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Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12/GRAAD 12

TECHNICAL MATHEMATICS P2/TEGNIJSE WISKUNDE V2

NOVEMBER 2019

MARKING GUIDELINE/NASIERIGLYN

MARKS/ PUNTE: 150

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

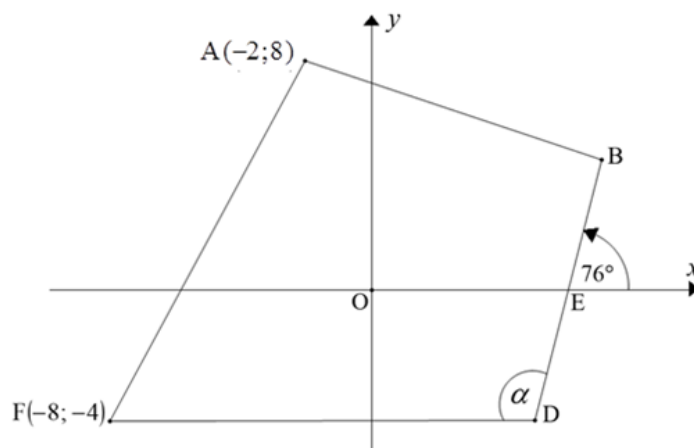
**These marking guidelines consists of 29 pages.
Hierdie nasienriglyne bestaan uit 29 bladsye.**

NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy to be applied as indicated on the marking guidelines.
- # Questions where Tolerance Range will be applied are Q4.2.2, Q6.3, Q10.1.3 and Q11.2.3.

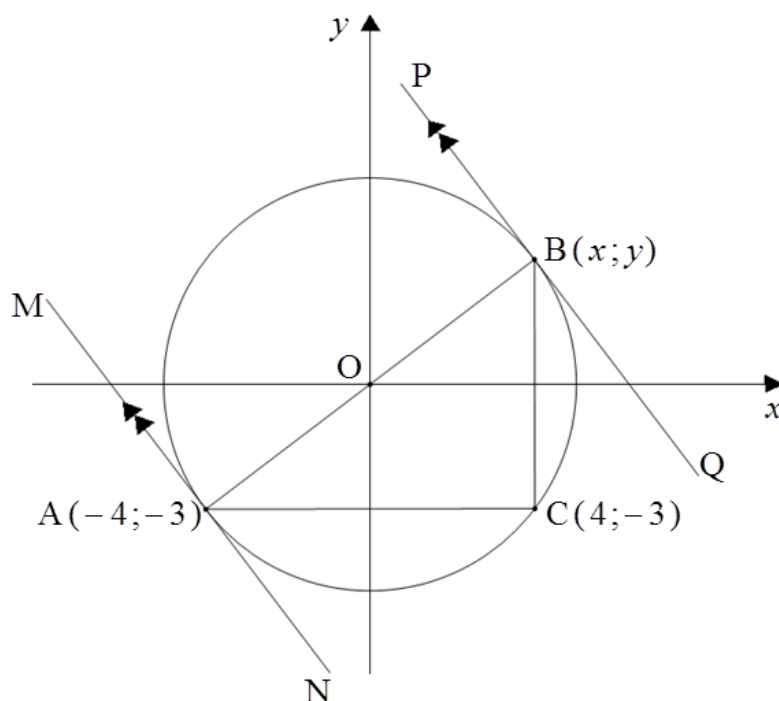
LET WEL:

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Volgehoue akkuraatheid sal toegepas word soos op die nasienriglyne van aangedui.
- # Vrae waar Toleransie Wydte toegepas word is V4.2.2, V6.3, V10.1.3 en V11.2.3.

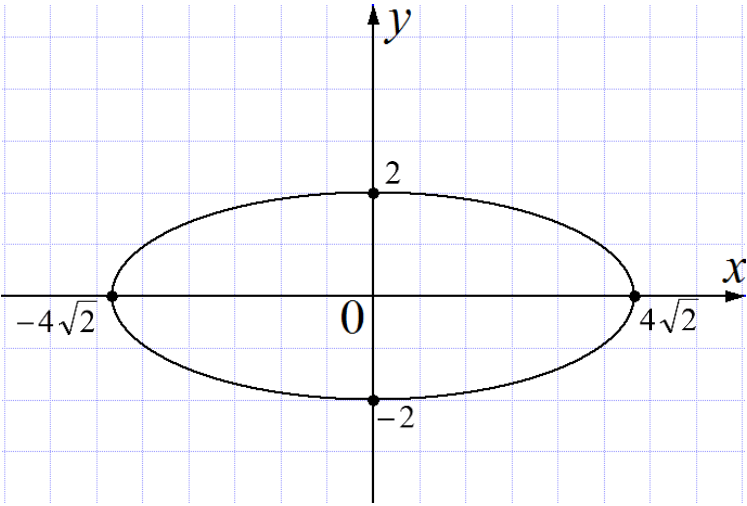
QUESTION/VRAAG 1

1.1	$\hat{OED} = 76^\circ$ $\therefore \alpha = 104^\circ$	✓ angle/hoek AO: Full marks/Volpunte (1)	A	
1.2	$AF = \sqrt{(-2 - (-8))^2 + (8 - (-4))^2}$ $= \sqrt{36 + 144}$ $= \sqrt{180}$ $= 6\sqrt{5}$	✓ SF ✓ length in simplified surd form/ <i>lengte in vereenvoudigde wortelvorm</i> AO: Full marks/Volpunte (2)	CA	L2
1.3	$m = \tan \theta$ $= \tan 76^\circ$ ≈ 4	✓ SF ✓ gradient/gradiënt (rounded/afgerond) AO: Full marks/Volpunte (2)	A	L2
1.4	$M_{AF} \left(\frac{-2 + (-8)}{2}, \frac{8 + (-4)}{2} \right)$ $M_{AF}(-5; 2)$	✓ SF ✓ S coordinates of/koördinate van M_{AF} AO: Full marks/Volpunte (2)	A	L1

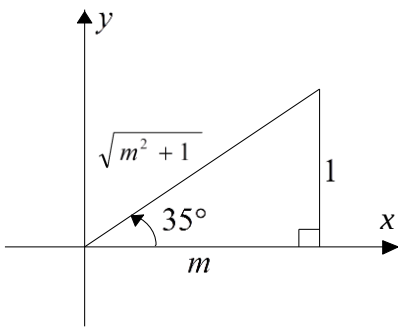
1.5	$m_{AF} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{8 - (-4)}{-2 - (-8)} \text{ OR/OF } = \frac{8 - 2}{-2 - (-5)} \text{ OR/OF } = \frac{-4 - 2}{-8 - (-5)}$ $= 2$ $\therefore m_{\text{perpend}} = -\frac{1}{2}$ $y - 2 = -\frac{1}{2} [x - (-5)] \text{ OR/OF } 2 = -\frac{1}{2} (-5) + c$ $y = -\frac{1}{2}x - \frac{5}{2} + 2 \quad \text{OR/OF} \quad c = -\frac{1}{2}$ $\therefore y = -\frac{1}{2}x - \frac{1}{2}$	✓ SF A ✓ gradient of/gradient van m_{AF} CA ✓ gradient of/gradient van m_{perpend} CA ✓ SF CA from Q 1.4 ✓ equation/vergelyking CA (5)	
		[12]	

