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*

2021

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

Marking Codes/*Nasienkodes*	
A	Accuracy/*Akkuraatheid*
AO	Answer Only/*Slegs antwoord*
CA	Consistent accuracy/*Volgehoue akkuraatheid*
I	Identity/*Identiteit*
F	Correct Formula/*Korrekte formule*
M	Method/*Metode*
NPR	No penalty for rounding/*Geen penaliseering vir afronding*
NPU	No penalty for units/*Geen penaliseering vir eenhede weggelaat*
R	Rounding/*Afronding*
RE	Reason/*Rede*
S	Simplification/*Vereenvoudiging*
SF	Substitution in correct formula/*Vervanging in korrekte formule*
ST	Statement/*Bewering*
ST/RE	Statement with Reason/*Bewering met rede*

These marking guidelines consists of 23 pages.
Hierdie nasienriglyne bestaan uit 23 bladsye.

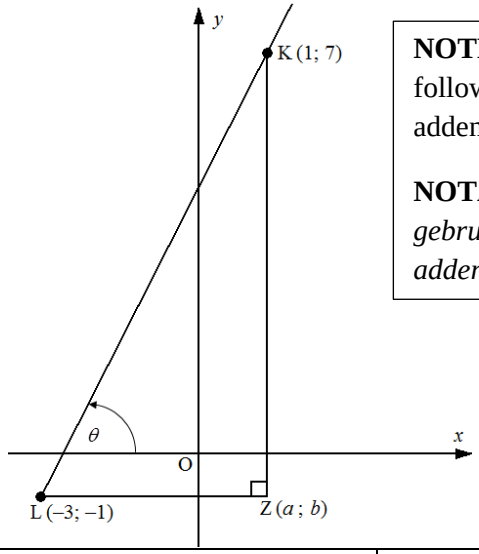
NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in all aspects of the marking guidelines where indicated.
- # Indicates the questions where tolerance range will be applied**:**
  Q4.1 , Q4.2 , Q5.1 , Q8.5

LET WEL:

- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.*
- *Volgehoue akkuraatheid is deurgaans op alle aspekte van die nasienriglyne van toepassing.*
- *# Toon vrae waar Toleransie Wydte (Verdraagsaamheids omvang) toegepas word:*
  Q4.1 , Q4.2 , Q5.1 , Q8.5

QUESTION/*VRAAG* 1



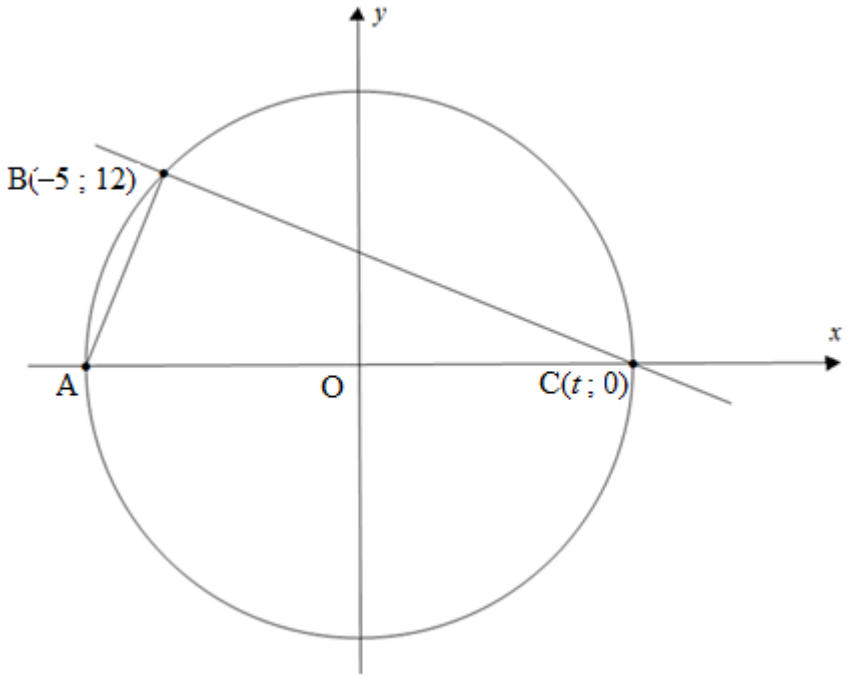
NOTE: if the candidate used (–3 ; 1) follow the marking guidelines in the addendum

NOTA: *Indien die kandidaat* (–3 ; 1) *gebruik volg die nasienriglyne in die addendum*

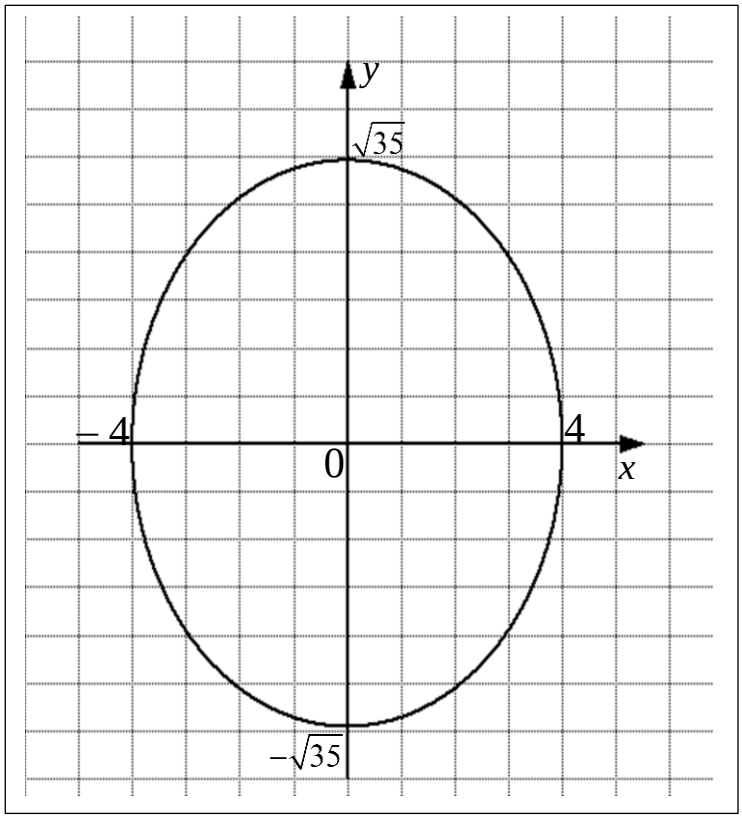
1.1	$a = 1$ $b = -1$	✓value of/*waarde van a* **A** ✓value of/ *waarde van b* **A** (2)
1.2	$KL = \sqrt{(x_K - x_L)^2 + (y_K - y_L)^2}$ $= \sqrt{(1-(-3))^2 + (7-(-1))^2}$ $= \sqrt{80}$ **OR**/*OF* $4\sqrt{5}$ **OR**/*OF* $\approx 8{,}94$	✓ **SF** **A** ✓ Length / *Lengte* **CA** **AO Full marks /*Volpunte*** (2)
1.3	$M\left(\frac{x_K + x_L}{2} ; \frac{y_K + y_L}{2}\right)$ $M\left(\frac{1+(-3)}{2} ; \frac{7+(-1)}{2}\right)$ $M(-1; 3)$ **OR/*OF*** $x_M = \frac{x_1 + x_2}{2}$, $y_M \frac{y_1 + y_2}{2}$ $x_M = \frac{1+(-3)}{2}, y_M = \frac{7+(-1)}{2}$ $M(-1; 3)$	✓ *x*-value/*waarde* **A** ✓ *y*-value /waarde **A** **[Penalty of one mark if not simplified/** ***Penaliseer met een punt indien nie vereenvoudig nie*]** (2) **AO Full marks /*Volpunte***

