basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

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

GRADE/GRAAD 12

TECHNICAL MATHEMATICS P2/*TEGNIESE WISKUNDE V2*

2023

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

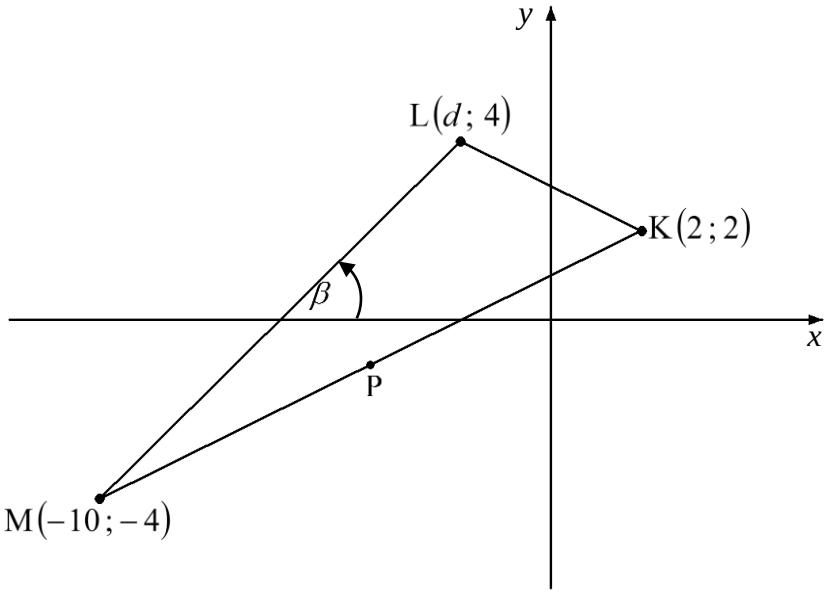
CODE/ *KODE*	EXPLANATION/*VERDUIDELIKING*
A	Accuracy/*Akkuraatheid*
AO	Answer only/*Slegs antwoord*
CA	Consistent accuracy/*Volgehoue akkuraatheid*
I	Identity/*Identiteit*
M	Method/*Metode*
NPR	No penalty for rounding/*Geen penalisering vir afronding nie*
NPU	No penalty for omitting units/*Geen penalisering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

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

NOTE:
- If a candidate answers a question **TWICE**, only mark the **FIRST** attempt.
- Consistent Accuracy marking must be applied where indicated.
- Questions where Tolerance Range will be applied: Q4.3; Q7.3.3; Q10.4 and Q11.2.2

LET WEL:
- *Indien 'n kandidaat 'n vraag **TWEE** keer beantwoord, sien slegs die **EERSTE** poging na.*
- *Volgehoue akkuraatheid-nasien moet toegepas word soos aangedui.*
- *Vrae waar Tolaransie wydte toegepas word: V4.3; V7.3.3; V10.4 and V11.2.2*

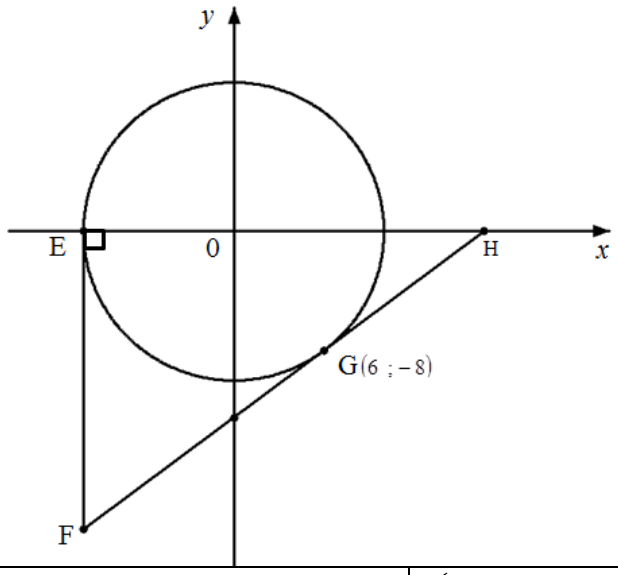
QUESTION/*VRAAG* 1



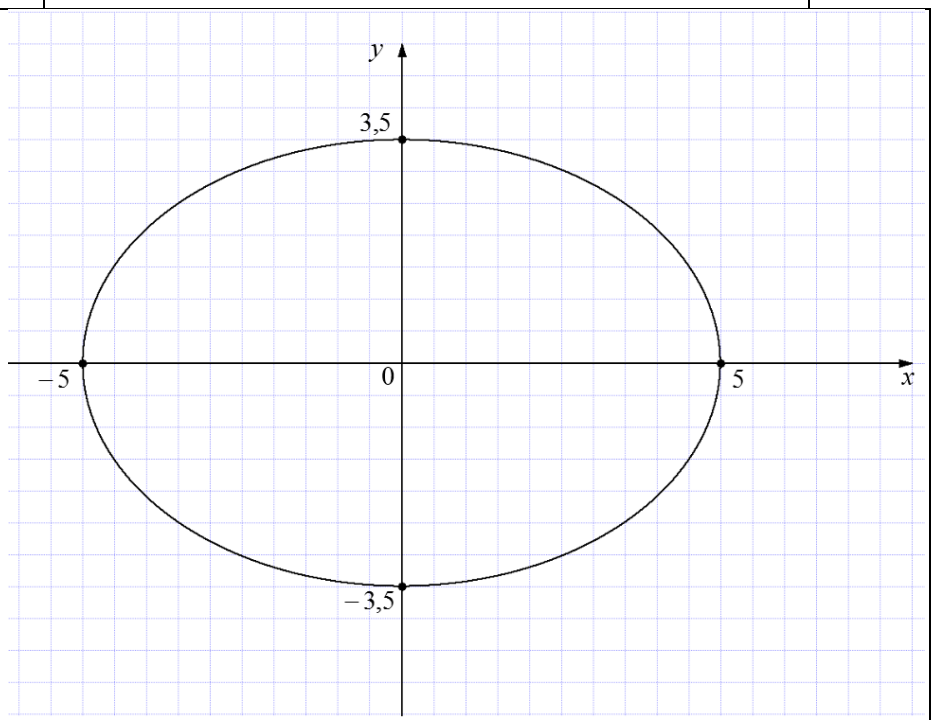
1.1	$m = 1$	✓gradient/*gradiënt* **A** (1)
1.2.1	$\tan\beta = m = 1$ $\therefore\ \beta = 45°$	✓ **SF** **CA** ✓value of angle/*waarde van hoek* **AO: full marks/ *volpunte*** **CA** (2)
1.2.2	$y = x + 6$ **OR/*OF*** $y - x = 6$ $4 = d + 6$ **OR/*OF*** $4 - d = 6$ $\therefore\ d = -2$ **OR/*OF*** $\frac{4-(-4)}{d-(-10)} = 1$ $8 = d + 10$ $d = -2$	✓ **SF** **A** ✓value of/ *waarde van d* **CA** **OR/*OF*** ✓ **SF** **CA** ✓value of/ *waarde van d* **CA** **AO: full marks/ *volpunte*** (2)