QUESTION/VRAAG 2

2.1.1	$x^2 + y^2 = (-4)^2 + (-3)^2$ OR/OF $x^2 + y^2 = (4)^2 + (-3)^2$ $\therefore x^2 + y^2 = 25$ OR/OF $y = \pm\sqrt{25 - x^2}$	✓ SF A ✓ equation/vergelyking A AO: Full marks/Volpunte (2)	L1
2.1.2(a)	B(4 ; 3)	✓ coordinates of/ koördinate van B A (1)	
2.1.2(b)	$\therefore m_{PQ} = -\frac{4}{3}$	✓ gradient of/gradiënt van PQ A (1)	
2.1.3	$y - 3 = -\frac{4}{3}(x - 4)$ $y = -\frac{4}{3}x + \frac{16}{3} + 3$ $y = -\frac{4}{3}x + \frac{25}{3}$ OR/OF	✓ SF CA from/van Q/ V 2.1.2(a) & (b) ✓ S CA ✓ equation/vergelyking CA OR/OF	L2

	$y = mx + c$ $3 = -\frac{4}{3}(4) + c$ $c = \frac{25}{3}$ $y = -\frac{4}{3}x + \frac{25}{3}$	✓ SF CA from/van Q/V 2.1.2(a) & (b) ✓ value of/waarde van c CA ✓ equation/vergelyking CA (3)	
2.2.1	$x^2 + 8y^2 - 32 = 0$ $\frac{1}{32}x^2 + \frac{8}{32}y^2 = \frac{32}{32}$ $\frac{x^2}{(4\sqrt{2})^2} + \frac{y^2}{2^2} = 1$	✓ dividing both sides/deel albei sye by/deur 32 and/en transposing/oordra A ✓ correct surd form/korrekte wortelvorm CA Accept: $\frac{x^2}{(\sqrt{32})^2} + \frac{y^2}{2^2} = 1$ AO: Full marks/Volpunte (2)	L1
2.2.2		CA from/van Q/V 2.2.1 ✓ both y-intercepts/beide y-afsnitte CA ✓ both x-intercepts/beide x-afsnitte CA ✓ elliptical shape/elliptiese vorm CA (3)	
		[12]	

QUESTION/VRAAG 3

3.1.1	$\sin 3\alpha = \sin 3(32^\circ)$ $\approx 0,99$	✓ value of /waarde van $\sin 3\alpha$ A NPR (1)	L1
3.1.2	$\frac{\sec^2 \theta - 1}{\tan \alpha} = \frac{\sec^2 20^\circ - 1}{\tan 32^\circ}$ $= \frac{\left(\frac{1}{\cos 20^\circ}\right)^2 - 1}{\tan 32^\circ}$ $\approx 0,21$ OR/OF $\frac{\sec^2 \theta - 1}{\tan \alpha} = \frac{\tan^2 20^\circ}{\tan 32^\circ}$ $\approx 0,21$	✓ I $\left(\frac{1}{\cos 20^\circ}\right)$ A ✓ value of/waarde van $\frac{\sec^2 \theta - 1}{\tan \alpha}$ CA OR/OF ✓ I A ✓ value of/waarde van $\frac{\sec^2 \theta - 1}{\tan \alpha}$ CA NPR AO: Full marks/Volpunte (2)	L1
3.2.1	 $r = \sqrt{m^2 + 1}$ $\sin 35^\circ = \frac{1}{\sqrt{m^2 + 1}}$	✓ r A ✓ definition of/ definisie van sin CA AO: Full marks/Volpunte (2)	L2