1.4	$m_{KL} = \frac{y_L - y_K}{x_L - x_K}$ $= \frac{-1-7}{-3-1}$ $= 2$	✓ **SF** **A** ✓gradient/*gradiënt* **CA** **AO Full marks /*Volpunte*** (2)
1.5	$\tan\theta = m = 2$ $\theta \approx 63{,}4°$ **Penalty for rounding/ *Penaliseering vir afronding***	**CA from/ *vanaf* Q/V1.4** ✓ **gradient** **CA** ✓value of /*waarde van* θ (rounded)/ *(afgerond)* **CA** **AO Full marks/ *Volpunte*** (2)
1.6	$y = 2x + c$ $1 = 2(-5) + c$ $c = 11$ $\therefore y = 2x + 11$ **OR/*OF*** $y - y_1 = m(x - x_1)$ $y - 1 = 2(x - (-5))$ $y = 2x + 10 + 1$ $\therefore y = 2x + 11$	✓ gradient/*gradiënt* **CA** ✓**SF** (–5; 1) **A** ✓equation/ *verg* **CA** **OR/*OF*** ✓ gradient/*gradiënt* **CA** ✓ **SF** (–5; 1) **A** ✓ equation/ *vergelyking* **CA** (3)
1.7	$\therefore y = \frac{3}{2}x + \frac{17}{2}$ LHS/*LK* $= -2$ RHS/*RK* $= \frac{3}{2}(-4) + \frac{17}{2} = \frac{5}{2}$ LHS/*LK* $\neq$ RHS/*RK* $\therefore$ the point does NOT lie on the line $\therefore$ *die punt lê NIE op die lyn* **OR/*OF*** $m_{KL} = 2$ $m_{New/Nuwe} = \frac{y_1 - y_2}{x_1 - x_2} = \frac{-2-1}{-4+5} = -3$ $m_{New/Nuwe} \neq m_{KL}$ $\therefore$ the point does NOT lie on the line $\therefore$ *die punt lê NIE op die lyn* **OR/*OF*** $y + 2 = 2(x + 4)$ $y = 2x + 6$ $\therefore (-4\,;-2)$ does NOT lie on $y = 2x + 11$ *lê NIE op* $y = 2x + 11$	✓ **M** LHS/*LK* $\neq$ RHS/*RK* **CA** ✓conclusion/ *gevolgtrekking* **CA** **OR/*OF*** ✓ **M** $m_{New/Nuwe} \neq m_{KL}$ **A** ✓conclusion/ *gevolgtrekking* **CA** **OR/*OF*** ✓**M** equation/*vergelyking* **CA** ✓conclusion/ *gevolgtrekking* **CA** (2) **[15]**

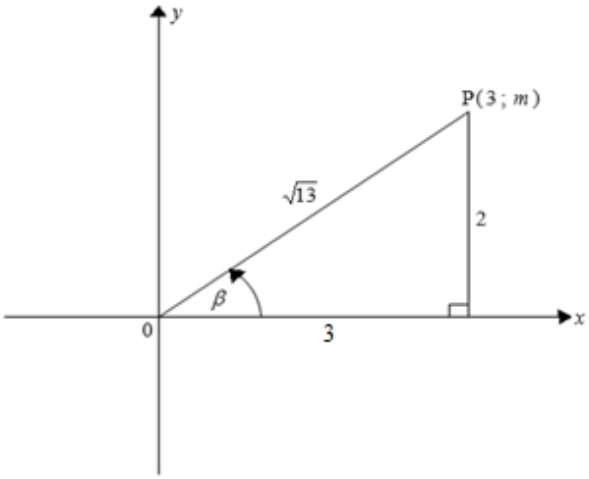
QUESTION/*VRAAG* 2



2.1.1	$r^2 = x^2 + y^2$ $= (-5)^2 + (12)^2$ $= 169$ $\therefore x^2 + y^2 = 169$ *OR / OF* $x^2 + y^2 = 13^2$ $x = \pm\sqrt{169 - y^2}$ *OR / OF* $y = \pm\sqrt{169 - x^2}$	✓ **SF** **A** ✓equation/ *vergelyking* **CA** **AO Full marks/ *Volpunte*** (2)
2.1.2	$t = \sqrt{169} = 13$	✓value of / *waarde van* t **CA** (1)
2.1.3	$m_{OB} = -\frac{12}{5}$ $m_{\text{tang/raaklyn}} = \frac{5}{12}$ $y = mx + c$ OR/*OF* $y - y_1 = m(x - x_1)$ $12 = \frac{5}{12}(-5) + c$ *OR / OF* $y - 12 = \frac{5}{12}(x - (-5))$ $c = \frac{169}{12}$ $\therefore y = \frac{5}{12}x + \frac{169}{12}$ **OR/OF**	✓ gradient/*gradiënt* **A** ✓ gradient/*gradiënt* **CA** ✓substitution/ *vervanging* (–5; 1) **A** ✓ equation/ *vergelyking* **CA** **OR/OF**

	$x.x_1 + y.y_1 = r^2$ $x(-5) + y(12) = 169$ $12y = 5x + 169$ $y = \frac{5}{12}x + \frac{169}{12}$	✓ substitution/ *vervanging* (–5; 1) **A** ✓ 169 **CA** ✓ **S** **CA** ✓ equation/ *vergelyking* **CA** (4)
2.2		✓both *x*-intercepts/ *beide x-afsnitte* **A** ✓both *y*-intercepts *beide y-afsnitte* **A** ✓elliptical shape/eliptiese *vorm* **CA** (3) **[10]**

