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**NATIONAL
SENIOR CERTIFICATE/
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

SEPTEMBER 2025

**TECHNICAL MATHEMATICS P2/TEGNIIESE WISKUNDE V2
MARKING GUIDELINE/NASIENRIGLYN**

MARKS/PUNTE: 150

This marking guideline consists of 18 pages./
Hierdie nasienriglyn bestaan uit 18 bladsye.



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NOTE:

- Continuous accuracy (CA) applies only where indicated in this marking guideline.
- Assuming values/answers in order to solve a problem is unacceptable.

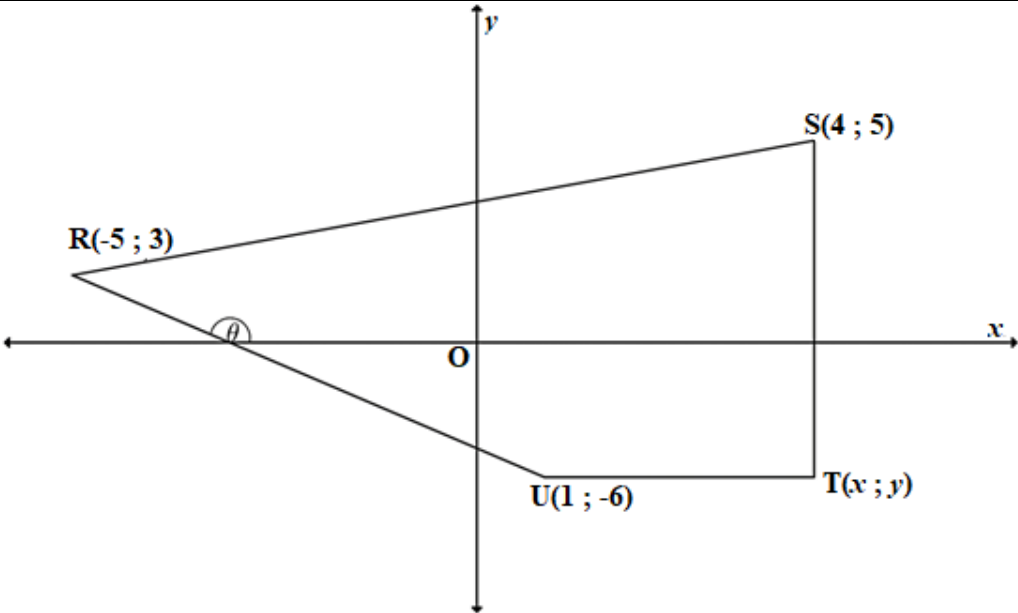
LET WEL:

- *Volgehoue akkuraatheid (CA) is slegs van toepassing soos aangedui in hierdie nasienriglyn.*
- *Aanvaarding van waardes/antwoorde om 'n problem op te los, is onaanvaarbaar.*

MARKING CODES / NASIENKODES	
M	Method / Metode
A	Accuracy / Akkuraatheid
AO	Answer only / Slegs antwoord
CA	Consistent accuracy / Deurlopende akkuraatheid
F	Formula / Formule
I	Identity / Identiteit
R	Rounding / Afronding
S	Simplification / Vereenvoudiging
ST	Statement / Bewering
RE	Reason / Rede
ST RE	Statement and correct reason / Bewering en korrekte rede
SF	Substitution correctly in correct formula / Korrekte vervanging in die korrekte formule
NPU	No penalty for omitting units / Geen penalisering vir eenhede uitgelaat
NPR	No penalty for rounding / Geen penalisering vir ronding