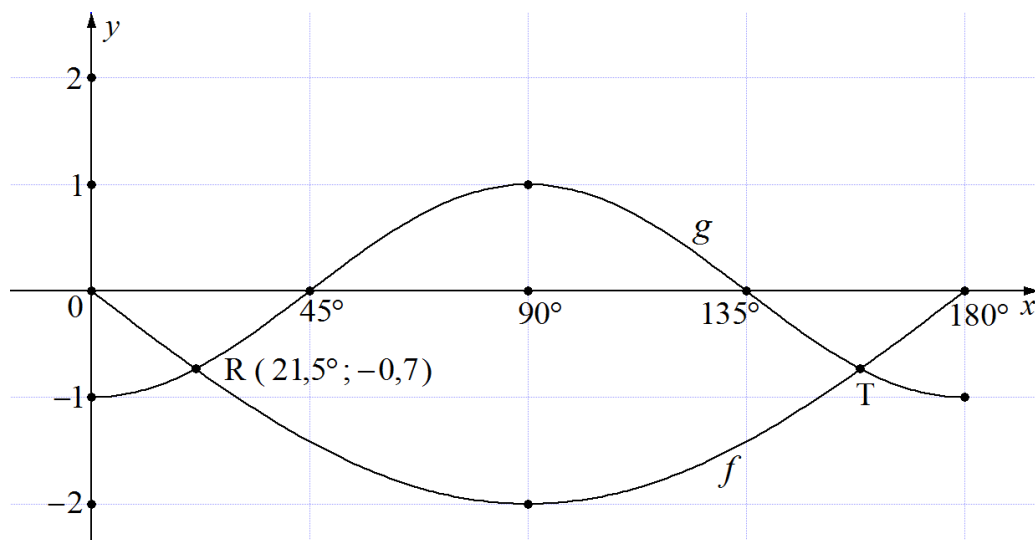
3.2.2	$\left(\cos \frac{29}{36} \pi\right)\left(\tan \frac{7}{36} \pi\right)$ $= (\cos 145^\circ)(\tan 35^\circ)$ $= (-\cos 35^\circ)\left(\frac{\sin 35^\circ}{\cos 35^\circ}\right)$ $= -\sin 35^\circ$ $= -\frac{1}{\sqrt{m^2 + 1}}$ OR/OF $\left(\cos \frac{29}{36} \pi\right)\left(\tan \frac{7}{36} \pi\right)$ $= (\cos 145^\circ)(\tan 35^\circ)$ $= (-\cos 35^\circ)(\tan 35^\circ)$ $= \left(-\frac{m}{\sqrt{m^2 + 1}}\right)\left(\frac{1}{m}\right)$ $= -\frac{1}{\sqrt{m^2 + 1}}$ OR/OF $\left(\cos \frac{29}{36} \pi\right)\left(\tan \frac{7}{36} \pi\right)$ $= \left[\cos\left(\pi - \frac{29}{36} \pi\right)\right]\left(\tan \frac{7}{36} \pi\right)$ $= \left(-\cos \frac{7}{36} \pi\right)\left(\frac{\sin \frac{7}{36} \pi}{\cos \frac{7}{36} \pi}\right)$ $= -\sin \frac{7}{36} \pi = -\sin 35^\circ$ $= -\frac{1}{\sqrt{m^2 + 1}}$	$\checkmark$ changing to degrees/ verander na grade A $\checkmark$ $-\cos 35^\circ$ CA $\checkmark$ I A $\checkmark$ S CA $\checkmark$ ratio/verhouding CA OR/OF $\checkmark$ changing to degrees/ verander na grade A $\checkmark$ $-\cos 35^\circ$ CA $\checkmark$ ratio of/verhouding van cos CA $\checkmark$ ratio of/verhouding van tan A $\checkmark$ S CA OR/OF $\checkmark$ reduction/reduksie A $\checkmark$ $-\cos \frac{7}{36} \pi$ CA $\checkmark$ I A $\checkmark$ S CA $\checkmark$ ratio of/verhouding van sine CA (5)
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3.3.1	$2 \cos \theta + \sin \theta = 0$ $\sin \theta = -2 \cos \theta$ $\frac{\sin \theta}{\cos \theta} = \frac{-2 \cos \theta}{\cos \theta} ; \cos \theta \neq 0$ $\therefore \tan \theta = -2$ OR/OF $2 \cos \theta = -\sin \theta$ $\frac{2 \cos \theta}{\sin \theta} = \frac{\sin \theta}{\sin \theta} ; \sin \theta \neq 0$ $\cot \theta = -\frac{1}{2}$ $\frac{1}{\tan \theta} = -\frac{1}{2}$ $\tan \theta = -2$	✓ transposing/oordra A ✓ M dividing both sides by/deel beide kante deur $\cos \theta$ A (2) OR/OF ✓ transposing/oordra A ✓ M dividing both sides by/deel beide kante deur $\sin \theta$ A (2)	
3.3.2	$\tan \theta = -2$ Ref/verw. $\angle \approx 63,43^\circ$ $\theta \approx 180^\circ - 63,43^\circ$ or/of $\theta \approx 360^\circ - 63,43^\circ$ $\therefore \theta \approx 116,57^\circ$ or/of $\theta \approx 296,57^\circ$	✓ ref/verw A ✓ 2^{nd} & 4^{th} / 2^{de} en 4^{de} quadrants/kwadrante A ✓ $116,57^\circ$ CA ✓ $296,57^\circ$ CA AO: Full marks/Volpunte (4)	
		[16]	

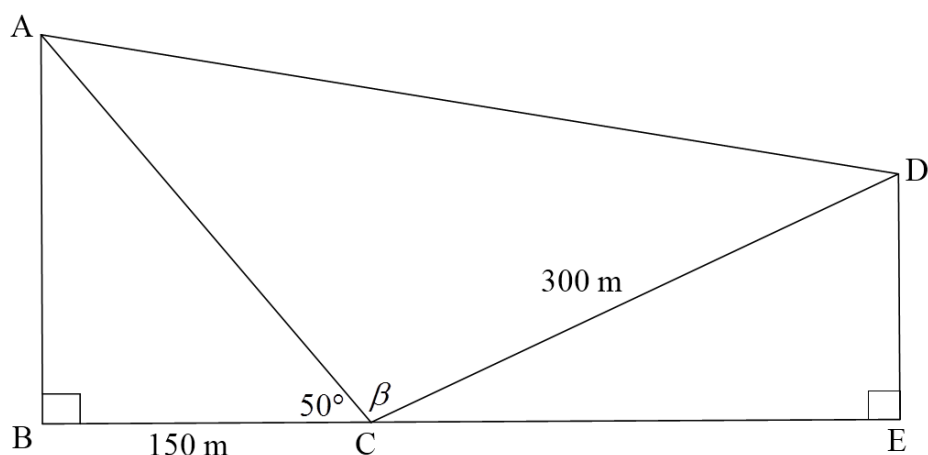
QUESTION/VRAAG 4

4.1.1	$\cot^2 2\beta - \operatorname{cosec}^2 2\beta = -1$	$\checkmark - 1$	A (1)	
4.1.2	$\tan^2 A \cdot \operatorname{cosec}^2 A - \cos 2\pi$ $= \frac{\sin^2 A}{\cos^2 A} \cdot \frac{1}{\sin^2 A} - 1$ $= \frac{1}{\cos^2 A} - 1$ $= \frac{1 - \cos^2 A}{\cos^2 A} = \frac{\sin^2 A}{\cos^2 A}$ $= \tan^2 A$ OR/OF $\tan^2 A \cdot \operatorname{cosec}^2 A - \cos 2\pi$ $= \frac{\sin^2 A}{\cos^2 A} \cdot \frac{1}{\sin^2 A} - 1$ $= \frac{1}{\cos^2 A} - 1$ $= \sec^2 A - 1$ $= \tan^2 A$ OR/OF $\tan^2 A \cdot \operatorname{cosec}^2 A - \cos 2\pi$ $= \tan^2 A (1 + \cot^2 A) - 1$ $= \tan^2 A + \tan^2 A \cdot \cot^2 A - 1$ $= \tan^2 A + 1 - 1$ $= \tan^2 A$	$\checkmark \text{ I } \left(\frac{\sin A}{\cos A} \right)$ $\checkmark \text{ I }$ $\checkmark 1$ $\checkmark \text{ I }$ $\checkmark \text{ S }$ OR/OF $\checkmark \text{ I } \left(\frac{\sin A}{\cos A} \right)$ $\checkmark \text{ I }$ $\checkmark 1$ $\checkmark \text{ I }$ $\checkmark \text{ S }$ OR/OF $\checkmark \text{ I }$ $\checkmark 1$ $\checkmark \text{ product/produk }$ $\checkmark 1$ $\checkmark \text{ S }$	A A A CA CA OR/OF A A A CA CA OR/OF A A CA CA CA (5)	