QUESTION/*VRAAG* 3

3.1.1	 $\left(\sqrt{13}\right)^2 = (3)^2 + (m)^2$ $13 = 9 + m^2$ $m^2 = 4$ **OR/OF** $m = \sqrt{\left(\sqrt{13}\right)^2 - 3^2}$ $\therefore m = 2$	✓ value of / *waarde van* m **A** **AO Full marks / *Volpunte*** (1)
3.1.2	$\sec^2\beta + \tan^2\beta$ $= \left(\frac{\sqrt{13}}{3}\right)^2 + \left(\frac{2}{3}\right)^2$ $= \frac{13}{9} + \frac{4}{9}$ $= \frac{17}{9}$ **OR/*OF*** $\sec^2\beta + \tan^2\beta$ $= 1 + \tan^2\beta + \tan^2\beta$ $= 1 + 2\tan^2\beta$ $= 1 + 2\left(\frac{2}{3}\right)^2$ $= 1 + \frac{8}{9}$ $= \frac{17}{9}$	**CA from/ *vanaf* Q/V3.1.1** ✓ ratio of/ *verh* $\sec\beta$ **A** ✓ ratio of/ *verh* $\tan\beta$ **CA** ✓ simplification/ *vereenv* **CA** ✓ value of/ *waarde van* $\sec^2\beta + \tan^2\beta$ **CA** **OR/*OF*** ✓ **I** **A** ✓ **S** **A** ✓ ratio of / *verh van* $\tan\beta$ **CA** ✓ value of/*waarde van* $\sec^2\beta + \tan^2\beta$ **CA** (4)

3.2.1	$\cos\theta = \frac{1}{2}$ $\therefore \theta = 60°$	✓value of/*waarde van* θ **A** (1)
3.2.2	$\tan\alpha = -1$ ref/verw.$\angle = 45°$ $\alpha = 180° - 45°$ $\alpha = 135°$ $\quad 0° \le \alpha \le 180°$	✓ref./ *verw* $\angle$ **A** ✓2nd quadrant/ *2de kwadrant* **A** ✓value/*waarde* **CA** **AO Full marks / *Volpunte*** (3)
3.2.3	$\cos(\alpha - \theta)$ $= \cos(135° - 60°)$ $= \cos 75°$ $\approx 0,26$ **OR**/OF $\frac{\sqrt{6} - \sqrt{2}}{4}$	✓substitution/ *vervanging* **CA** ✓value of/*waarde van* $\cos(\alpha - \theta)$ **CA** **NPR** **AO Full marks / *Volpunte*** (2)
3.3	$2\tan x + 0,924 = 0$ $2\tan x = -0,924$ $\tan x = -0,462$ ref/*verw*$\angle \approx 24,8°$ $x \approx 180° - 24,8°$ or/*of* $x \approx 360° - 24,8°$ $\therefore x \approx 155,2°$ or/*of* $x \approx 335,2°$	✓**S** **A** ✓ ref./*verw*$\angle$ **CA** ✓ $x \approx 155,2°$ **CA** ✓ $x \approx 335,2°$ **CA** **NPR** (4) **[15]**

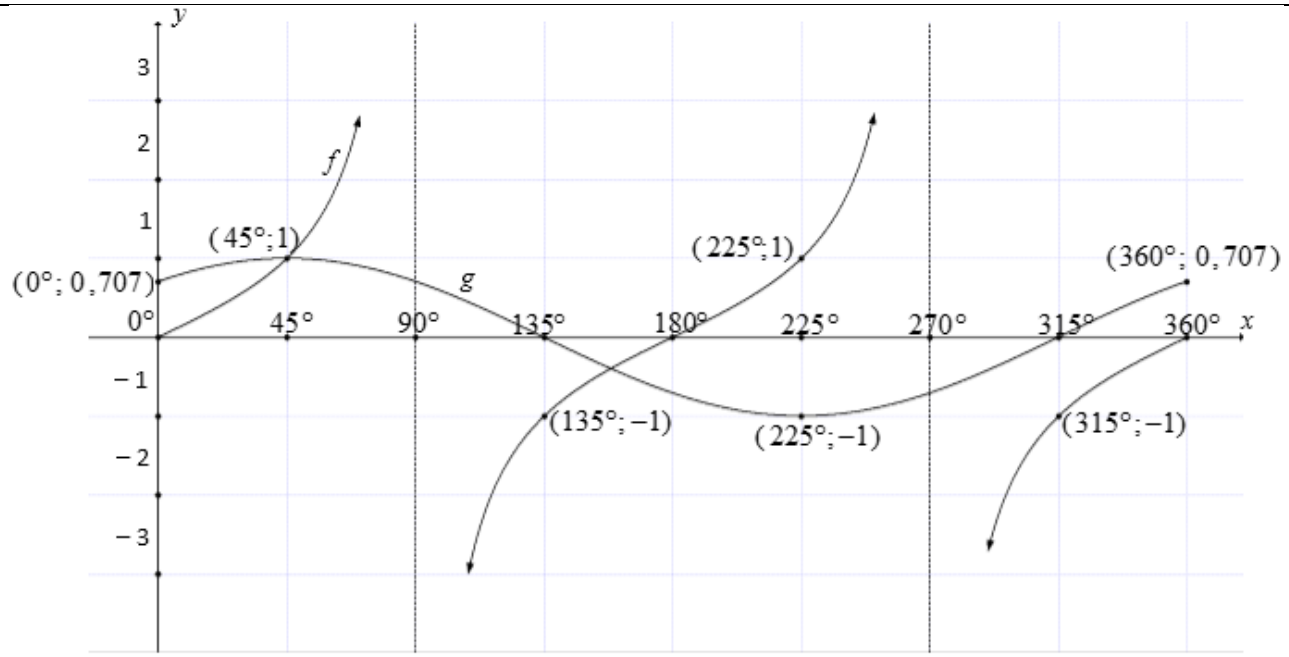
QUESTION/*VRAAG* 4

4.1	$\cos\theta(\tan\theta + \cot\theta)$	
	$= \cos\theta\left(\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\right)$	✓**I** $\frac{\sin\theta}{\cos\theta}$ **A** ✓**I** $\frac{\cos\theta}{\sin\theta}$ **A**
	$= \cos\theta\left(\frac{\sin^2\theta + \cos^2\theta}{\cos\theta\cdot\sin\theta}\right)$	✓**S** **CA**
	$= \cos\theta\left(\frac{1}{\cos\theta\cdot\sin\theta}\right)$	✓**I** **A**
	$= \frac{1}{\sin\theta}$ OR/*OF* $\text{cosec}\,\theta$	✓**S** **CA**
	OR/*OF*	**OR/*OF***
	$\cos\theta(\tan\theta + \cot\theta)$	
	$= \cos\theta\cdot\tan\theta + \cos\theta\cdot\cot\theta$	✓**M** expanding/*uitbrei* **A**
	$= \cos\theta\cdot\frac{\sin\theta}{\cos\theta} + \cos\theta\cdot\frac{\cos\theta}{\sin\theta}$	✓**I** $\frac{\sin\theta}{\cos\theta}$ **A** ✓**I** $\frac{\cos\theta}{\sin\theta}$ **A**
	$= \sin\theta + \frac{\cos^2\theta}{\sin\theta}$	
	$= \frac{\sin^2\theta + \cos^2\theta}{\sin\theta}$	✓**S** **A**
	$= \frac{1}{\sin\theta}$ *OR / OF* $\text{cosec}\,\theta$	✓**I** **A**
	OR/*OF*	**OR/*OF***
	$\cos\theta\left(\tan\theta + \frac{1}{\tan\theta}\right)$	✓**I** $\frac{1}{\tan\theta}$ **A**
	$= \cos\theta\cdot\left(\frac{\tan^2\theta + 1}{\tan\theta}\right)$	✓**S** **A**
	$= \cos\theta\cdot\left(\frac{\sec^2\theta}{\tan\theta}\right)$	✓**I** $\sec^2\theta$ **A**
	$= \cos\theta\cdot\left(\frac{1}{\cos^2\theta}\cdot\frac{\cos\theta}{\sin\theta}\right)$	✓**I** $\frac{1}{\cos^2\theta}\cdot\frac{\cos\theta}{\sin\theta}$ **A**
	$= \frac{1}{\sin\theta}$ *OR / OF* $\text{cosec}\,\theta$	✓**S** **CA**
		(5)