QUESTION/VRAAG 1

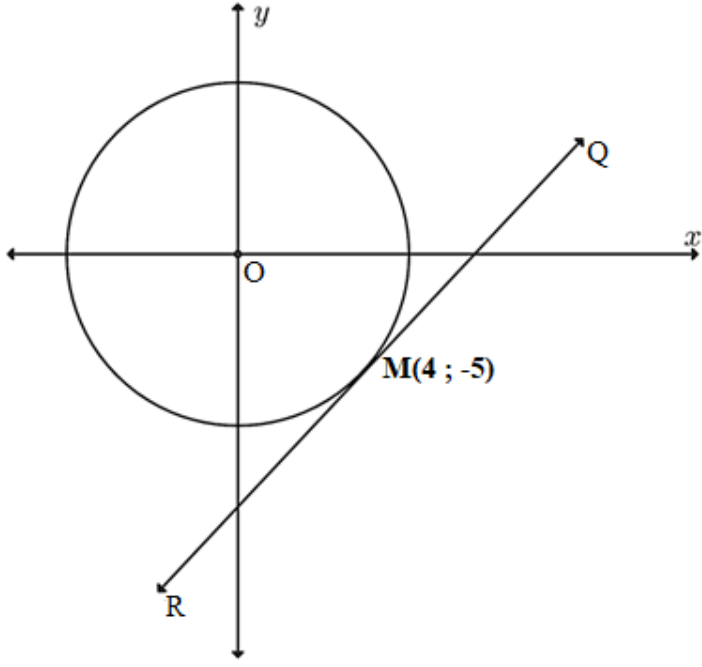
				
1.1	T(4; -6)	✓x-value / waarde ✓y-value / waarde	A A	(2)
1.2	$RS = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $RS = \sqrt{(4 - (-5))^2 + (5 - 3)^2}$ $RS = \sqrt{81 + 4}$ $RS = \sqrt{85}$ $RS = 9,22 \text{ units/eenhede}$	✓F ✓Subst. / Vervang	A A	(3)
1.3	$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$ $= M\left(\frac{-5 + 4}{2}; \frac{3 + 5}{2}\right)$ $= M\left(-\frac{1}{2}; 4\right)$	✓x-value / waarde ✓y-value / waarde	A A	(2)
1.4	$\tan\theta = m_{RU}$ $\tan\theta = \frac{-6-3}{1+5} = \frac{-9}{6}$ $\theta = \tan^{-1}\left(\frac{+9}{6}\right)$ $\text{Ref/ Verw.} < = 56,31^\circ$ $\therefore \theta = 180^\circ - 56,31^\circ$ $\theta = 123,69^\circ$	✓F ✓Subst. / Vervang ✓S ✓Ref/ Verw < ✓Ans / Antw	A CA CA CA CA	(5)



1.5	$m_{RS} = \frac{5-3}{4+5} = \frac{2}{9}$ $m_l = \frac{-1}{2/9} = -\frac{9}{2}$ $y - 4 = -\frac{9}{2}\left(x + \frac{1}{2}\right)$ $y = -\frac{9}{2}x - \frac{9}{4} + 4$ $y = -\frac{9}{2}x + \frac{7}{4}$ OR/OF $m_{RS} = \frac{5-3}{4+5} = \frac{2}{9} \qquad m_l = \frac{-1}{2/9} = -\frac{9}{2}$ $y = -\frac{9}{2}x + C$ $4 = -\frac{9}{2}\left(-\frac{1}{2}\right) + C$ $C = \frac{7}{4}$ $y = -\frac{9}{2}x + \frac{7}{4}$	$\checkmark m_{RS} = \frac{2}{9} \qquad \text{A}$ $\checkmark m_l = -\frac{9}{2} \qquad \text{CA}$ $\checkmark \text{Subst} \qquad \text{CA}$ $\checkmark \text{S} \qquad \text{CA}$ $\checkmark \text{Ans/Antw} \qquad \text{CA}$ OR/OF $\checkmark m_{RS} = \frac{2}{9} \qquad \text{A}$ $\checkmark m_l = -\frac{9}{2} \qquad \text{CA}$ $\checkmark \text{Subst} \qquad \text{CA}$ $\checkmark \text{S} \qquad \text{CA}$ $\checkmark \text{Ans/Antw} \qquad \text{CA}$	(5)
			[17]