4.2.1	$\sec 60^\circ = 2$	✓ 2	A (1)	
4.2.2 #	$\operatorname{cosec}(180^\circ + \theta) \cdot \sin(360^\circ - \theta) - [\sin(180^\circ + \theta)]^{\sec 60^\circ} = \cos^2 \theta$ $\text{L.H.S./LK} = \operatorname{cosec}(180^\circ + \theta) \cdot \sin(360^\circ - \theta) - [\sin(180^\circ + \theta)]^2$ $= (-\operatorname{cosec} \theta) \cdot (-\sin \theta) - \sin^2(180^\circ + \theta)$ $= \left(-\frac{1}{\sin \theta}\right) \cdot (-\sin \theta) - (-\sin \theta)^2$ $= 1 - \sin^2 \theta = \cos^2 \theta = \text{R.H.S./RK}$	✓ – cosec θ ✓ – sin θ ✓ I ✓ – sin θ ✓ S $1 - \sin^2 \theta$	A A A A CA (5)	
			[12]	

QUESTION/VRAAG 5

5.1	360°	✓ period/periode	A (1)	
5.2	$a = -2$ $b = 2$	✓ value of/waarde van a ✓ value of/waarde van b	A A (2)	
5.3	$T(158,5^\circ; -0,7)$	✓ x coordinate/koördinaat ✓ y coordinate/koördinaat Accept: $T(159,5^\circ; -0,7)$	A A (2)	
5.4.1	$135^\circ < x < 180^\circ$ OR/OF $x \in (135^\circ; 180^\circ)$	✓ end points/eindpunte ✓ correct notation/korrekte notasie	A A (2)	
5.4.2	$x = 45^\circ$ or/of $x = 135^\circ$	✓ $x = 45^\circ$ ✓ $x = 135^\circ$	A A (2)	
			[9]	

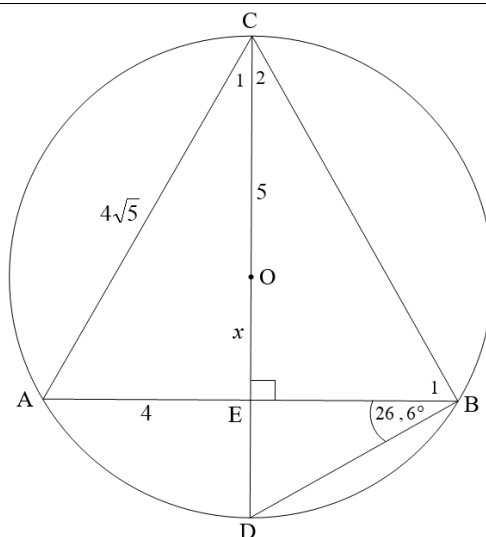
QUESTION/VRAAG 6

6.1	$\cos 50^\circ = \frac{150}{AC}$ $AC = \frac{150}{\cos 50^\circ}$ $\approx 233,36 \text{ m}$ OR/OF $AB = 150 \tan 50^\circ$ $AC = \sqrt{(150 \tan 50^\circ)^2 + (150)^2}$ $\approx 233,36 \text{ m}$ OR/OF $\hat{BAC} = 40^\circ$ $\sin 40^\circ = \frac{150}{AC}$ $AC = \frac{150}{\sin 40^\circ} \quad \text{OR/OF} = 150 \operatorname{cosec} 40^\circ$ $\approx 233,36 \text{ m}$ OR/OF $\hat{BAC} = 40^\circ$ $\frac{150}{\sin 40^\circ} = \frac{AC}{\sin 90^\circ}$ $AC = \frac{150 \sin 90^\circ}{\sin 40^\circ}$ $\approx 233,36 \text{ m}$	✓ trig ratio/verhouding A ✓ the subject/ die onderwerp AC CA ✓ length of/lengte van AC CA OR/OF ✓ Length of AB A ✓ M CA ✓ length of/lengte van AC CA OR/OF ✓ trig ratio/verhouding A ✓ the subject/ die onderwerp AC CA ✓ length of/lengte van AC CA OR/OF ✓ SF A ✓ the subject/ die onderwerp AC CA ✓ length of/lengte van AC CA NPR (3)
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6.2	Area of/oppervlakte van $\Delta ACD = \frac{1}{2} \times AC \times CD \sin \beta$ $3,3648 \times 10^4 = \frac{1}{2} \times 233,36 \times 300 \times \sin \beta$ $\sin \beta = \frac{3,3648 \times 10^4}{35004} = \frac{2804}{2917} \approx 0,96126157$ ref / verw. $\angle \approx 74^\circ$ $\beta \approx 180^\circ - 74^\circ$ $\therefore = 106^\circ$ OR/OF Area of/oppervlakte van $\Delta ACD = \frac{1}{2} \times AC \times CD \sin \beta$ $3,3648 \times 10^4 = \frac{1}{2} \times 233,36 \times 300 \times \sin \beta$ $3,3648 \times 10^4 = 35\,004 \sin \beta$ $\sin \beta = \frac{3,3648 \times 10^4}{35004}$ ref / verw. $\angle \approx 74^\circ$ $\beta \approx 180^\circ - 74^\circ$ $\therefore = 106^\circ$	✓ F A ✓ SF CA from/van Q/V 6.1 ✓ S CA ✓ ref. / verw. $\angle$ CA ✓ size of/grootte van β CA OR/OF ✓ F A ✓ SF CA from/van Q/V 6.1 ✓ S CA ✓ ref. / verw. $\angle$ CA ✓ size of/grootte van β CA NPR (5)	
6.3 #	$AD^2 = AC^2 + DC^2 - 2AC \cdot DC \cos \hat{ACD}$ $= (233,36)^2 + (300)^2 - 2(233,36)(300) \cos 106^\circ$ $\approx 183050,5296$ $\therefore AD \approx 427,84\text{m}$	✓ F A ✓ SF CA from/van Q/V 6.1, 6.2 ✓ S CA ✓ length of /lengte van AD CA NPR (4)	
		[12]	