4.2	$\frac{\sin^2(180° + B)\cdot\text{cosec}(\pi - B)}{\sec(2\pi - B)\cdot\cos(180° - B)}$ $= \frac{\sin^2 B\cdot\text{cosec}B}{\sec B\cdot(-\cos B)}$ $= \frac{\sin^2 B\cdot\frac{1}{\sin B}}{-\frac{1}{\cos B}\cdot\cos B}$ $= -\sin B$ **OR/*OF*** $= \frac{\sin^2(180° + B)\cdot\frac{1}{\sin(\pi - B)}}{\frac{1}{\cos(2\pi - B)}\cdot\cos(180° - B)}$ $= \frac{\sin^2 B\cdot\frac{1}{\sin B}}{\frac{1}{\cos B}\cdot(-\cos B)}$ $= \frac{\sin^2 B\cdot\frac{1}{\sin B}}{-\frac{1}{\cos B}\cdot\cos B}$ $= -\sin B$	✓ $\sin^2 B$ **A** ✓ $\text{cosec}\,B$ **A** ✓ $\sec B$ **A** ✓ $-\cos B$ **A** ✓**I** $\frac{1}{\sin B}$ **A** ✓**I** $\frac{1}{\cos B}$ **A** ✓**S** **CA** **OR/*OF*** ✓**I** $\frac{1}{\sin(\pi - B)}$ **A** ✓**I** $\frac{1}{\cos(2\pi - B)}$ **A** ✓ $\sin^2 B$ **A** ✓ $\sin B$ **A** ✓ $\cos B$ **A** ✓ $-\cos B$ **A** ✓S **CA** (7)
		[12]

QUESTION 5

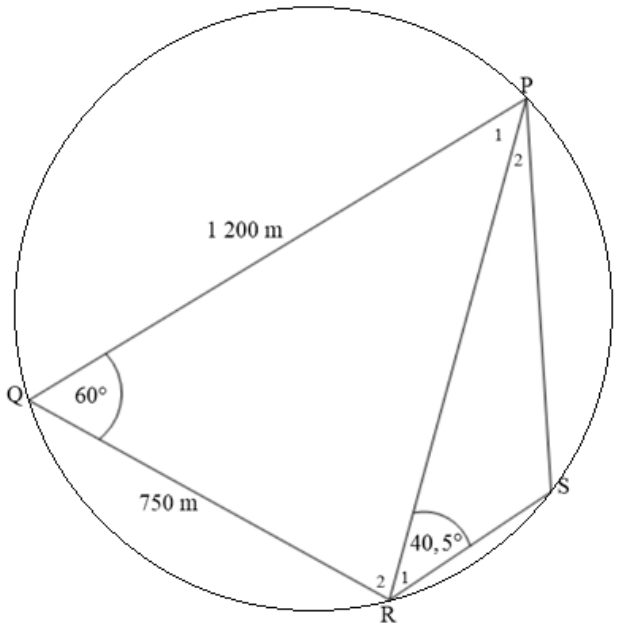
5.1



f		g	
✓shape/*vorm*	**A**	✓shape/*vorm*	**A**
✓*x*-intercepts/*x-afsnitte*	**A**	✓*x*-intercepts/*x-afsnitte*	**A**
✓asymptotes/ *asimptote*	**A**	✓turning points/ *draaipunte*	**A**
✓$(0^o\ ;\ 0)$	**A**	✓endpoints/*eindpunte*	**A**
			(8)

5.2.1	$x = 90°$ and/en $x = 270°$	✓90° **A** ✓270° **A** (2)
5.2.2	$x \in (90^o\ ;\ 135°]$ or/*of* x=180° **OR/*OF*** $90° < x \leq 135°$ or/*of* x=180°	✓ $x \in (90^o\ ;\ 135°]$ **CA** ✓ x=180° **CA** **OR/*OF*** ✓ $90° < x \leq 135°$ **CA** ✓ x=180° **CA** (2) **[12]**

QUESTION/*VRAAG* 6

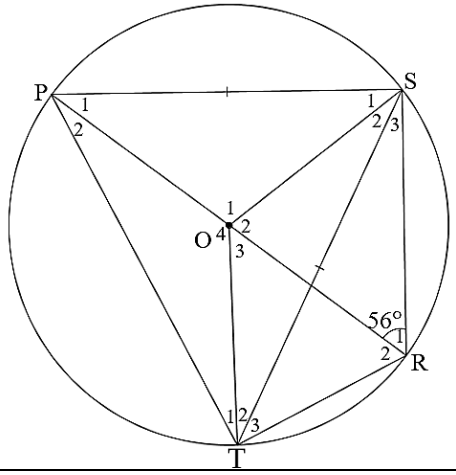


6.1	$PR^2 = QR^2 + PQ^2 - 2QR \cdot PQ\cos Q$ $= (750)^2 + (1200)^2 - 2(750)(1200)\cos 60°$ $= 1\,102\,500$ $\therefore PR = 1\,050$ m	✓cosine rule/ *reël* **A** ✓**SF** **A** ✓value/PR/*wrde* **CA** (3)
6.2	$\hat{S} = 120°$	✓size of/*grootte van* $\hat{S}$ **A** (1)
6.3	$\frac{PS}{\sin R_1} = \frac{PR}{\sin S}$ $\frac{PS}{\sin 40,5°} = \frac{1\,050}{\sin 120°}$ $PS = \frac{1\,050 \sin 40,5°}{\sin 120°}$ $\therefore PS \approx 787,41$m	✓sine rule/ *reël* **A** ✓ **SF** **CA** ✓value of PS/ *waarde van* **CA** **NPR** (3)
6.4	Area/*Oppervlakte* $\Delta QPR = \frac{1}{2} QR \cdot QP \sin Q$ $= \frac{1}{2}(750)(1\,200)\sin 60°$ $\approx 389\,711,43$ m^2	✓ area rule/*reël* **A** ✓ **SF** **A** ✓value of/ *waarde van* **CA** (3) **[10]**