QUESTION/VRAAG 2

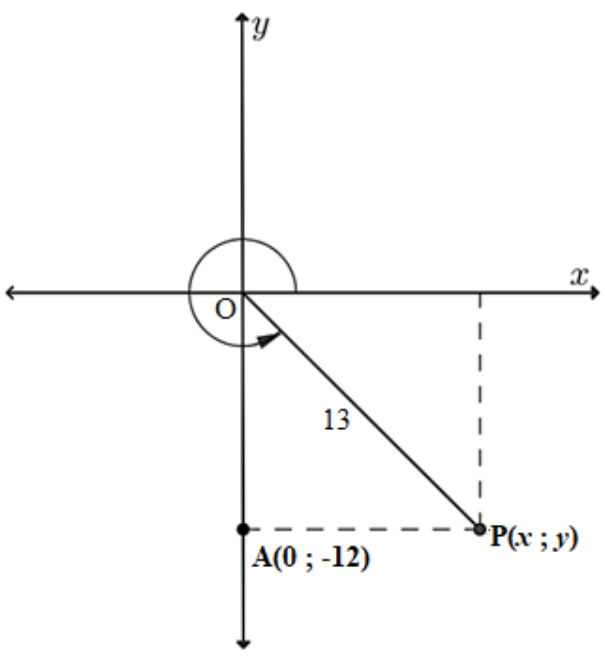
2.1				
2.1.1	Tangent / Raaklyn	✓Ans/Antw	A	(1)
2.1.2	$x^2 + y^2 = r^2$ $4^2 + (-5)^2 = r^2$ $16 + 25 = r^2$ $41 = r^2$ $x^2 + y^2 = 41$	✓Subst./Vervang ✓Eqn/Vgl	A CA	(2)
2.1.3	$x \cdot x_2 + y \cdot y_2 = r^2$ $x(4) + y(-5) = 41$ $4x - 5y = 41$ $y = \frac{4}{5}x - \frac{41}{5}$ $y = \frac{4}{5}x - \frac{41}{5}$ OR/OF	✓F ✓SF ✓S ✓Eqn/Vgl	A A CA CA	



	$m_{QR} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - 0}{4 - 0} = -\frac{5}{4}$ $m_{\text{tangent}} = -1 \div -\frac{5}{4} = \frac{4}{5}$ $y - y_1 = m(x - x_1)$ $y + 5 = \frac{4}{5}(x - 4)$ $y = \frac{4}{5}x - \frac{16}{5} - 5$ $y = \frac{4}{5}x - \frac{41}{5}$	✓ m_{QR} A ✓ m_{tangent} CA ✓ S CA ✓ Eqn/Vgl CA	(4)
2.2.1	$\frac{x^2}{32} + \frac{y^2}{81} = 1$ $\frac{x^2}{(\sqrt{32})^2} + \frac{y^2}{9^2} = 1$	✓ Stand form/vorm CA	(1)
2.2.2		✓ elliptical shape/ elliptiese vorm A ✓ x-int/as A ✓ y-int/as A	(3)
			[11]



QUESTION/VRAAG 3

3.1	$x = 1,271 \text{ rad}$ $\cot x + 11 = \cot(1,271) + 11$ $\cot x + 11 = \frac{1}{\tan\left(1,271 \times \frac{180^\circ}{\pi}\right)} + 11$ $\cot x + 11 = 11,31$	$\checkmark \frac{1}{\tan X}$ A $\checkmark 1,271 \times \frac{180^\circ}{\pi}$ A $\checkmark \text{Ans / Antw}$ A	(3)
3.2			
3.2.1	$x^2 + y^2 = r^2$ $x^2 + (-12)^2 = 13^2$ $x = \sqrt{13^2 - (-12)^2}$ $x = 5$ $P(5; -12)$	$\checkmark$ Subst / Vervang A $\checkmark$ x-value/waarde A $\checkmark$ y-value/waarde A	(3)