QUESTION/VRAAG 7

7.1	Perpendicular to the chord/ <i>loodreg op die koord</i>	✓ ST	A (1)
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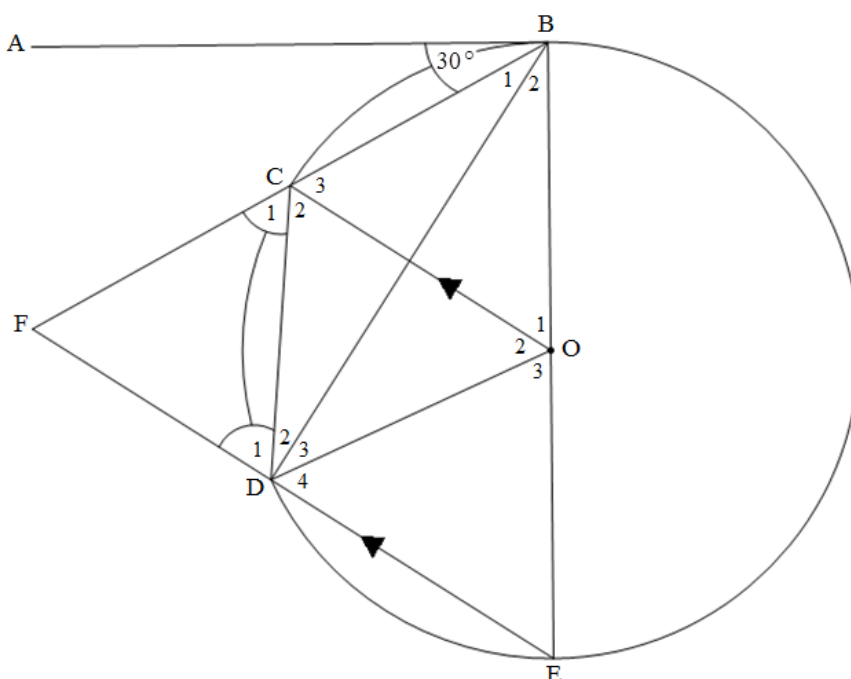
7.2.1(a)	$\hat{C}_1 = 26,6^\circ$ [$\angle^s$ in the same segment (arc or chord)/ $\angle^e$ in dieselfde segment (boog of koord)] OR/OF $\sin \hat{C}_1 = \frac{4}{4\sqrt{5}}$ $\therefore \hat{C}_1 = 26,6^\circ$	✓ ST ✓ RE OR/OF ✓ ratio/verhouding ✓ size of/ grootte van $\hat{C}_1$ A (2)	
7.2.1(b)	$\hat{A} = 180^\circ - 90^\circ - 26,6^\circ$ [sum/som $\angle^s \Delta$] $= 63,4^\circ$ OR/OF $90^\circ = \hat{A} + 26,6^\circ$ [ext. $\angle$ of $\Delta =$ sum of 2 int. opp. $\angle^s$ buite $\angle$ van $\Delta =$ som teenrst binne $\angle^e$] $\hat{A} = 63,4^\circ$ OR/OF $\cos A = \frac{4}{4\sqrt{5}} = \frac{\sqrt{5}}{5}$ $\therefore A = \cos^{-1}\left(\frac{\sqrt{5}}{5}\right) = 63,4^\circ$	✓ ST CA from/van Q/V 7.2.1(a) OR/OF ✓ ST CA from/van Q/V 7.2.1(a) OR/OF ✓ ST A (1)	

7.2.1(c)	$\hat{B}_1 = 90^\circ - 26,6^\circ$ [$\angle$ in semi circle/in halfsirkel] $= 63,4^\circ$ OR/OF $\cos \hat{B}_1 = \frac{4}{4\sqrt{5}}$ $\therefore \hat{B}_1 = 63,4^\circ$ OR/OF $\hat{A} = \hat{B}_1 = 63,4^\circ$ $\left[\begin{array}{l} \angle \text{s opp. equal sides/} \angle \text{e teenoor gelyke sye /} \\ \text{OE} \perp \text{AB and/ en AE} = \text{EB} \end{array} \right]$	✓ ST A ✓ RE A OR/OF ✓ cos ratio/ verhouding A ✓ ST A OR/OF ✓ ST A ✓ RE A (2)	
7.2.2(a)	AE = 4 units/eenhede	✓ length of /lengte van AE A (1)	
7.2.2(b)	ED = 5 – x units/eenhede	✓ length of /lengte van ED A (1)	
7.2.3	$4^2 + (x+5)^2 = (4\sqrt{5})^2$ $16 + x^2 + 10x + 25 = 80$ $x^2 + 10x - 39 = 0$ $(x-3)(x+13) = 0$ $x = 3$ or/of $x \neq -13$ One mark penalty if a candidate include $x = -13$ as the answer/ Een punt penalisering indien die kandidaat $x = -13$ as antwoord insluit OR/OF $\frac{5-x}{4} = \tan 26,6^\circ$ $5-x = 4 \tan 26,6^\circ$ $5-x \approx 2,003 \approx 2$ $x \approx 2,997 \approx 3$ OR/OF $x^2 = (5)^2 - (4)^2$ $x^2 = 9$ $x = 3$ OR/OF	✓ M A ✓ S CA ✓ factors/ formula CA faktore/ formule CA ✓ correct value of / korrekte waarde van x CA OR/OF ✓ tan ratio/verhouding A ✓ S CA ✓ S CA ✓ correct value of / korrekte waarde van x CA OR/OF ✓ Th. of Pythagoras A ✓ subst./verv. CA ✓ S CA ✓ correct value of / korrekte waarde van x CA OR/OF	

$4h^2 - 4dh + x^2 = 0$ $4h^2 - 4(10)h + (8)^2 = 0$ $4h^2 - 40h + 64 = 0$ $h^2 - 10h + 16 = 0$ $(h - 8)(h - 2) = 0$ $h = 8$ or $h = 2$ $EC = x + 5$ $8 = x + 5$ $\therefore x = 3$ OR/OF $\sin 63,4^\circ = \frac{x + 5}{4\sqrt{5}}$ $8 \approx x + 5$ $\therefore x \approx 3$ OR/OF $CE^2 = (4\sqrt{5})^2 - (4)^2$ $CE^2 = 64$ $CE = 8$ $x = 8 - 5$ $\therefore x = 3$	✓ SF A ✓ factors/ formula faktore/ formule CA ✓ both values of/ beide waardes van h CA ✓ correct value of / korrekte waarde van x CA OR/OF ✓ sin ratio/ verh A ✓ substitution/ vervanging A ✓ S CA ✓ correct value of / korrekte waarde van x CA OR/OF ✓ Theorem of Pyth. A ✓ substitution/ vervanging A ✓ value of/ waarde van CE CA ✓ correct value of / korrekte waarde van x CA AO: Full marks/Volpunte (4)
	[12]

QUESTION/VRAAG 8

8.1	90° / Right angle/ Regte hoek	✓ 90° / Right angle/ Regte hoek A (1)	
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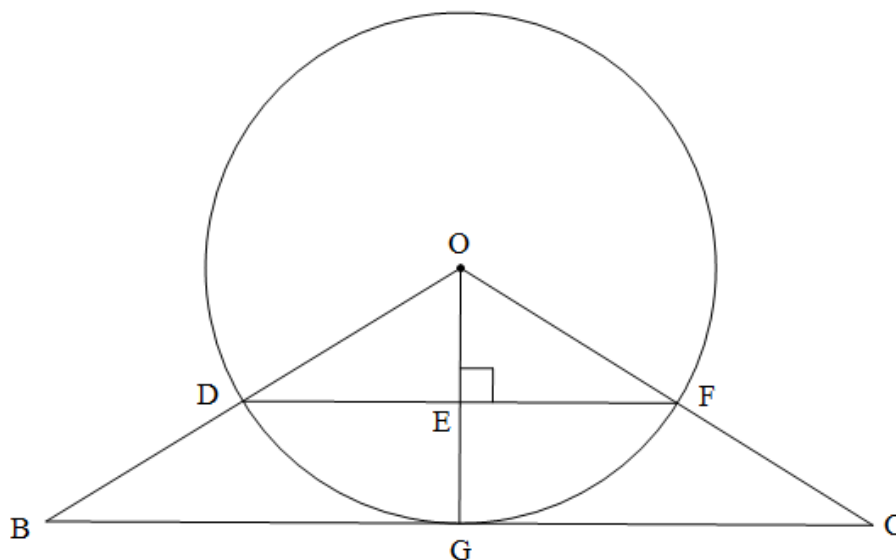