QUESTION/*VRAAG* 7

7.1	are equal/ *is gelyk*	✓answer/ *antwoord*	**A** (1)

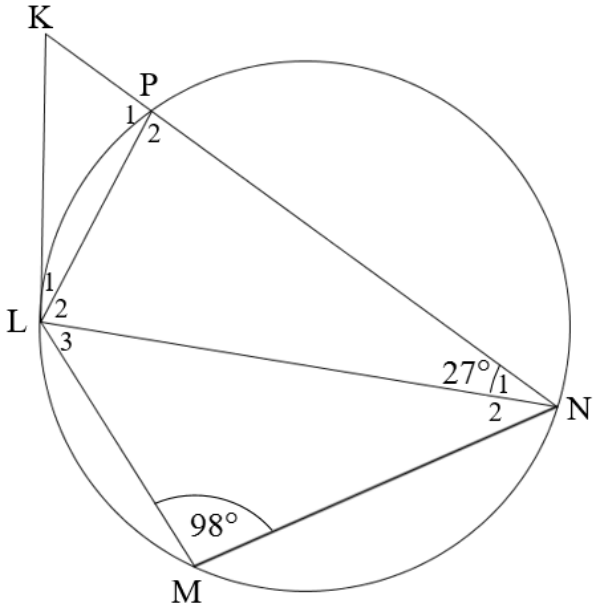
7.2



7.2.1(a)	$P\hat{T}S = \hat{R}_1 = 56°$ ($\angle$s in the same segment/ *dieselfde segment*) $O\hat{S}R = \hat{R}_1 = 56°$ ($\angle$s opp. = sides) /$(\angle^e$ *teenoorg = sye*$)$ $T\hat{P}S = P\hat{T}S = 56°$ [$\angle$s opp. = sides/*teenoorg = sye*; **OR**/OF = chords subtend/ *= koorde onderspan =* $\angle^e$]	✓**ST** ✓**RE** **A** ✓**ST** ✓**RE** **A** ✓**ST** **A** (5)
7.2.1(b)	$P\hat{S}R = 90°$ ($\angle$s in semicircle) /$(\angle^e$ *in halfsirkel*$)$ $\hat{P}_1 + 90° + 56° = 180°$ (sum of $\angle$s of Δ) /$(som\,van\angle^e in\,\Delta)$ $\therefore \hat{P}_1 = 34°$ **OR/*OF*** $\hat{O}_1 = 112°$ [$\angle$ at centre = $2\times\angle$ at circum./ *mdpts*$\angle = 2\times omtrk\angle$] $\therefore \hat{P}_1 = \hat{S}_1 = 34°$ ($\angle$s opp. = sides/*teenoorg = sye*)	✓**ST** ✓**RE** **A** ✓value of / *waarde van* $\hat{P}_1$ **CA** **OR/*OF*** ✓**ST** ✓**RE** **A** ✓value of / *waarde van* $\hat{P}_1$ **CA** (3)
7.2.1(c)	$34° + \hat{P}_2 = 56°$ $\therefore \hat{P}_2 = 22°$ $\hat{S}_3 = \hat{P}_2 = 22°$ ($\angle$s in same segment) /$(\angle^e$*in dieslfde segment*$)$ **OR/*OF*** $\hat{S}_1 + \hat{S}_2 + \hat{S}_3 = 90°$ ($\angle$ in the semi-circle) /$(\angle^e$ *in halfsirkel*$)$ $\hat{S}_1 + \hat{S}_2 = 180° - 112°$ (sum of $\angle$s of Δ) /$(som\,van\angle^e in\,\Delta)$ $= 68°$ $\therefore \hat{S}_3 = 90° - 68° = 22°$	✓**ST** **CA** ✓**ST** **CA** ✓**RE** **A** **OR/*OF*** ✓**ST/RE** **CA** ✓**ST/RE** **A** ✓**ST** **CA**

	OR/*OF* $\hat{O}_2 + \hat{O}_3 = 112°$ $\left[\begin{matrix}\angle \text{at centre} = 2\times\angle \text{at circum.}\\ mdpts\angle = 2\times omtrk\angle\end{matrix}\right]$ $\hat{S}_2 = \hat{T}_2 = 34°$ $[\angle\text{s opp. = sides/}teenoorg = sye]$ $\therefore \hat{S}_3 = 90° - 68° = 22°$ $\left[\begin{matrix}\angle \text{ in the semi-circle/}\\ \angle\ in\,halfsirkel\end{matrix}\right]$	**OR/*OF*** ✓**ST/RE** **CA** ✓**ST/RE** **A** ✓**ST** **CA** (3)
7.2.2	$\hat{O}_3 = 44°$ $\left(\begin{matrix}\angle \text{at centre} = 2\times\angle \text{at circum./}\\ mdpts\angle = 2\times omtrk\angle\end{matrix}\right)$ $\hat{O}_3 \neq \hat{R}_1$ $\therefore$ OT is not parallel to SR (alt. $\angle$s are not equal) $\therefore$ *OT is nie parallel an SR* $\left(verw\ \angle^e\ nie\ gelyk\right)$ **OR/*OF*** $\hat{O}_3 = 44°$ $\left(\begin{matrix}\angle \text{at centre} = 2\times\angle \text{at circum./}\\ mdpts\angle = 2\times omtrk\angle\end{matrix}\right)$ $\hat{O}_2 = 68°$ $\left(\begin{matrix}\angle \text{at centre} = 2\times\angle \text{at circum./}\\ mdpts\angle = 2\times omtrk\angle\end{matrix}\right)$ $S\hat{O}T + O\hat{S}R = 44° + 68° + 56° = 168° \neq 180°$ $\therefore$ OT is not parallel to SR (co-int $\angle$s $\neq 180°$) $\therefore$ *OT is nie parallel an SR* $\left(ko\text{-}binne\ \angle\text{s}\ \neq 180°\right)$ **OR/*OF*** $\hat{S}_2 = \hat{T}_2 = 34°$ $[\angle\text{s opp. = sides/}teenoorg = sye]$ $\hat{S}_3 = 90° - 68° = 22°$ $\left[\begin{matrix}\angle \text{ in the semi-circle/}\\ \angle^e in\,dieslfde\,segment\end{matrix}\right]$ $\hat{T}_2 \neq \hat{S}_3$ $\therefore$ OT is not parallel to SR (alt. $\angle$s are not equal) $\therefore$ *OT is nie parallel an SR* $\left(verwisselende\ \angle^e\ nie\ gelyk\right)$	✓**ST** ✓**RE** **A** ✓**RE** **A** **OR/*OF*** ✓**ST** **A** ✓ **ST** **A** ✓**RE** **A** **OR/*OF*** ✓**ST** **A** ✓ **ST** **A** ✓**RE** **A** (3)
		[15]