3.2.2	$\cos^2 \theta - \sec^2 \theta$ $= \left(\frac{5}{13}\right)^2 - \left(\frac{13}{5}\right)^2$ $= -6,61$	$\checkmark \left(\frac{5}{13}\right)^2$ CA $\checkmark \left(\frac{13}{5}\right)^2$ CA $\checkmark \text{Ans/Antw}$ CA NPR	(3)
3.2.3	$\frac{1}{\operatorname{cosec} \theta} - \cot \theta = \frac{1}{\left(\frac{13}{-12}\right)} - \left(\frac{5}{-12}\right)$ $\frac{1}{\operatorname{cosec} \theta} - \cot \theta = \frac{-79}{156}$	$\checkmark \frac{13}{-12}$ A $\checkmark \frac{5}{-12}$ CA $\checkmark \text{Ans/Antw}$ CA NPR	(3)
3.3	$-7 \tan \beta + 3 = 1$ $-7 \tan \beta = 1 - 3$ $\tan \beta = \frac{-2}{-7}$ $\tan \beta = \frac{2}{7}$ $\beta = \tan^{-1} \left(\frac{2}{7}\right)$ $\beta = 15,95^\circ$	$\checkmark \text{S}$ A $\checkmark \tan^{-1} \left(\frac{2}{7}\right)$ CA $\checkmark 15,95^\circ$ CA	(3)
			[15]



QUESTION/VRAAG 4

4.1	$\frac{\cos^2(180^\circ + x) + \sin(360^\circ + x) \cdot \sin x + \tan^2 x}{\cot(180^\circ + x) \cdot \tan x}$ $= \frac{(-\cos x)^2 + \sin x \cdot \sin x + \tan^2 x}{\cot x \cdot \tan x}$ $= \frac{\cos^2 x + \sin^2 x + \tan^2 x}{\frac{1}{\tan x} \cdot \tan x}$ $= \frac{1 + \tan^2 x}{1}$ $= \sec^2 x$	$\checkmark -\cos x$ $\checkmark \sin x$ $\checkmark \cot x$ $\checkmark \frac{1}{\tan x}$ $\checkmark \cos^2 x + \sin^2 x = 1$ $\checkmark \sec^2 x$	A A A A A A	(6)
4.2	$\operatorname{cosec} \theta - \cot \theta = \frac{\sin \theta}{1 + \cos \theta}$ $LHS / LK = \operatorname{cosec} \theta - \cot \theta$ $= \frac{1}{\sin \theta} - \frac{\cos \theta}{\sin \theta}$ $= \frac{1 - \cos \theta}{\sin \theta}$ $= \frac{1 - \cos \theta}{\sin \theta} \times \frac{1 + \cos \theta}{1 + \cos \theta}$ $= \frac{1 - \cos^2 \theta}{\sin \theta(1 + \cos \theta)}$ $= \frac{\sin^2 \theta}{\sin \theta(1 + \cos \theta)}$ $= \frac{\sin \theta}{1 + \cos \theta}$ $= RHS / RK$	$\checkmark \frac{1}{\sin \theta}$ $\checkmark \frac{\cos \theta}{\sin \theta}$ $\checkmark \frac{1 + \cos \theta}{1 + \cos \theta}$ $\checkmark S$ $\checkmark \sin^2 \theta$	A A A CA A	(5)
				[11]

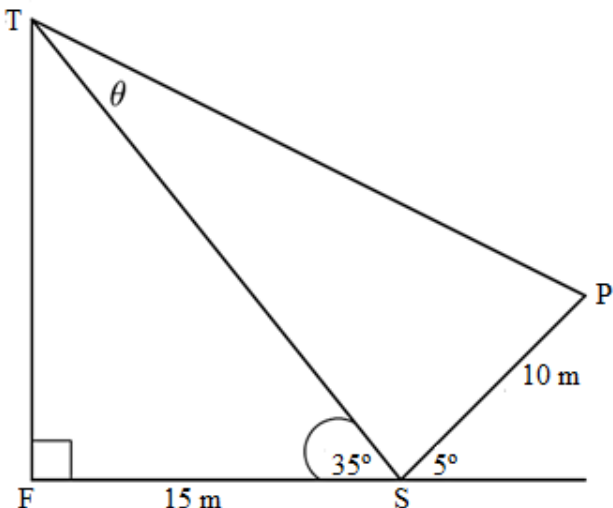


QUESTION/VRAAG 5

5.1	$f(x) = \sin(x + 45^\circ)$ and / en $g(x) = 3\cos x$ for $x \in [0^\circ ; 360^\circ]$.		
		f: ✓ y-intercept/as A ✓ x-intercept/as A ✓ Shape / Vorm A g: ✓ y-intercept/as A ✓ x-intercept/as A ✓ Shape / Vorm A	(6)
5.2.1	360°	✓ 360° A	(1)
5.2.2	Amplitude = 3	✓ Answer/antwoord A	(1)
5.3	$x = 0^\circ$ or $x = 360^\circ$	✓ $x = 0^\circ$ A ✓ $x = 360^\circ$ A	(2)
5.4	$135^\circ < x < 255^\circ$	✓ $x = 135^\circ$ A ✓ $x = 225^\circ$ A	(2)
			[12]



