OR/*OF*** $= 2{,}36$ rad	✓ angle/*hoek in* rad	**A** (1)
10.2.2	Arc length / *booglengte* PQ: $s = r \times \theta$ $s = (15) \times \left(\frac{3\pi}{4}\right)$ $= \frac{45\pi}{4}$ cm **OR/*OF*** $\approx 35{,}34$ cm	✓ **F** ✓ **SF** ✓ arc length/*booglengte* **NPR**	**A** **CA** **CA** (3)
10.2.3	45° **OR/*OF*** $\frac{\pi}{4}$ **OR/*OF*** 0,79 rad	✓ angle/*hoek*	**A** (1)

10.2.4	Area of sector/ *Area van sektor* $= \frac{r^2\theta}{2}$ $= \frac{(15)^2 \times \left(45° \times \frac{\pi}{180°}\right)}{2}$ $= \frac{225\pi}{8}$ cm^2 **OR/*OF*** $\approx 88{,}36$ cm^2 **OR/*OF*** Area of sector/ *Area van sektor* $= \frac{rs}{2}$ $= \frac{(15) \times \left(15 \times 45° \times \frac{\pi}{180°}\right)}{2}$ $= \frac{225\pi}{8}$ cm^2 **OR/*OF*** $\approx 88{,}36$ cm^2	✓ **F** ✓ **SF** ✓ area **OR/*OF*** ✓ **F** ✓ **SF** ✓ area **NPU**	**A** **CA** **CA** **OR/*OF*** **A** **CA** **CA** (3)
10.2.5	1 circumference of pulley/*1 omtrek van katrol* $C = 2\pi r$ **OR / OF** $C = \pi D$ $= 2\pi(15)$ $= \pi(30)$ $= 30\pi \approx 94{,}25\,cm$ $\therefore$ 24 rotations/*rotasies* $= 24 \times 30\pi$ $= 720\pi \approx 2261{,}95$ cm Length of rope required/*lengte van tou benodig* $= (720\pi \div 100)$m + 3 m $\approx 25{,}62$ m	✓ **F** ✓ **SF** ✓circumference/*omtrek* ✓ **M** ✓ conversion to/*herlei na* m ✓ length/*lengte*	**A** **A** **CA** **A** **A** **CA** (6)
			[25]

QUESTION/*VRAAG* 11

11.1			
11.1.1	18 cm	✓ 18	**A** (1)
11.1.2	$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + ... + o_{n-1}\right)$ $5940 = (18)\left(\frac{80+86}{2} + x + 82 + 76\right)$ $330 = x + 241$ $x = 89\text{ cm}$ **OR/*OF*** $A_T = a(m_1 + m_2 + m_3 + ... + m_n)$ $5940 = (18)\left(\frac{80+x}{2} + \frac{x+82}{2} + \frac{82+76}{2} + \frac{76+86}{2}\right)$ $330 = x + 241$ $x = 89\text{ cm}$	✓ **F** **A** ✓ **SF** **CA** ✓**S** **CA** ✓value of/*waarde van x* **CA** **OR/*OF*** ✓ **F** **A** ✓ **SF** **CA** ✓**S** **CA** ✓ value of/*waarde van x* **CA** (4)	



11.2.1	24 cm	✓ 24	**A** (1)
11.2.2	Vol. of a sphere/*van sfeer*: $V = \frac{4}{3}\pi(4)^3$ $= \frac{256}{3}\pi \approx 268{,}08 \text{ cm}^3$ Vol. of cylinder/*van silinder*: $V = \pi(4)^2(24)$ $= 384\pi \approx 1206{,}37 \text{ cm}^3$ Vol. carved off $= 384\pi - \left(3 \times \frac{256}{3}\pi\right)$ *Vol afgekerf* $= 128\pi \text{ cm}^3$ **OR/*OF*** $\approx 402{,}12 \text{ cm}^3$ Mass of wood carved off/*Massa van hout afgekerf* $= \frac{128\pi}{384\pi} \times 1{,}5$ $= 0{,}5 \text{ kg}$	✓**SF** ✓ Vol. of sphere/*van sfeer* ✓**SF** ✓ Vol. of cylinder/*van silinder* ✓ Vol. carved off/*afgekerf* ✓ **M** ✓ Mass carved off/*massa afgekerf*	**A** **CA** **CA** **CA** **CA** **A** **CA** (7)
			[13]

TOTAL/*TOTAAL*: 150