1.2.3	$P\left(\frac{x_k + x_m}{2}; \frac{y_k + y_m}{2}\right)$ $P\left(\frac{2+(-10)}{2}; \frac{2+(-4)}{2}\right)$ $P(-4;-1)$	✓ *x*-value/*waarde* **A** ✓ *y*-value /*waarde* **A** **AO: full marks/ *volpunte*** (2)
1.3.1	$m = 1$	✓gradient/*gradiënt* **CA** **From/ *vanuit* 1.1** (1)
1.3.2	$y = 1x + c$ $2 = 1(2) + c$ $\therefore c = 0$ $\therefore y = x$ **OR/*OF*** $y - y_1 = m(x - x_1)$ $y - 2 = 1(x - 2)$ $y - 2 = x - 2$ $\therefore \ y = x$	✓ substitution/ *vervanging* **CA** ***m* from/*van* 1.3.1 and/*en* K(2; 2)** ✓equation/ *vergelyking* **CA** **OR/*OF*** ✓ substitution/ *vervanging* **CA** ***m* from/*van* 1.3.1 and/*en* K(2; 2)** ✓equation/ *vergelyking* **CA** **AO: full marks/ *volpunte*** (2)
		[10]

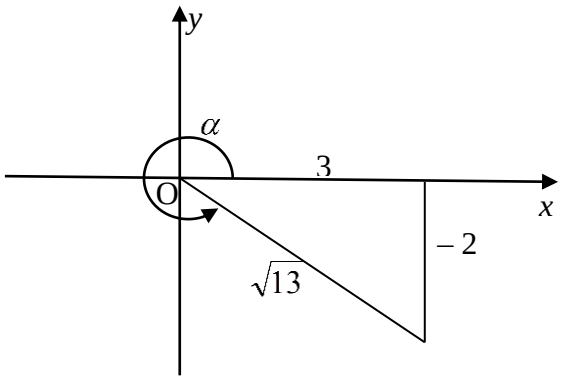
QUESTION/*VRAAG* 2



2.1.1	$x^2+y^2=r^2$ $(6)^2+(-8)^2=r^2$ $x^2+y^2=100$ **OR/*OF*** $y=\pm\sqrt{100-x^2}$ **OR/*OF*** $x=\pm\sqrt{100-y^2}$	✓ **F** **A** ✓ subsitution/ *vervanging* **A** ✓equation/ *vergelyking* **CA** **AO: full marks/ *volpunte*** (3)
2.1.2	$m_{OG}=-\frac{8}{6}=-\frac{4}{3}$ $m_{tan}=\frac{3}{4}$ $y=mx+c$ **OR/*OF*** $y-y_1=m(x-x_1)$ $-8=\frac{3}{4}(6)+c$ $y-(-8)=\frac{3}{4}(x-6)$ $c=-\frac{25}{2}$ $\therefore y=\frac{3}{4}x-\frac{25}{2}$ **OR/*OF*** $y.y_1+x.x_1=r^2$ $y(-8)+x(6)=100$ $-8y+6x=100$ $\therefore y=\frac{3}{4}x-\frac{25}{2}$	✓**SF** **A** ✓ m_{OG} **CA** ✓ m_{tan} **CA** ✓substitution/*vervanging* **CA** ✓equation/*vergelyking* **CA** **OR/*OF*** ✓**F** **A** ✓substitution/*verv* $(6;-8)$ **A** ✓substitution/*verv* r^2 **CA** ✓**S** **CA** ✓equation/*vergelyking* **CA** (5)

2.2	$\text{E}(-10\ ;\ 0)$	✓coordinates/ koördinate **CA** (1)
2.3	$y=\frac{3}{4}x-\frac{25}{2}$ $y=\frac{3}{4}(-10)-\frac{25}{2}$ $=-20$ EF = 20 units $\text{EG}=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ $=\sqrt{(-10-6)^2+(0-(-8))^2}$ $=\sqrt{320}$ **OR**/***OF*** $8\sqrt{5}\approx 17{,}89$ units / *eenhede* $\therefore \text{EF}\neq\text{EG}$	✓substitution /*Vervang* **CA** ✓length/ *lengte* EF **CA** ✓ **SF** **CA** ✓length/ *lengte* EG **CA** ✓ conclusion/*gevolgtr* **CA** (5)
2.4		✓both *x*-intercepts/ *beide x-afsnitte* **A** ✓both *y*-intercepts *beide y-afsnitte* **A** ✓elliptical shape/*eliptiese vorm* **CA** (3) **[17]**