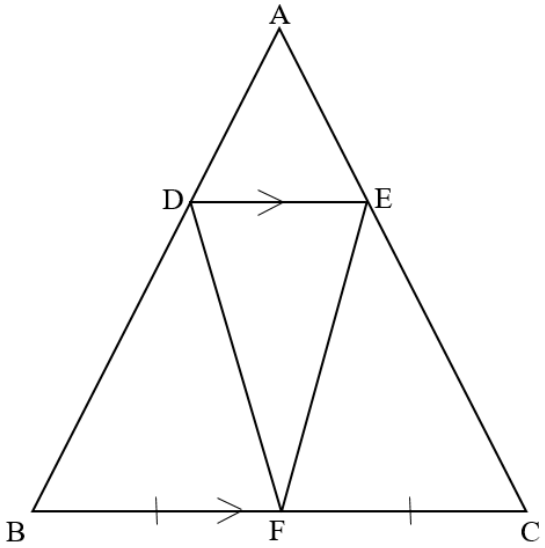
QUESTION/*VRAAG* 8



8.1	$\hat{M} = 98° \neq 90°$ $\therefore$ LN is not a diameter ($\angle$ subtended by LN $\neq 90°$) $\therefore$ *LN is nie 'n middellyn* $(\angle$ *deur LN onderspan* $\neq 90°)$ **OR/*OF*** $\hat{P}_2 + 98° = 180°$ (Opp. $\angle$s of cyclic quad.) /$(teens\angle^e KVHK)$ $\hat{P}_2 = 82° \neq 90°$ $\therefore$ LN is not a diameter ($\angle$ subtended by LN $\neq 90°$) $\therefore$ *LN is nie 'n middellyn* $(\angle$ *deur LN onderspan* $\neq 90°)$	✓**ST** $\hat{M} = 98° \neq 90°$ **A** ✓**RE** **A** **OR/*OF*** ✓**ST** $\hat{P}_2 = 82° \neq 90°$ **A** ✓**RE** **A** (2)
8.2.1	$\hat{P}_2 + 98° = 180°$ (Opp. $\angle$s of cyclic quad.) $(teenst\angle^e van$ 'n kvhk $)$ $\hat{P}_2 = 82°$	✓**ST / RE** **A** ✓ $\hat{P}_2 = 82°$ **A** (2)
8.2.2	$\hat{P}_1 + 82° = 180°$ ($\angle$s on straight line) /$(\angle op 'n\ r.lyn)$ $\therefore \hat{P}_1 = 98°$ **OR/*OF*** $\hat{P}_1 = 98°$ (Ext. $\angle$ of a cyclic quad.) /$(buite\angle van\ \ kvhk)$	✓**ST / RE** **A** ✓ $\hat{P}_1 = 98°$ **CA** **OR/*OF*** ✓ **ST / RE** **A** ✓ $\hat{P}_1 = 98°$ **CA** (2)
8.2.3	$\hat{L}_1 = 27°$ (tan-chord theorem) / *rkl.koord st.*	✓**ST** **A** ✓**RE** **A** (2)

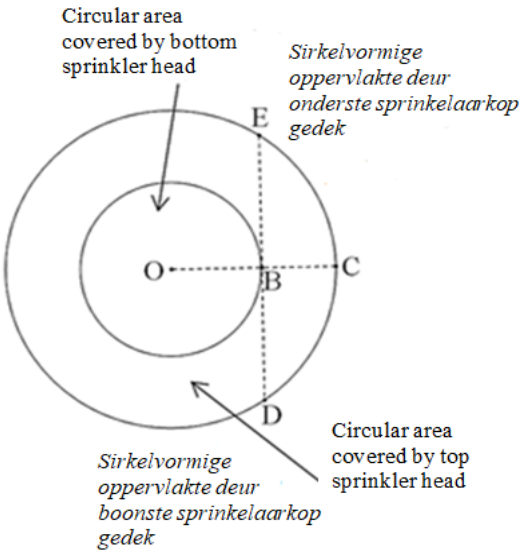
8.3.1	$\hat{K}$ is common/ *gemeen* $\hat{L}_1 = \hat{N}_1$ (both = 27° / tan – *chord / rkl – koord*) $\hat{P}_1 = \hat{KLN}$ (3rd ∠ of Δ / 3*de* ∠ *van* Δ) $\therefore \Delta KLP \| \| \| \Delta KNL$ (∠,∠,∠) **OR** Equiangular/*gelykhoekig*	✓**ST** **A** ✓**ST** **A** ✓**ST/RE** **A** (3)
8.3.2	$\frac{KL}{KN} = \frac{KP}{KL}$ (|||s) $\therefore\ KL^2 = KN.KP$	✓**ST** **A** ✓**RE** **A** (2)
8.4	$KL^2 = KN.KP$ $(6)^2 = 13.KP$ $\therefore$ KP ≈ 2,77 units/*eenhede*	✓subst/ *verv* **A** ✓value of / *waarde van* KP **A** **NPR** (2)
8.5	$\hat{K} + 27° + 98° = 180°$ (∠s of/*van* Δ) $\therefore \hat{K} = 55°$ $\hat{K} + \hat{M} = 55° + 98° \neq 180°$ $\therefore$ KLMN is not a cyclic quad. $\therefore$ *KLMN is nie 'n kvhk nie* **OR/OF** $\hat{K} + \hat{L}_1 + = 86°$ (ext∠ = sum of opp.int ∠*s* / *buite∠ = som van teenoost.binne∠e*) $\therefore \hat{K} = 55°$ $\hat{K} + \hat{M} = 55° + 98° \neq 180°$ $\therefore$ KLMN is not a cyclic quad. $\therefore$ *KLMN is nie 'n kvhk nie*	✓**ST/RE** **CA** ✓value of / *waarde van* K **A** ✓Conclusion/*gevolgt.* **A** **OR/OF** ✓**ST/RE** **CA** ✓value of / *waarde van* K **A** ✓Conclusion/*gevolgt.* **A** (3)
		[18]