8.2.1(a)	$\hat{CBO} = 90^\circ - 30^\circ$ [tan $\perp$ radius (diameter)/ raaklyn $\perp$ radius (middellyn)] $= 60^\circ$	✓ ST ✓ RE	A A (2)	
8.2.1(b)	$\hat{D}_2 = 30^\circ$ [tan – chord/raaklyn – koord]	✓ ST ✓ RE	A A (2)	
8.2.1(c)	$\hat{O}_1 = 60^\circ$ [$\angle$ at centre = 2 $\angle$ at circumference/ middlepunt $\angle$ = 2 omtreks $\angle$] OR/ OF $\hat{OBA} = 90^\circ$ [rad $\perp$ tan/raaklyn] $\therefore \hat{OBC} = 60^\circ$ $\therefore \hat{OBC} = \hat{C}_3 = 60^\circ$ [$\angle$ s opp. equal sides, OC and OB radii / $\angle$ e teenoor gelyke sye, OC en OB radii] $\hat{O}_1 = 180^\circ - 120^\circ = 60^\circ$ [sum of $\angle$ s of Δ / som van $\angle$ e van Δ]	✓ ST from/van Q/V 8.2.1 (a) ✓ RE OR/ OF ✓ ST from/van Q/V 8.2.1 (a) ✓ ST	CA A CA A (2)	

8.2.1(d)	$\hat{O}_1 = \hat{E} = 60^\circ$ $\left[\begin{array}{l} \text{corresp } \angle s / \text{ooreenk } \angle e \\ CO \parallel FE \end{array} \right]$ $\hat{D}_4 = \hat{E} = 60^\circ$ $\angle s \text{ opp.} = \text{sides} / \angle e \text{ teenoor} = \text{sye}$ $\hat{O}_2 = \hat{D}_4 = 60^\circ$ $[\text{Alt } \angle s / \text{verw. } \angle e, CO \parallel FE]$	✓ ST ✓ ST ✓ ST	A A A (3)
8.2.2	$\hat{C}_1 = \hat{E} = 60^\circ$ $\left[\begin{array}{l} \text{ext } \angle \text{ of cyclicquad/} \\ \text{buite } \angle \text{ van koorde vierh.} \end{array} \right]$ $\hat{D}_1 = \hat{CBO} = 60^\circ$ $\left[\begin{array}{l} \text{ext } \angle \text{ of cyclicquad/} \\ \text{buite } \angle \text{ van koorde vierh.} \end{array} \right]$ $\therefore FC = FD$ $\left[\begin{array}{l} \text{sides opposite} = \angle s / \\ \text{sye teenoor} = \angle e \end{array} \right]$ OR/OF $FB = FE$ $[\text{sides opp.} = \angle s / \text{sye teenoor} = \angle e]$ $DE = CB$ $[\text{equilateral / gelyksydige } \Delta]$ $FB - CB = FE - DE$ $\therefore FC = FD$	✓ST ✓RE ✓ST ✓RE OR/OF ✓ST ✓RE ✓ST ✓M	CA A CA A CA A CA A (4)
			[14]

QUESTION/VRAAG 9

9.1	Parallel to the third side/Ewewydig aan die derde sy	✓ ST	A (1)	
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9.2.1	$\hat{OGC} = 90^\circ$ [tan $\perp$ radius/raaklyn $\perp$ radius] $\hat{OEF} = 90^\circ$ [OG $\perp$ GC] $\therefore DF \parallel BC$ [corr. $\angle$ s are equal/ooreenk. $\angle$ e is gelyk]	✓ ST ✓ RE ✓ RE	A A A (3)	
9.2.2 (a)	$BC : DF = 10 : 6 = 5 : 3$ OR/OF $\triangle ODF \parallel \triangle OBC$ $\frac{OD}{OB} = \frac{OF}{OC} = \frac{DF}{BC} = \frac{3}{5}$ $\therefore BC : DF = 5 : 3$	✓ proportionality/eweredigh ✓ simplified ratio/ vereenv.verhouding OR/OF ✓ proportionality/eweredigh ✓ simplified ratio/ vereenv.verhouding AO: Full marks/Volpunte	A A A A (2)	

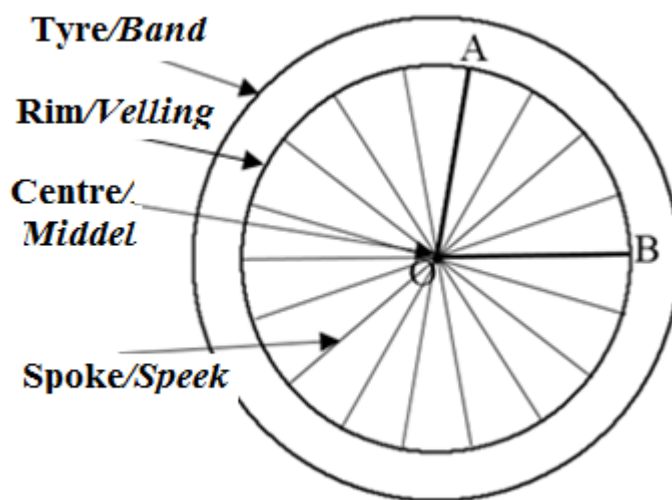
9.2.2 (b)	$\frac{EG}{OG} = \frac{2}{5}$ $\frac{EG}{6} = \frac{2}{5}$ $EG = \frac{12}{5} \text{ units / eenhede } \textbf{OR / OF } 2,4 \text{ units /eenhede}$ OR/OF $\frac{OD}{OB} = \frac{OE}{OG}$ $\frac{3}{5} = \frac{OE}{6}$ $OE = \frac{18}{5} = 3,6$ $EG = 6 - 3,6 = 2,4$	$\checkmark$ proportionality/eweredigh A $\checkmark$ substitution/vervanging A $\checkmark$ length of /lengte van EG CA OR/OF $\checkmark$ proportionality/eweredigh A $\checkmark$ substitution/vervanging A $\checkmark$ length of /lengte van EG CA (3)	
9.2.2 (c)	$OE = 6 - 2,4 = 3,6 \text{ units/eenhede}$ $\frac{\text{Area (Opp.) } \triangle OBG}{\text{Area (Opp.) } \triangle ODE} = \frac{\frac{1}{2}(10)(6)\sin \hat{BOG}}{\frac{1}{2}(6)(3,6)\sin \hat{BOG}}$ $= \frac{25}{9}$ OR/OF $\frac{\text{Area (Opp.) } \triangle OBG}{\text{Area (Opp.) } \triangle ODE} = \frac{\frac{1}{2}(BG)(OG)}{\frac{1}{2}(DE)(OE)}$ $= \frac{5}{3} \times \frac{6}{3,6}$ $= \frac{25}{9}$ OR/OF $\frac{\text{Area (Opp.) } \triangle OBG}{\text{Area (Opp.) } \triangle ODE} = \frac{\frac{1}{2}(4,8)(3,6)}{\frac{1}{2}(8)(6)}$ $= \frac{24}{8,64}$ $\approx 2,78$	$\checkmark$ length of /lengte van OE CA from /van Q/V 9.2.2 (b) $\checkmark$ SF CA $\checkmark$ value/waarde CA OR/OF $\checkmark$ length of /lengte van OE CA from/van Q/V 9.2.2 (b) $\checkmark$ SF CA $\checkmark$ value/waarde CA OR/OF $\checkmark$ length of /lengte van DE CA from/van Q/V 9.2.2 (b) $\checkmark$ SF CA $\checkmark$ value/waarde CA (3)	