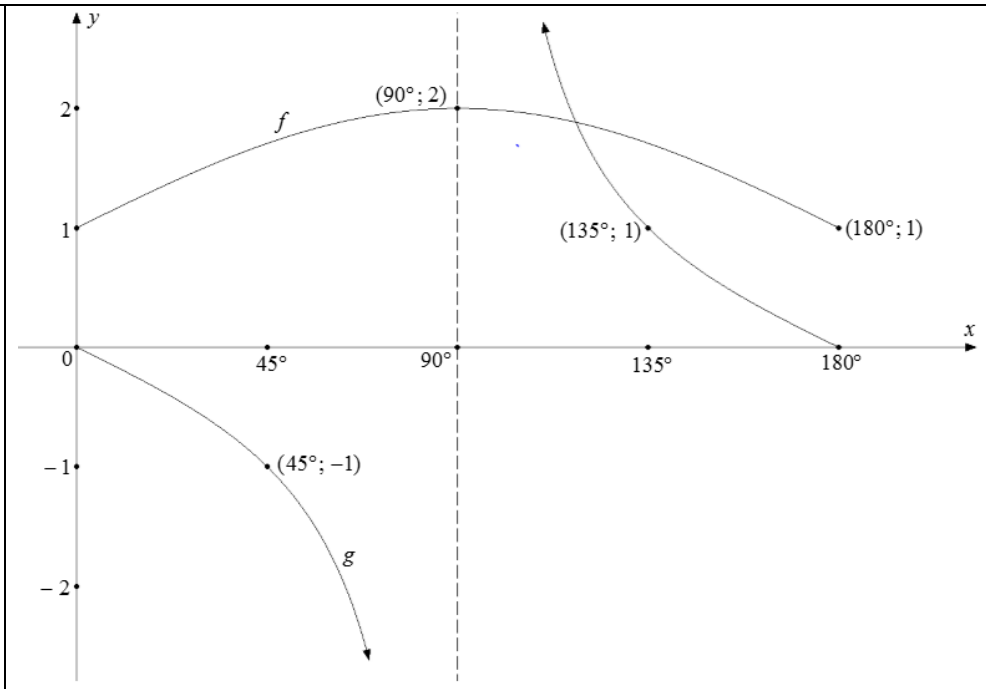
QUESTION/*VRAAG* 3

3.1.1	$\sin B$ $= \sin 59°$ $\approx 0,86$ **NPR**	✓ $\approx 0,86$ **A** (1)
3.1.2	$\sec A + \cos B$ $= \sec 66° + \cos 59°$ $= \frac{1}{\cos 66°} + \cos 59°$ $\approx 2,97$ **NPR**	✓ substitution/ *vervanging* **A** ✓ 2,97 **CA** **AO: full marks/*volpunte*** (2)
3.2	$r^2 = x^2 + y^2$ $r^2 = (3)^2 + (-2)^2$ $r = \sqrt{13}$  $4\cot\alpha + \sin^2\alpha$ $= 4\left(-\frac{3}{2}\right) + \left(-\frac{2}{\sqrt{13}}\right)^2$ $= -\frac{74}{13}$	✓ r value/ *waarde van* **A** ✓ diagram **A** diagram can be implied by the use of $y = -2$ */diagram kan deur die gebruik van* $y = -2$ *geïmpliseer word.* ✓ cot ratio/*verhouding* **CA** ✓ sin ratio/ *verhouding* **CA** ✓ simplification/ *vereenv* **CA** (5)
3.3	cosec $x = -3,054$ $\frac{1}{\sin x} = -3,054$ $\sin x = -\frac{1}{3,054}$ **OR / *OF*** $\sin x \approx 0,327...$ Ref/*verw.*$\angle \approx 19,11°$ $x \approx 180° + 19,11°$ or/*of* $x \approx 360° - 19,11°$ $\therefore x \approx 199,11°$ or/*of* $x \approx 340,89°$ **NPR**	✓ **I** **A** ✓sin$x$ the subject/ *onderwerp* **A** ✓ reference angle/ *verw.hk* **CA** ✓x- values in 3rd quadr/ *waarde in die 3de kwadr.* **CA** ✓x- values in 4th quadr/ *waarde in die 4de kwadr.* **CA** **Accept negetive ref. angle/ *aanvaar negatiewe verw.hk*** (5)
		[13]

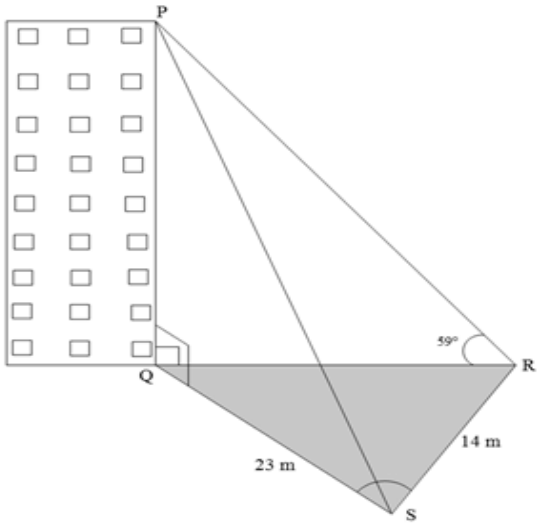
QUESTION/*VRAAG* 4

4.1	$\cos B$	✓ $\cos B$	**A** (1)
4.2.1	$\sin^2 P$	✓$\sin^2 P$	**A** (1)
4.2.2	$\frac{\sin\beta}{\cos\beta}$ **OR/*OF*** $\frac{1}{\cot\beta}$ **OR/*OF*** $\frac{\pm\sqrt{\sec^2\beta-1}}{1}$	✓ **I**	**A** (1)
4.3	$2\sin(\pi + B)\cdot\cos(2\pi - B)\cdot\tan(180° - B) + \cos(180° - B)\cdot\frac{2}{\sec(180° + B)}$ $= (-2\sin B)\cdot\cos B\cdot(-\tan B) + (-\cos B)\cdot\frac{2}{(-\sec B)}$ $= 2\sin B\cdot\cos B\cdot\frac{\sin B}{\cos B} + \cos B\cdot 2\cos B$ $= 2\sin^2 B + 2\cos^2 B$ $= 2(\sin^2 B + \cos^2 B)$ $= 2(1)$ $= 2$	✓ $-2\sin B$ **A** ✓ $-\tan B$ **A** ✓ $-\cos B$ **A** ✓ $-\sec B$ **A** ✓ **I** $\cos B$ **A** ✓ 2 **CA** (6)	
4.4	$\frac{\cos\theta + \sin^2\theta\cdot\sec\theta}{\text{cosec}\,\theta} = \tan\theta$ LHS/ LK $= \frac{\cos\theta + \sin^2\theta\cdot\sec\theta}{\text{cosec}\,\theta}$ $= \frac{\cos\theta + \sin^2\theta\cdot\frac{1}{\cos\theta}}{\frac{1}{\sin\theta}}$ $= \frac{\cos^2\theta + \sin^2\theta}{\cos\theta} \div \frac{1}{\sin\theta}$ $= \frac{1}{\cos\theta}\times\frac{\sin\theta}{1}$ $= \tan\theta = \text{RHS/RK}$	✓ **I** $\frac{1}{\cos\theta}$ **A** ✓ **I** $\frac{1}{\sin\theta}$ **A** ✓ **S** $\cos^2\theta + \sin^2\theta$ **CA** ✓ **I** 1 **A** ✓ **S** **CA** (5)	
			[14]

QUESTION/*VRAAG* 5

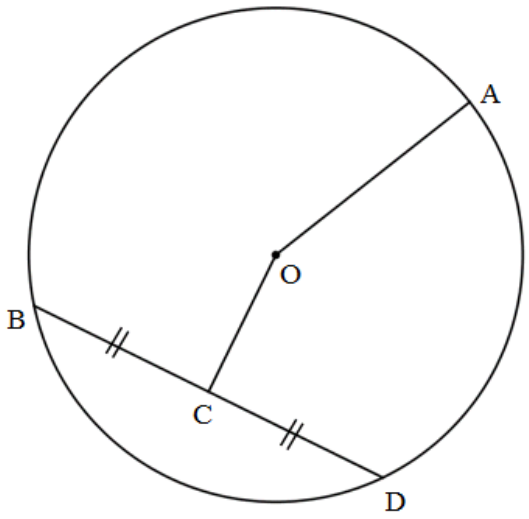
5.1		*f*: ✓ shape/*vorm* **A** ✓ intercept/*afsnit* **A** ✓ turning point/ *draaipunt* **A** *g*: ✓ shape/*vorm* **A** ✓ intercepts/ *afsnitte* **A** ✓ asymptote/ *asimptoot* **A** (6)
5.2.1	$y \in [1\,;\,2]$ **OR/*OF*** $1 \leq y \leq 2$ **OR/*OF*** $y \geq 1$ and /*en* $y \leq 2$	✓ end points/*eindpunte* **CA** ✓ notation/*notasie* **CA** (2)
5.2.2	180°	✓ period/ *periode* **A** (1)
5.2.3	$h(x) = \tan x$	✓ equation/*vergelyking* **A** (1)
5.3	$= \sin 0° + 1 - (-\tan 0°)$ $= 1 - 0$ $= 1$	✓ Substitution / *vervang* **A** ✓ 1 **CA** **AO: full marks/ *volpunte*** (2)
		[12]