QUESTION/*VRAAG* 9



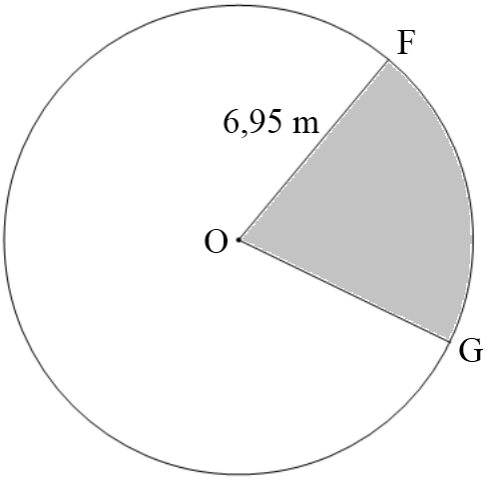
9.1.1	$\frac{AB}{DB}=\frac{AC}{EC}$ (Prop. theorem/ *ewerd.st*; DE || BC) $\frac{1,8}{DB}=\frac{3}{2}$ $DB=\frac{2}{3}\times 1,8\,m$ $\therefore DB=1,2\,m$	✓**ST/RE** **A** ✓length of / *lengte van* DB **A** (2)
9.1.2	$AD=\frac{1,8}{3}=0,6\,m$ or/*of* $AD=1,8-1,2=0,6\,m$ $\therefore\ DF=\frac{3}{2}(0,6\,m)=0,9\,m$	✓**M** C**A** ✓length of/ *lengte van* DF **CA** (2)
9.2	$\frac{CF}{FB}=\frac{1}{1}=1$ (BF = FC; F is the midpoint of/ *is die middelpunt van* BC) $\frac{CE}{EA}=\frac{2}{1}=2$ $\therefore \frac{CF}{FB}\neq\frac{CE}{EA}$ $\therefore$ EF is NOT parallel to/*aan* AB (sides are not prop./ *sye nie in verhouding*) **OR/*OF*** BF = FC; F is the midpoint of/ *mdpt van* BC $AE\neq EC$; ; E is NOT the midpoint of/ *is NIE die middelpunt van* AC $\therefore$ EF is NOT parallel to/*aan* AB (FE not joining midpoints of two sides of a triangle/ *verbind nie twee middelpunte van 'n driehoek*)	✓**ST** **A** ✓**ST** **A** ✓Conclusion/ *gevolg.* **CA** **OR/*OF*** ✓ F is the midpoint of/ *mdpt van* BC **A** ✓ E is NOT the midpoint of/ *is NIE die middelpunt van* AC **A** ✓Conclusion/ *gevolg* **CA** (3)
		[7]

QUESTION/*VRAAG* 10



10.1.1(a)	$BC = 6{,}95 - 4 = 2{,}95\text{ m}$	✓height of segment/ *hoogte van segment* **NPU**	**A** (1)
10.1.1(b)	$h = 2{,}95\text{ m}$ and/*en* $d = 13{,}9\text{ m}$ $4h^2 - 4dh + x^2 = 0$ $4(2{,}95)^2 - 4(13{,}9)(2{,}95) + x^2 = 0$ $-129{,}21 + x^2 = 0$ $x^2 = 129{,}21$ $x = 11{,}36$ $ED \approx 11{,}37$ **OR/OF** **Using the half chord of /*Gebruik halfkoord van* PQ** $\frac{1}{2}ED = \sqrt{(6{,}95)^2 - (4)^2}$ $\frac{1}{2}ED = \sqrt{32{,}3025}$ $\frac{1}{2}ED = 5{,}68$ $ED \approx 11{,}37$	✓formula/ *formule* ✓**SF** ✓**S** ✓length /*lengte* **OR/OF** ✓ Pythagoras ✓ **SF** ✓**S** ✓length /*lengte* **NPR** **NPU**	**A** **CA** **CA** **CA** **A** **CA** **CA** **CA** (4)

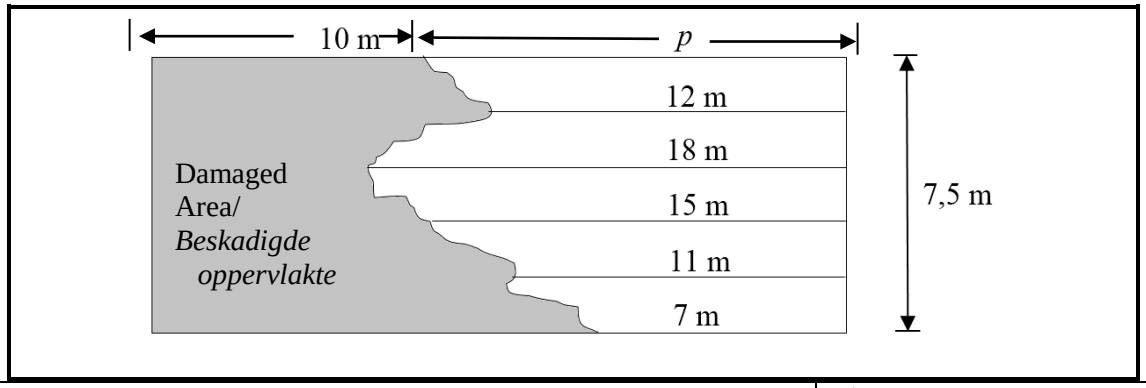
10.1.2



10.1.2(a)	angle of sector/ *hoek van sektor*, $\hat{FOG} = 20\% \times 2\pi$ $= \frac{2}{5}\pi = 1,26\,\text{rad}$ **OR/OF** angle of sector/*hk van sektor*, $\hat{FOG} = 360° \times \frac{20}{100} = 72°$ $72° = 72° \times \frac{\pi}{180°}$ $= \frac{2}{5}\pi$ **OR / OF** $1,26\,\text{rad}$ **OR/OF** Circmf. / *Omtrek* $= 2\pi r$ $= 2\pi(6,95)$ $= 43,67\text{m}$ $20\% \times 43,67\text{m} = 8,73$ $s = r\theta$ $8,73 = 6,95\theta$ $\theta = 1,26\,\text{rad}$	✓**M** **A** ✓✓ radian/ *radiaal* **CA** **OR/OF** ✓angle size/ *hoek grootte* **A** ✓**M** **A** ✓radian/ *radiaal* **A** **OR/OF** ✓Circumf. / *omtrek* **A** ✓**M** **CA** ✓ radian/ *radiaal* **CA** **NPR NPU** (3)