9.3	In $\triangle DOE$ and/en $\triangle BOG$ $\hat{DOE} = \hat{BOG}$ [common /gemene $\angle$] $\hat{OED} = \hat{OGB} = 90^\circ$ [proved / bewys] $\therefore \hat{ODE} = \hat{OBG}$ [3rd/3de $\angle$] $\therefore \triangle DOE \parallel \triangle BOG$ $\angle\angle\angle$ OR/OF In $\triangle DOE$ and/en $\triangle BOG$ $\frac{OE}{OG} = \frac{3,6}{6} = \frac{3}{5}$ $\frac{OD}{OB} = \frac{6}{10} = \frac{3}{5}$ $\frac{DE}{BG} = \frac{3}{5}$ $\therefore \triangle DOE \parallel \triangle BOG$ [corr.sides are in proportion/ ooreen. sye is eweredig]	✓ ST A ✓ ST A ✓ RE A OR/OF ✓ one ratio/verh A ✓ two ratios/verh A ✓ RE A (3)	
		[15]	

	In Δ OAL: OC = OL = 20 cm $OL^2 = OA^2 + AL^2$ $(20)^2 = OA^2 + (16)^2$ $400 - 256 = OA^2$ $OA = \sqrt{144} = 12$ $\therefore AB = OA - OB$ $= 12 - 1,5$ $= 10,5 \text{ cm}$	radii	✓ length of/ <i>lengte van</i> OL A ✓ substitution/ <i>vervanging</i> A ✓ value of / <i>waarde van</i> OA CA ✓ M CA ✓ length of / <i>lengte van</i> AB CA (5)	
10.1.3	$w = 64\pi \text{ rad/min}$ $= 64\pi \times 2\pi \text{ rad/min}$ $= 128\pi^2 \text{ rad/min}$ OR/OF $\approx 1263,13 \text{ rad/min}$ $\omega = 2\pi n$ $128\pi^2 = 2\pi n$ OR/OF $1263,13 = 2\pi n$ $\frac{128\pi^2}{2\pi} = \frac{2\pi n}{2\pi}$ $\therefore n = 64\pi \text{ rev/min}$ OR/OF $\approx 201,03 \text{ rev/min}$		✓ conversion A ✓ SF CA ✓ value of / <i>waarde van</i> n CA (3)	
10.1.4	$v = \pi Dn$ $= \pi(40 \text{ cm}) \times (64\pi)$ $\therefore v = 25266,19 \text{ cm/min}$ OR/OF $\therefore v = 421,10 \text{ cm/sec}$ OR/OF $\therefore v = 4,21 \text{ m/sec}$ OR/OF $\therefore v = 252,66 \text{ m/min}$		✓ F A ✓ SF CA ✓ value of v CA ✓ unit CA	

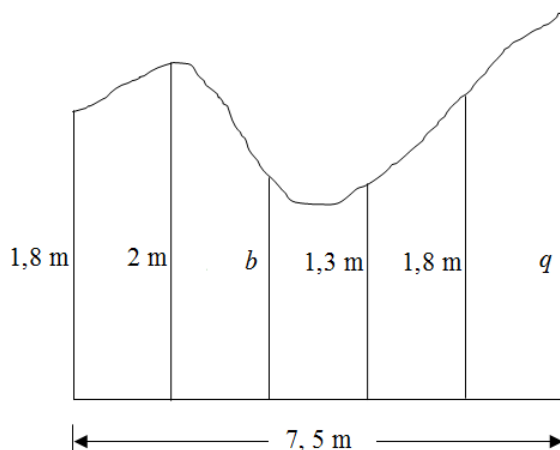
	OR/OF $v = \pi D n$ $= \pi (40 \text{ cm}) \times (64 \pi)$ $\therefore v = 25266,19 \text{ cm/min}$ OR/OF $\therefore v = 421,10 \text{ cm/sec}$ OR/OF $\therefore v = 4,21 \text{ m/sec}$ OR/OF $\therefore v = 252,66 \text{ m/min}$	OR/OF ✓ F A ✓ SF A ✓ value of / waarde van v CA ✓ unit/ eenheid CA (4)	
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10.2