QUESTION/*VRAAG* 6

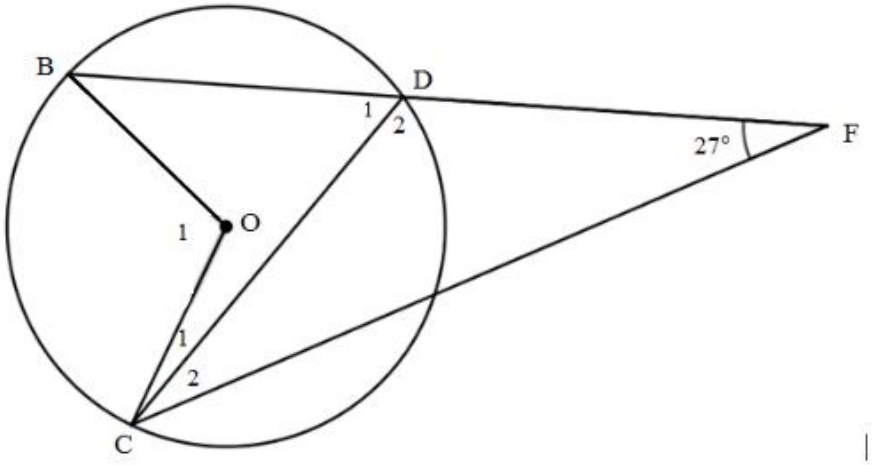


6.1	$QR^2 = QS^2 + SR^2 - 2QS \cdot SR \cos \hat{QSR}$ **OR/*OF*** in ΔQRS: $s^2 = r^2 + q^2 - 2r \cdot q \cos \hat{S}$ $QR^2 = QS^2 + SR^2 - 2QS \cdot SR \cos \hat{S}$	✓ $2QS \cdot SR \cos \hat{QSR}$ **A** (1)
6.2	$QR^2 = (23)^2 + (14)^2 - 2(23)(14)\cos 86°$ $\approx 680,0768309$ $QR \approx 26,08\text{ m}$	✓ **SF** **A** ✓ value of/ *waarde van* QR **CA** **NPR** (2)
6.3	Area of/*Oppervlakte van* $\Delta QRS = \frac{1}{2} QS \times SR \sin \hat{S}$ **OR/*OF*** $\frac{1}{2} rq \sin \hat{S}$ **OR/*OF*** $\frac{1}{2}(23)(14)\sin \hat{S}$	✓ $QS \times SR$ **OR/*OF*** $r \times q$ **OR/*OF*** 23×14 **A** (1)
6.4	Area of/*oppervlakte van* $\Delta QRS = \frac{1}{2}(23)(14)\sin 86°$ $\approx 160,61\text{ m}^2$	✓ **SF** **A** ✓ area value/ *oppervlakte waarde* **CA** **NPR** (2)
6.5	$\tan 59° = \frac{PQ}{QR}$ **OR / *OF*** $\frac{r}{p}$	✓ $\frac{PQ}{QR}$ **OR/*OF*** $\frac{r}{p}$ **A** (1)
6.6	$\tan 59° \approx \frac{PQ}{26,08}$ $PQ \approx 26,08 \tan 59° \approx 43,40\text{ m}$ **OR/*OF*** $\frac{PQ}{\sin 59°} = \frac{26,08}{\sin 31°}$ $PQ \approx 43,40$	✓ substitution/ *vervanging* **CA** ✓ value of/ *waarde van* PQ **CA** **NPR** (2)
		[9]

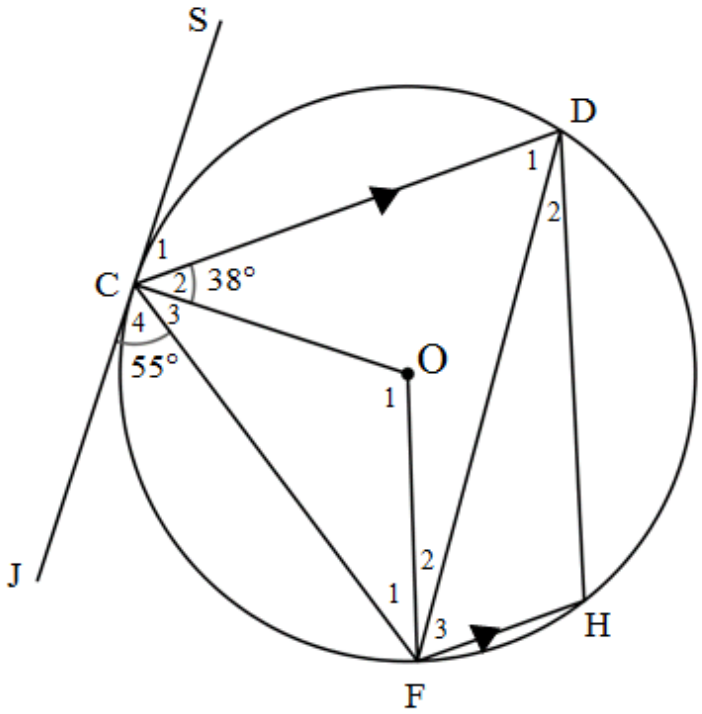
QUESTION/*VRAAG* 7

7.1	Bisects/ *halveer*	✓ST **A** (1)
7.2		
7.2.1	AO = 7 cm	✓ **ST** **A** (1)
7.2.2	OC ⊥ BD (line from centre to midpt of chord / *lyn vanuit midpt na midpt van koord*) $BC = 5,5$ cm $OC^2 = BO^2 - BC^2$ (Pythagoras) $= 7^2 - 5,5^2$ $OC = \sqrt{18,75}$ $\approx 4,33$ cm **OR/*OF*** $4h^2 - 4dh + x^2 = 0$ $4h^2 - 4(14)h + (11)^2 = 0$ $4h^2 - 56h + 121 = 0$ $h = \frac{-(-56) \pm \sqrt{(56)^2 - 4(4)(121)}}{2(4)}$ $h \approx 11,33$ or/*of* $h \approx 2,67$ $\therefore OC \approx 7 - 2,67 \approx 4,33$ cm **OR/*OF***	✓ **RE** **A** ✓ **ST** **A** ✓ **ST** **CA** ✓ **ST** length of/*lengte van* OC **CA** **OR/*OF*** ✓ **F** **A** ✓ **SF** **A** ✓ Standard form/ *Standaard vorm* **CA** ✓ **ST** length of/*lengte van* OC **CA** **OR/*OF***