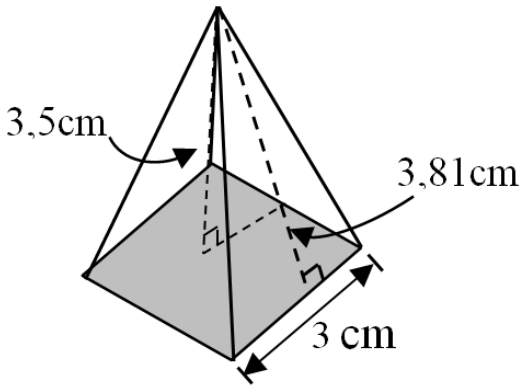
10.1.2(b)	$A = \frac{r^2\theta}{2}$ $= \frac{(6{,}95)^2(1{,}26)}{2}$ $\approx 30{,}43\ m^2$ **OR/*OF*** $A = \frac{r\,s}{2}$ $= \frac{(6{,}95)(8{,}73)}{2}$ $\approx 30{,}43\ m^2$ $A = 20\% \times \pi r^2$ $= 20\% \times \pi (6{,}95)^2$ $\approx 30{,}35\,m^2$	✓Formula/ *formule* **A** ✓**SF** **A** ✓area/ *oppervlakte* **CA** **NPU** **OR/*OF*** ✓Formula/ *formule* **A** ✓**SF** **A** ✓area/ *oppervlakte* **CA** **NPU** **NPR** (3)
10.2.1	$n = \frac{18}{3600}$ $n(\text{in rev/sec/}sek) = 0{,}005\ rev/\text{sec}/\ sek$ $n(\text{in rad/sec/}sek) = 0{,}005\ rev/\text{sec}/\ sek \times 2\pi$ $= 0{,}01\pi\ rad/\text{sec}/\ sek\ or/of$ $0{,}03141..rad/\text{sec}/\text{se}k$	✓**M** n (in rev/sec/*sek*) **A** ✓value of/ *waarde van* n **CA** **NPU NPR** **AO Full marks/ *Volpunte*** (2)
10.2.2	$D = 2\times 10\text{ m} = 20\text{ m}$ $v = \pi D n$ **OR/OF** $v = 2\pi r n$ $= \pi \times 20 \times \left(\frac{18}{3600}\right)$ $= 2\pi \times 10 \times \left(\frac{18}{3600}\right)$ $= 0{,}1\pi$ m/s **OR/OF** $\approx 0{,}31$ m/s	✓Formula/ *formule* **A** ✓**SF** **CA** ✓circum.velocity/ *omtrekssnelheid* **CA** **NPU** **NPR** (3)
10.2.3	$\omega = 2\pi n$ $= 2\pi\left(\frac{18}{3600}\right)$ $= 0{,}01\pi$ rad/sec/*sek* **OR/**OF $\approx 3{,}14\times 10^{-2}$ rad/sec/ *sek*	✓Formula/ *formule* **A** ✓**SF** **CA** ✓ang.velocity/ *hoeksnelheid* **CA** **NPU** **NPR** (3)
		[19]

QUESTION 11



11.1.1	Area = length × breadth/ *Oppervlakte = lengte × breedte* $187,5 = \text{length} \times 7,5$ **OR/*OF*** $\text{length / } lengte = \frac{A}{b} = \frac{187,5}{7,5}$ $\text{length/ } lengte = 25\,\text{m}$	✓**M** **A** ✓length/*lengte* **A** **AO Full marks/ *Volpunte*** (2)
11.1.2	$p = 15\,\text{m}$	✓values of/*waarde van p* **CA** (1)
11.1.3	$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + ... + o_{n-1}\right)$ $= 1,5\left(\frac{15+7}{2} + 12 + 18 + 15 + 11\right)\text{m}^2$ $= 1,5\,(11 + 12 + 18 + 15 + 11)\,\text{m}^2$ $= 100,50\ \text{m}^2$ $\text{Damaged area/ } beskadigde\ oppervlakte = 187,5 - 100,50 = 87\text{m}^2$ It will take 87 × 0, 25 hours = 21, 75 hours to repair the damaged area *Dit sal* $87 \times 0,25$ *uur* $= 21,75$ *ure vat om die beskadigde oppervlakte te herstel* **OR/OF** $A_T = a\,(m_1 + m_2 + m_3 + ... + m_n)$ $= 1,5\left(\frac{15+12}{2} + \frac{12+18}{2} + \frac{18+15}{2} + \frac{15+11}{2} + \frac{11+7}{2}\right)\text{m}^2$ $= 1,5\,(13,5 + 15 + 16,5 + 13 + 9)\,\text{m}^2$ $= 100,50\ \text{m}^2$ $\text{Damaged area/ } beskadigde\ oppervlakte = 187,5 - 100,50 = 87\text{m}^2$ It will take 87 × 0, 25 hours = 21, 75 hours to repair the damaged area *Dit sal* $87 \times 0,25$ *uur* $= 21,75$ *ure vat om die beskadigde oppervlakte te herstel* **OR/OF**	✓formula/*formule* **A** ✓value of/ *waarde van a* **A** ✓**SF** **CA** ✓value of/*waarde van* A_T **CA** ✓87m^2 **CA** ✓time/*tyd* **CA** **OR/OF** ✓**F** **A** ✓value of/ *waarde van a* **A** ✓**SF** **CA** ✓value of/*waarde van* A_T **CA** ✓87m^2 **CA** ✓Time/*tyd* **CA** **OR/OF**

	$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + ... + o_{n-1}\right)$ $= 1,5\left(\frac{10+18}{2} + 13 + 7 + 10 + 14\right)\text{m}^2$ $= 1,5\left(14 + 13 + 7 + 10 + 14\right)\text{m}^2$ $= 87\,\text{m}^2$ It will take $87 \times 0,25$ hours $= 21,75$ hours to repair the damaged area *Dit sal* $87 \times 0,25\,uur = 21,75\,ure$ *vat om die beskadigde oppervlakte te herstel*	✓**F** **A** ✓value of/ *waarde van a* **A** ✓NEW ordinates/*NUWE ordinate* **CA** ✓**SF** **CA** ✓value of/*waarde van* A_T **CA** ✓Time/*tyd* **CA** (6)

11.2		
11.2.1	$1\ell = 1\,000\ \text{cm}^3$ $1{,}5\ell = 1500\ \text{cm}^3$	✓value of/ *waarde van volume* **A** (1)
11.2.2	$\text{TSA/TBO} = 4\left(\frac{1}{2}\text{side length of base} \times \text{slant height}\right) + (\text{side length})^2$ / $= 4 \times \left[\frac{1}{2}(\textit{sylengte van basis}) \times (\textit{skuinshoogte})\right] + (\textit{sylengte})^2$ $= 4\left(\frac{1}{2} \times 3 \times 3{,}81\right) + (3 \times 3)$ $= 22{,}86 + 9$ $= 31{,}86\,\text{cm}^2$	✓**F** **A** ✓**SF** **A** ✓ value of/ *waarde van* TSA **CA** **NPR/NPU** **AO Full marks/** ***Volpunte***

11.2.3	$\text{Volume of pyramid} = \frac{1}{3}(\text{length} \times \text{breadth}) \times \perp \text{Height}$ / $\textit{Volume van piramide} = \frac{1}{3} \times (\textit{lengte} \times \textit{breedte}) \times \perp \textit{hoogte}$ $= \frac{1}{3}(3 \times 3) \times 3,5$ $= 10,5\,\text{cm}^3$ $\text{number of small pyramids} / \textit{aantal klein piramide} = \frac{1500}{10,5}$ $\approx 142,86$ $\therefore 142$ $\text{Remaining milk}/\textit{Oorblywende melk} = 1500 - (142 \times 10,5)$ **OR/OF** $0,86 \times 10,5$ $= 9\text{cm}^3$ **OR/OF** $9\,ml$	✓**SF** **A** ✓ value of/ *waarde van* $V_{\text{pyramid /piramide}}$ **CA** ✓**M** **CA** ✓ value of/ *waarde van* **CA** **NPU/NPR** (4) **[17]**

TOTAL/*TOTAAL*: 150