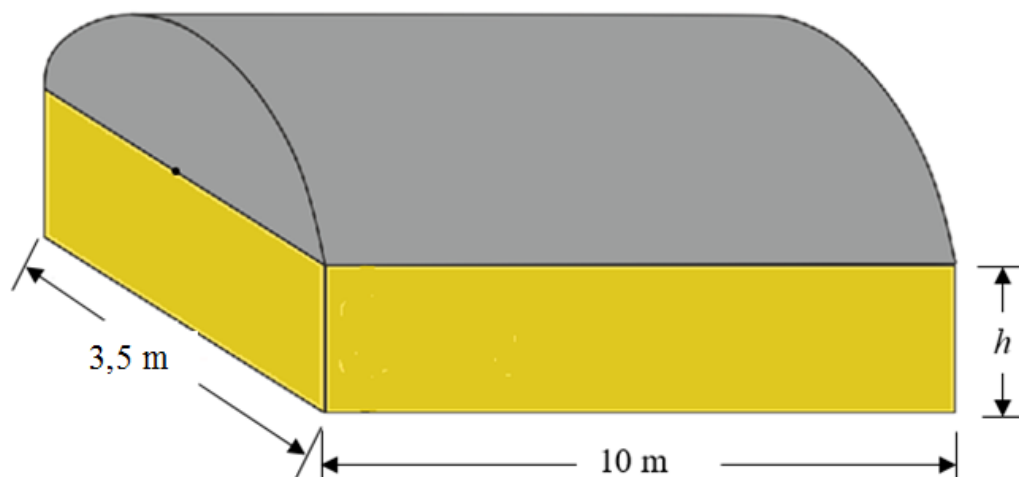
10.2.1	$\hat{A}OB = 4 \times 20^\circ = 80^\circ = \frac{4}{9}\pi$ $= 1,4$ OR/OF $\hat{A}OB = \frac{4}{18} \times 360^\circ = 80^\circ = \frac{4}{9}\pi$ $= 1,4$ OR/OF $P = 2\pi r = 2\pi(5,2) \approx 32,67 \dots \text{cm}$ $\text{Dist. between each spoke/ Afst. tussen elke speak} = \frac{32,67}{18} = 1,815 \dots \text{cm}$ $AB = 4 \times 1,815 \dots$ $= 7,26 \dots \text{cm}$ $s = r\theta$ $7,26 \dots = (5,2)\theta$ $\theta \approx 1,4$	✓ M A ✓ magnitude of/grootte van $\hat{A}OB$ A ✓ $\angle$ in radians/ in radiale CA OR/OF ✓ M A ✓ magnitude of/grootte van $\hat{A}OB$ A ✓ $\angle$ in radians/ in radiale CA OR/OF ✓ Perimeter/ omtrek A ✓ SF A ✓ $\angle$ in radians/ in radiale CA (3)
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10.2.2	$s = r\theta$ $= 5,2 \text{ cm} \times 1,4 \quad \text{or / of} \quad 5,2 \text{ cm} \times \frac{4}{9} \pi$ $\approx 7,3 \text{ cm}$ OR/OF $s = \frac{4}{18} \times 2\pi r$ $= \frac{4}{18} \times 2\pi (5,2) \text{ cm}$ $\approx 7,3 \text{ cm}$	✓ F A ✓ SF CA ✓ arc length/ <i>booglengte</i> CA OR/OF ✓ M A ✓ $\frac{4}{18}$ A ✓ arc length/ <i>booglengte</i> CA (3)	
10.2.3	Area of a sector/ <i>opp. van sektor</i> $= \frac{rs}{2}$ $= \frac{5,2 \times 7,3}{2}$ $= 19 \text{ cm}^2$ OR/OF Area of a sector/ <i>opp. van sektor</i> $= \frac{r^2 s}{2}$ $= \frac{(5,2)^2 \times 1,4}{2}$ $= 19 \text{ cm}^2$ OR/OF Area of a sector/ <i>Opp. van sektor</i> $= \frac{4}{18} \pi r^2$ $= \frac{4}{18} \pi (5,2)^2 \text{ cm}^2$ $\approx 19 \text{ cm}^2$	✓ F A ✓ SF CA ✓ area of sector/ <i>Opp. van sektor</i> CA OR/OF ✓ F A ✓ SF CA ✓ area of sector/ <i>Opp. van sektor</i> CA OR/OF ✓ ratio/ <i>verh</i> A ✓ substitution/ <i>vervang</i> CA ✓ area of sector/ <i>opp van sektor</i> CA (3)	
		[22]	

QUESTION/VRAAG 11


11.1.1	$b = \sqrt{2}$ $\approx 1,4\text{ m}$	✓ value of /value of b A NPR (1)	
11.1.2	$A_{\text{irr}} = \frac{2}{3} \times 19,125\text{ m}^2 = 12,75\text{ m}^2$ $A_T = a(m_1 + m_2 + m_3 + \dots + m_n)$ $12,75 = 1,5 \left(\frac{1,8+2}{2} + \frac{2+1,4}{2} + \frac{1,4+1,3}{2} + \frac{1,3+1,8}{2} + \frac{1,8+q}{2} \right)$ $12,75 = 1,5 \left(1,9 + 1,7 + 1,35 + 1,55 + \frac{1,8+q}{2} \right)$ $8,5 = 6,5 + \frac{1,8+q}{2}$ $4 = 1,8 + q$ $\therefore q = 2,2\text{ m}$ OR/OF $A_{\text{irr}} = \frac{2}{3} \times 19,125\text{ m}^2 = 12,75\text{ m}^2$ $12,75 = 1,5 \left(\frac{1,8+q}{2} + 2 + 1,4 + 1,3 + 1,8 \right)$ $8,5 = 6,5 + \frac{1,8+q}{2}$ $4 = 1,8 + q$ $\therefore q = 2,2\text{ m}$	✓ value of /waarde van A_{irr} A ✓ F A ✓ value of /waarde van a A ✓ SF CA ✓ value of /waarde van q CA OR/OF ✓ value of /waarde van A_{irr} A ✓ F A ✓ value of /waarde van a A ✓ SF CA ✓ value of /waarde van q CA (5)	

11.2



11.2.1	$V = l \times b \times h$ $70\text{m}^3 = 3,5\text{m} \times 10\text{m} \times h$ $\therefore h = 2\text{m}$	✓ value of h	A (1)
11.2.2	$r = \frac{1}{2} \times 3,5\text{m} = 1,75\text{m}$	✓ value of r	A (1)
11.2.3 #	$SA_{\text{Rec.Prism}} = 2 \times (b \times h) + 2 \times (l \times h)$ $= 2 \times (3,5\text{m} \times 2\text{m}) + 2 \times (10\text{m} \times 2\text{m})$ $= 54\text{m}^2$ $SA_{\frac{1}{2}\text{cylinder}} = \frac{1}{2} \times (2\pi r^2 + 2\pi rh)$ $= \frac{1}{2} [2\pi(1,75)^2 + 2\pi(1,75)(10)]\text{m}^2$ $= 20,56\pi\text{m}^2 \text{ OR/OF } \approx 64,60\text{m}^2$ $SA_T = 54\text{m}^2 + 64,60\text{m}^2 \text{ OR/OF } = 54\text{m}^2 + 20,56\pi\text{m}^2_{\frac{1}{2}\text{cilinder}}$ $= 118,60\text{m}^2$ YES, the total surface area is less than 120m^2 <i>JA, die totale buite-oppervlakte is minder as 120m^2</i>	✓ SF CA from Q11.2.1 ✓ value of / waarde van A_{Prism} CA ✓ SF CA from Q11.2.2 ✓ value of /waarde van $A_{\frac{1}{2}\text{cilinder}}$ CA ✓ SA total/totaal CA ✓ conclusion must be based on total surface area/gevolgtrekking moet gebaseer word volgens die totale buite-oppervlakte CA	(6)
		[14]	

TOTAL/TOTAAL: 150