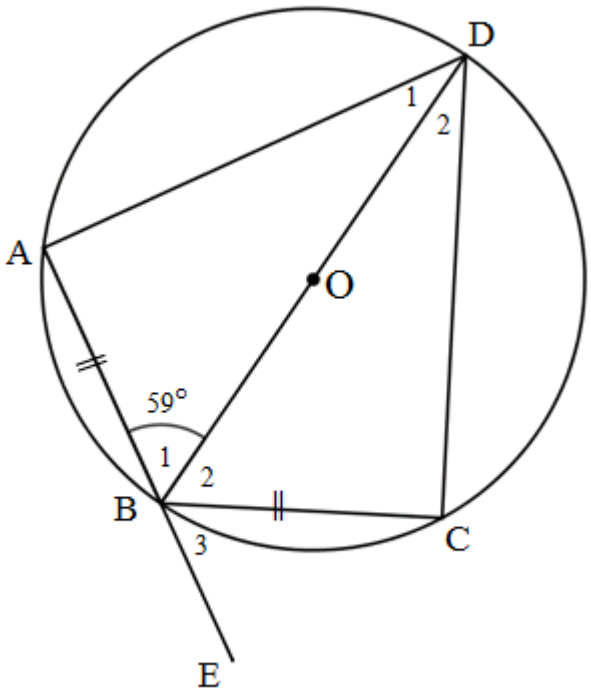
	$OC \perp BD$ $\begin{pmatrix}\text{line from centre to midpt of chord}\\ \textit{lyn vanuit midpt na midpt koord}\end{pmatrix}$ $BC = 5,5$ cm In ΔOBC, $\cos \hat{OBC} = \frac{5,5}{7}$ $\hat{OBC} \approx 38,21°$ $\tan 38,21° = \frac{OC}{5,5}$ **OR/*OF*** $\sin 38,21° = \frac{OC}{7}$ $OC \approx 4,33$ cm $OC \approx 4,33$ cm	✓ **RE** **A** ✓ **ST** **A** ✓ cos definition/ *def* **CA** ✓ **ST** length of/*lengte van* OC (4)

7.3		
7.3.1	$\hat{O}_1 = 4 \times 27° = 108°$	✓ **ST** **A** (1)
7.3.2	$\hat{D}_1 = 54°$ $\left(\begin{matrix}\angle \text{at centre} = 2 \times \angle \text{at circm} \\ midpts\angle = 2 \times omtreks\angle\end{matrix}\right)$	✓ **ST** **CA** ✓ **RE** **A** (2)
7.3.3	$\hat{C}_2 = 54° - 27° = 27°\left(ext\angle of\ \Delta / buite\angle van\ \Delta\right)$ $\therefore DC = DF \quad \left(\text{sides opp} = \angle s / sye\ teenoor = \angle e\right)$ **OR/*OF*** $\hat{D}_2 = 180° - 54° = 126°\left(\angle on\ str\ line / op\ reguitlyn\right)$ $\hat{C}_2 = 180° - 126° - 27° = 27°\left(sum\angle of\ \Delta / som\angle van\ \Delta\right)$ $\therefore DC = DF \quad \left(\text{sides opp} = \angle s / sye\ teenoor = \angle e\right)$	✓ **ST** **CA** ✓ **RE** **A** ✓ **RE** **A** **OR/*OF*** ✓ **ST** **CA** ✓ **RE** **A** ✓ **RE** **A** (3)
		[12]

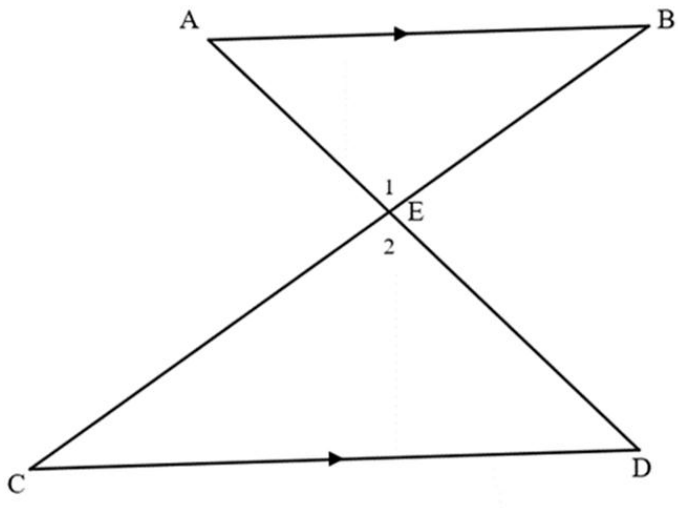
QUESTION/*VRAAG* 8

8.1	Perpendicular / *loodreg*	✓ST	**A** (1)
8.2			
8.2.1	$\hat{D}_1 = 55°$ (tan - chord / *raaklyn -koord*)	✓ **ST** ✓ **RE**	**A** **A** (2)
8.2.2	$\hat{F}_3 = 55°$ (alt/*verw* ∠s; CD ∥ FH)	✓ **ST** ✓ **RE**	**CA** **A** (2)
8.2.3	$\hat{C}_3 = 35°$ (tan/*raaklyn* ⊥ rad) $\therefore \hat{F}_1 = 35°$ (∠s opp = sides / ∠*e teenoor* = *sye*) **OR/*OF*** $\hat{O}_1 = 110°$ (∠*at centre* = 2 × circmf ∠ / *mdpts* ∠ = 2 × *omtrks* ∠) $\hat{F}_1 = \hat{C}_3 = \frac{1}{2} \times 70°$ (∠s opp = sides / ∠*e teenoor* = *sye*) $= 35°$	✓ **ST** ✓ **RE** ✓ **ST/RE** **OR/*OF*** ✓ **ST** ✓ **RE** ✓ **ST/RE**	**A** **A** **CA** **A** **A** **CA** (3)

8.2.4	$\hat{D}\hat{F}C = 180° - 38° - 35° - 55°$ $(\text{int } \angle\text{s of } \Delta / \textit{binne } \angle\textit{e van } \Delta)$ $= 52°$ $(\text{int } \angle\text{s of } \Delta / \textit{binne } \angle\textit{e van } \Delta)$ **OR/*OF*** $\hat{C}_1 = 52°$ $(\angle \textit{on straight line / op reguitlyn})$ $\hat{D}\hat{F}C = 52°$ $(\tan - \textit{chord th. / raaklyn} - \textit{koord})$ **OR/*OF*** $\hat{C}_1 = 52°$ $(\tan \perp \textit{rad th. / raaklyn} \perp \textit{rad})$ $\hat{D}\hat{F}C = 52°$ $(\tan - \textit{chord th. / raaklyn} - \textit{koord})$	✓ **ST** **CA** ✓ **RE** **A** **OR/*OF*** ✓ **ST** **CA** ✓ **RE** **A** **OR/*OF*** ✓ **ST** **CA** ✓ **RE** **A**	(2)

8.3		
8.3.1	$\hat{A} = 90°$ $(\angle \text{in semi-circle/}sirkel)$ $\therefore \hat{D}_1 = 31°$ $(\text{Int } \angle\text{s of } \Delta \text{ / } Binne\ \angle e\ van\ \Delta)$	✓ **ST** **A** ✓ **RE** **A** ✓ **ST** **CA** (3)
8.3.2	$\hat{D}_2 = 31°$ $\left(\begin{matrix}\text{equal chords, equal } \angle\text{s /} \\ gelyke\ krde, gelyke\ \angle e\end{matrix}\right)$	✓ **ST** **CA** ✓ **RE** **A** (2)
8.3.3	$\hat{B}_3 = 62°$ $(\text{ext } \angle \text{ of cyclic quad / } buite\ \angle van\ kdvk)$ **OR/*OF*** $\hat{B}_3 = 180° - \hat{B}_2 - \hat{B}_1$ $(\text{sum } \angle \text{ on str line / } som\ \angle op\ reguitlyn)$ $= 180° - 59° - 59° = 62°$	✓ **ST** **CA** ✓ **RE** **A** **OR/*OF*** ✓ **ST** **CA** ✓ **RE** **A** (2)
		[17]

QUESTION/*VRAAG* 9

9.1	Corresponding angles must be equal/ *ooreenstemmende hoeke moet gelyk wees* Corresponding sides must be proportional/ *Ooreenstemmende sye moet eweredig wees*	✓angles equal/ *gelyke hoeke* **A** ✓sides proportional / *sye eweredig* **A** (2)
9.2	Piece/*stuk* 1 = $\frac{2}{5}\times 3\text{m} = 1{,}2\text{ m}$ **OR/*OF*** $= 120\text{ cm}$ Piece/*stuk* 2 $= 3 - 1{,}2 = 1{,}8\text{m}$ **OR/*OF*** $= 180\text{ cm}$ **OR/*OF*** Piece/*stuk* 2 $= \frac{3}{5}\times 300\text{ cm} = 180\text{ cm}$ **OR/ *OF*** $2x + 3x = 3\text{m}$ $x = 0{,}6\text{m}$ Piece /*stuk* $1 = 2x = 1{,}2\text{m}$ **OR/*OF*** $= 120\text{cm}$ Piece/*stuk* $2 = 3x = 1{,}8\text{m}$ **OR/*OF*** $= 180\text{cm}$	✓ **ST** $\frac{2}{5}\times 3$ **A** ✓ **ST** length of piece 1/ *lengte van stuk* 1 **CA** ✓ **ST** length of piece 2 */lengte van stuk2* C**A** **OR/*OF*** ✓ **ST** x = 0,6 m **A** ✓ **ST** length of piece 1/ *lengte van stuk 1* C**A** ✓ **ST** length of piece 2 */lengte van stuk 2* C**A** (3)
9.3		
9.3.1	In ΔABE and/*en* ΔDCE: $\hat{A} = \hat{D}$ (alt./*verw.*∠s; AB|| CD) $\hat{B} = \hat{C}$ (alt./*verw.*∠s; AB || CD) $\hat{E}_1 = \hat{E}_2$ (vertically opposite/*regoorstaande* ∠) ∴ ΔABE ||| ΔDCE (∠∠∠)	Any two/*enige twee* ✓ **ST** **A** ✓ **ST** **A** ✓ **RE** **A** (3)

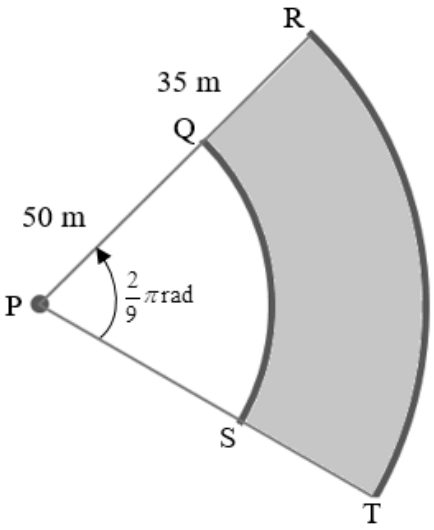
9.3.2	$\frac{AE}{AD}=\frac{BE}{CB}$ prop./ *eweredig* AB // CD $\frac{4}{9}=\frac{BE}{80}$ $\therefore BE=\frac{320}{9}$ mm **OR/*OF*** $\approx 35{,}56$ mm **OR/*OF*** $\frac{BE}{CE}=\frac{AE}{DE}$ $(\|\|\| \Delta s)$ $\frac{BE}{80-BE}=\frac{AE}{DE}=\frac{4}{5}$ $\therefore 5\,BE = 320 - 4\,BE$ $\therefore 9\,BE = 320$ $\therefore BE=\frac{320}{9}$ mm **OR/*OF*** $\approx 35{,}56$ mm	✓ **ST** **A** ✓ **RE** **A** ✓ **ST** AD = 9 **A** ✓ **ST** **CA** **OR/*OF*** ✓ **ST** **A** ✓ **RE** **A** ✓ **ST** CE = 80 – BE **A** ✓ **ST** **CA** (4)
		[12]

QUESTION/*VRAAG* 10

10.1	$\frac{\pi}{180°}$ **OR / OF** $\approx 0,17$	✓conversion factor/ *herleidingsfaktor*	**A** (1)
10.2	False/ Onwaar	✓answer/ *antwoord*	**A** (1)
10.3.1	$v = 45 \times \frac{1000}{3600} = 12,5\,\text{m/s}$ $r = 650 \div 1000 = 0,65\,\text{m}$ $D = 1,3\,\text{m}$ $v = \pi D n$ $12,5 = \pi(1,3)n$ $n \approx 3,06\ rev/omw/s$ **OR/*OF*** $v = 45 \times \frac{1000}{3600} = 12,5\,\text{m/s}$ $r = 650 \div 1000 = 0,65\,\text{m}$ $v = 2\pi r n$ $12,5 = 2\pi(0,65)n$ $n \approx 3,06\ rev/omw/s$ **OR/*OF*** $v = 45 \div 3600 = 0,0125\,\text{km/s}$ $r = 650 \div 1\,000\,000 = 0,00065\ \text{km}$ $v = 2\pi r n$ $0,0125 = 2\pi(0,00065)n$ $n \approx 3,06\ rev/omw/s$	✓both conversions / beide *herleidings* ✓**F** ✓ **SF** ✓ value of/ *waarde van n* **OR/*OF*** ✓both conversions/ *beide herleidings* ✓**F** ✓ **SF** ✓ value of/ *waarde van n* **OR/*OF*** ✓both conversions / *beide herleidings* ✓**F** ✓ **SF** ✓ value of/ *waarde van n*	**A** **A** **CA** **CA** **A** **A** **CA** **CA** **A** **A** **CA** **CA** (4)

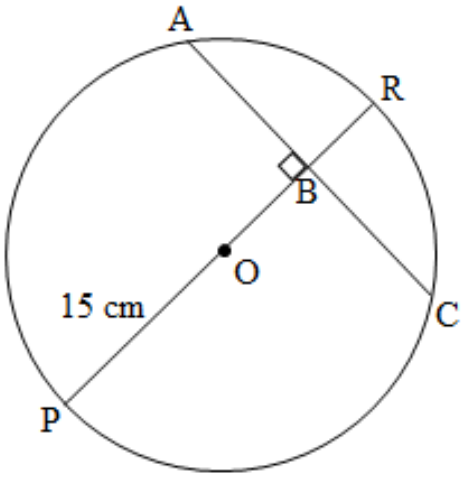
10.3.2	$\omega = 2\pi n$ $= 2\pi(3,06)$ $= \frac{153}{25}\pi$ **OR / *OF*** $\approx 19,23\,rad/s$ **OR/*OF*** $v = \omega r$ $12,5 = \omega(0,65)$ $\omega = \frac{12,5}{0,65} = \frac{250}{13}$ **OR / *OF*** $\approx 19,23\,rad/s$ **OR/*OF*** $\omega = 360° \times n$ $= 360° \times 3,06$ $= 1101,06 \times \frac{\pi}{180°}$ $\omega \approx 19,23\,rad/s$	✓ **F** ✓ **SF** ✓ angular velocity/ *hoeksnelheid* **OR/*OF*** ✓ **F** ✓ **SF** ✓ angular velocity/ *hoeksnelheid* **OR/*OF*** ✓ **F** ✓ **SF** ✓ angular velocity/ *hoeksnelheid*	**A** **CA** **CA** **A** **CA** **CA** **A** **CA** **CA** (3)

10.4



10.4	$A = \frac{r^2\theta}{2}$	✓ **F** **A**
	$A_1 = \frac{(50)^2\left(\frac{2}{9}\pi\right)}{2} = \frac{2\,500}{9}\pi m^2 \approx 872,66 m^2$	✓**SF** 50 **A**
	$A_2 = \frac{(85)^2\left(\frac{2}{9}\pi\right)}{2} = \frac{7\,225}{9}\pi m^2 \approx 2522,00 m^2$	✓ **SF** 85 **A**
	Shaded area/*Gearseerde oppervlakte* $= \frac{7\,225}{9}\pi\,m^2 - \frac{2\,500}{9}\pi m^2$ $= 525\pi \approx 1\,649,34\ m^2$	✓ Area/Oppervlakte **CA**
	∴ the area CANNOT be fully covered/ *oppervlakte KAN NIE volledig bedek word NIE*	✓ Conclusion/ *gevolgtrekking* **CA**
	OR/*OF*	**OR/*OF***
	$A = \frac{r^2\theta}{2}$ **OR/*OF*** $\frac{\theta}{360°}\pi r^2$ where $\theta = 40°$	✓ **F** **A**
	$= \frac{\left(\frac{2}{9}\pi\right)\left(85^2 - 50^2\right)}{2}$ **OR/*OF*** $\frac{1}{9}\pi(85^2 - 50^2)$	✓ **SF** 85 **A** ✓ **SF** 50 **A**
	$= 525\pi \approx 1\,649,34\,m^2$	✓ Area/Oppervlakte **CA**
	∴ the area CANNOT be fully covered *oppervlakte KAN NIE volledig bedek word NIE*	✓ Conclusion/ *gevolgtrekking* **CA**
	OR/*OF*	**OR/*OF***

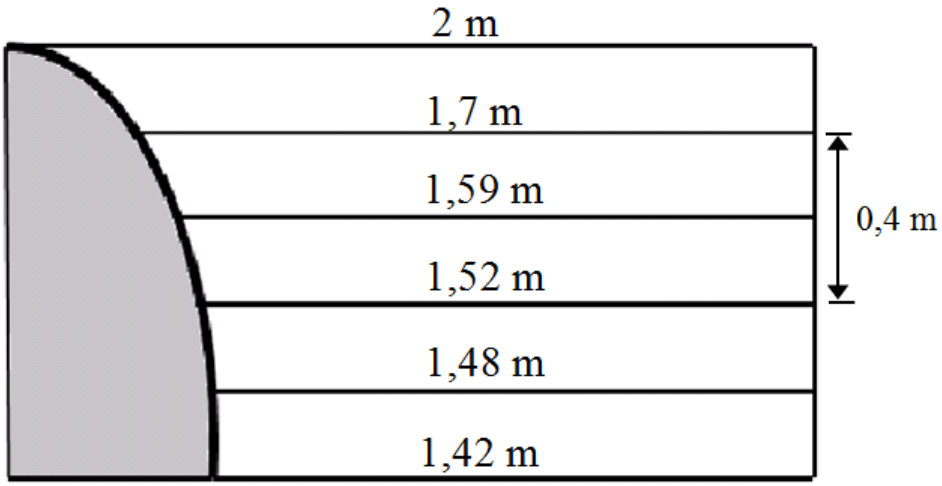
	$s_1 = r\theta$ $= 50 \times \frac{2}{9}\pi = \frac{100}{9}\pi \text{m} \approx 34,91\text{m}$	
	$A_1 = \frac{rs}{2}$	✓ **F** **A**
	$= \frac{50 \times \frac{100}{9}\pi}{2} = \frac{2\ 500}{9}\pi\text{m}^2 \approx 872,66\text{m}^2$	✓**SF** 50 **A**
	$s_2 = r\theta$ $= 85 \times \frac{2}{9}\pi = \frac{170}{9}\pi\text{m} \approx 59,34\text{m}$	
	$A_2 = \frac{rs}{2}$	
	$= \frac{85 \times \frac{170}{9}\pi}{2} = \frac{7\ 225}{9}\pi\text{m}^2 \approx 2522,00\text{m}^2$	✓ **SF** 85 **A**
	$\therefore$ Shaded/*Gearseerde oppervlakte* $= \frac{7\ 225}{9}\pi\text{m}^2 - \frac{2\ 500}{9}\pi\text{m}^2$ $= 525\pi\text{m}^2 \approx 1\ 649,34\,\text{m}^2$	✓ Area/Oppervlakte **CA**
	$\therefore$ the area CANNOT be fully covered *oppervlakte KAN NIE volledig bedek word NIE*	✓ Conclusion / *Gevolgtrekking* **CA** (5)



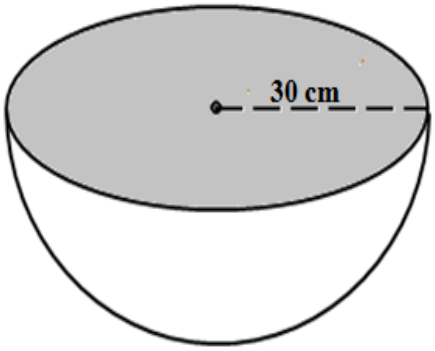
10.5	$4h^2-4dh+x^2=0$ $4h^2-4(30)h+(18)^2=0$ $4h^2-120h+324=0$ $h=\dfrac{-(-120)\pm\sqrt{(120)^2-4(4)(324)}}{2(4)}$ **OR / OF** $(h-27)(h-3)=0$ $h=27$ or / *of* $h=3$ $\therefore$ BR $=3$ cm **OR/*OF*** **Half chord method/ *halfkoord metode*:** AB $=$ BC $=9$ cm $\begin{pmatrix}\text{line from centre } \perp \text{chord/}\\ \textit{lyn vanuit mdpt } \perp \textit{koord}\end{pmatrix}$ AB$^2+$OB$^2=$OA^2 (Pythagoras Thm. / *St.*) $9^2+(15-h)^2=15^2$ $81+15^2-30h+h^2-15^2=0$ $h^2-30h+81=0$ $h=\dfrac{-(-30)\pm\sqrt{(30)^2-4(1)(81)}}{2(1)}$ **OR / OF** $(h-27)(h-3)=0$ $h=27$ or / *of* $h=3$ $\therefore$ BR $=3$ cm	✓ **F** **A** ✓ **SF** **A** ✓Standard form/*Standaard vorm* **CA** ✓ formula/factors/ *formule faktore* **CA** ✓length of/*lengte van* BR **CA** **OR/*OF*** ✓ length of/*lengte van* AB **A** ✓ **SF** **A** ✓Standard form/ *Standaard vorm* **CA** ✓ formula/factors/ *formule faktore* C**A** ✓length of/*lengte van* BR **CA** **OR/*OF***

		✓ length of/*lengte van* AB **A**
	OR/*OF*	
	$AB = BC = 9\text{ cm}$ $\begin{pmatrix}\text{line from centre} \perp \text{chord/}\\ \textit{lyn vanuit mdpt } \perp \textit{koord}\end{pmatrix}$	✓ value of/*waarde van* $\hat{AOC}$ **A** ✓ ratio/*verhouding* **CA**
	$\text{In } \Delta AOC,\ \sin \hat{AOC} = \frac{9}{15}$	
	$\therefore \hat{AOC} = 36,87°$	
	$\tan \hat{AOB} = \frac{9}{OB}$ **OR/*OF*** $\cos \hat{AOB} = \frac{OB}{15}$	✓length of/*lengte van* OB **CA** ✓length of/*lengte van* BR **CA**
	$OB = \frac{9}{\tan 36,87°}$ $OB = 15\cos 36,87°$ $= 12\text{ cm}$ $= 12\text{ cm}$ $BR = 15 - OB$ $BR = 15 - OB$ $= 3\text{ cm}$ $= 3\text{ cm}$	**OR/*OF***
		✓ length of/*lengte van* AB **A**
	OR/*OF*	
	$AB = BC = 9\text{ cm}$ $\begin{pmatrix}\text{line from centre} \perp \text{chord/}\\ \textit{lyn vanuit mdpt } \perp \textit{koord}\end{pmatrix}$	✓ **SF** **A**
	$AB^2 + OB^2 = OA^2$ (Pythagoras)	✓ length of/*lengte van* OB **CA**
	$9^2 + OB^2 = 15^2$	✓**M** **CA**
	$OB^2 = 15^2 - 9^2$	✓length of/*lengte van* BR **CA**
	$OB^2 = 144$	
	$OB = 12\text{ cm}$	
	$BR = 15 - 12$	(5)
	$\therefore BR = 3\text{ cm}$	
		[19]

QUESTION/*VRAAG* 11



11.1.1	0,2 m	✓0,2 m **A** (1)
11.1.2	$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + ... + o_{n-1}\right)$ $= 0{,}2\left(\frac{2+1{,}42}{2} + 1{,}7 + 1{,}59 + 1{,}52 + 1{,}48\right)\text{m}^2$ $= 0{,}2\ (8)\ \text{m}^2$ $= 1{,}6\ \text{m}^2$ **OR/*OF*** $A_T = a\ (m_1 + m_2 + m_3 + ... + m_n)$ $= 0{,}2\left(\frac{2+1{,}7}{2} + \frac{1{,}7+1{,}59}{2} + \frac{1{,}59+1{,}52}{2} + \frac{1{,}52+1{,}48}{2} + \frac{1{,}48+1{,}42}{2}\right)\text{m}^2$ $= 0{,}2\ (8)\ \text{m}^2$ $= 1{,}6\ \text{m}^2$	✓**F** **A** ✓**SF** **CA** ✓value of/ *waarde van* A_T **CA** **OR/*OF*** ✓**F** **A** ✓**SF** **CA** ✓value of/ *waarde van* A_T **CA** (3)

11.1.3	$4 = 0,2\left(8+5x\right)\text{m}^2$ $4 = 1,6 + x$ $4 - 1,6 = x$ $2,4\text{m} = x$ **OR / *OF*** $\left(x \times 0,2 \times 5\right) + 1,6 = 4\ \text{m}^2$ $x = 4 - 1,6$ $x = 2,4\text{m}$	✓substitution of 5*x*/*vervang* 5*x* **CA** ✓simplification/ *vereenv* **CA** ✓value of / *waarde van x* **CA** **OR / *OF*** ✓setting up equation/*opstel van vergelyking* **CA** ✓simplification/ *vereenv* **CA** ✓value of / *waarde van x* **CA** (3)
11.2		
11.2.1	Surface area of hemisphere/ *Buite opp. van hemisfeer* $= \frac{1}{2} \times 4\pi r^2$ $= 2\pi\left(30\right)^2$ $= 1\,800\pi$ **OR / *OF*** $\approx 5\,654,87\ \text{cm}^2$ **OR/*OF*** Surface area of sphere/ *Buite opp. van sfeer* $= 4\pi r^2$ $= 4\pi\left(30\right)^2$ $= 3\,600\pi\ \text{cm}^2$ **OR / *OF*** $\approx 11309,73\ \text{cm}^2$ Surface area of hemisphere/ *Buite opp. van hemisfeer* $= \frac{3\,600\pi}{2} = 1\,800\pi$ **OR/*OF*** $\approx 5\,654,89\ \text{cm}^2$	✓**F** **A** ✓**SF** **A** ✓surface.area/*buite oppervlakte* **CA** **NPR** **OR /*OF*** ✓**F** **A** ✓**SF** **A** ✓surface area/*buite oppervlakte* **CA** **NPR** (3)

11.2.2	Volume of 75% hemisphere/ *Volume van hemisfeer* $= \frac{1}{2} \times \frac{4}{3}\pi r^3 \times 75\%$ $= \frac{1}{2} \times \frac{4}{3}\pi (30)^3 \times 0,75$ $= 13\,500\pi \text{ cm}^3$ **OR / *OF*** $\approx 42\,411,50 \text{ cm}^3$	✓**F** **A** ✓**SF** **A** ✓ value of/ *waarde van* V **CA**
	Time taken to fill/ *tyd geneem om te vul* $= \frac{13500\pi}{90}$ $= 150\pi \text{ sec}$ **OR/*OF*** $\approx 471,24 \text{ s}$ $= 2,5\pi \text{ min}$ **OR/*OF*** $\approx 7,85 \text{ minutes}$	✓**M** (dividing /*deel deer* by 90) **A** ✓ time taken/*tyd geneem* **CA** **NPR**
	OR/*OF*	**OR/*OF***
	Volume of sphere/van *sfeer* $= \frac{4}{3}\pi r^3$ $= \frac{4}{3}\pi (30)^3$ $= 36\,000\pi \text{ cm}^3$ **OR / *OF*** $\approx 113\,079,34 \text{ cm}^3$	✓**F** **A** ✓**SF** **A**
	Volume of 75% hemisphere/ *Volume van hemisfeer* $= \frac{36\,000\pi}{2} \times 75\%$ $= 13500\pi \text{ cm}^3$ **OR/*OF*** $\approx 42\,411,50 \text{ cm}^3$	✓ value of/ *waarde van* V **CA**
	time taken to fill/ *tyd geneem om te vul* $= \frac{13500\pi}{90}$ $= 150\pi \text{ s}$ **OR/*OF*** $\approx 471,24 \text{ s}$ $= 2,5\pi \text{ min}$ **OR/*OF*** $\approx 7,85 \text{ minutes}$	✓**M** (dividing *deel deer* by 90) **A** ✓ time taken/*tyd geneem* **CA** **NPR** (5)
		[15]

TOTAL/*TOTAAL*: 150