QUESTION/VRAAG 6

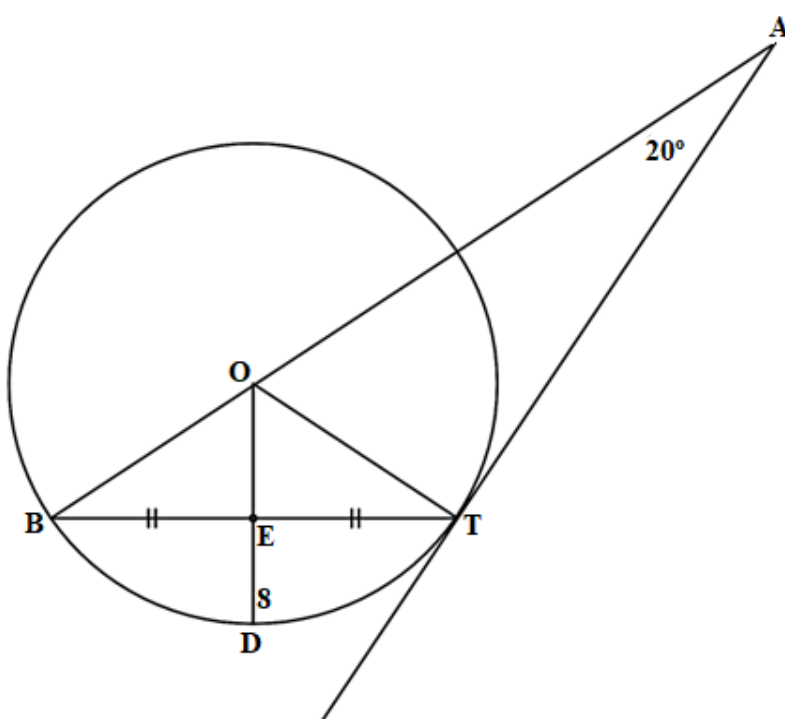
			
6.1	$\cos \hat{M} = \frac{SF}{ST}$ $ST = \frac{15}{\cos 35^\circ}$ $ST = 18,3\text{m}$ OR/OF $\sec \hat{M} = \frac{ST}{SF}$ $ST = 15 \sec 35^\circ$ $ST = 18,3\text{m}$	✓M A ✓Subt/Vervang A OR/OF ✓M A ✓Subt/Vervang A	(2)
6.2	$\hat{TSP} = 180^\circ - (35^\circ + 5^\circ) = 140^\circ$ $TP^2 = ST^2 + SP^2 - 2 \cdot ST \cdot SP \cos \hat{S}$ $TP^2 = (18,3)^2 + (10)^2 - 2 \cdot (18,3) \cdot (10) \cos 140^\circ$ $TP^2 = 334,89 + 100 + 280,3723$ $TP = \sqrt{715,2623}$ $TP = 26,74\text{m}$	✓ 140° A ✓F..... A ✓Subt/Vervang A ✓S CA ✓Answer/Antwoord CA NPR	(5)



6.3	$\frac{\sin \theta}{SP} = \frac{\sin \hat{S}}{TP}$ $\sin \theta = \frac{10 \times \sin 140^\circ}{26,74}$ $\sin \theta = \frac{10 \times \sin 140^\circ}{26,74}$ $\theta = \sin^{-1}(0,2404)$ $\theta = 13,91^\circ$ OR/OF $SP^2 = TS^2 + TP^2 - 2.TS.TP.\cos \theta$ $(10)^2 = (18,3)^2 + (26,74)^2 - 2(18,3)(26,74)\cos \theta$ $\frac{(10)^2 - (18,3)^2 - (26,74)^2}{-2(18,3)(26,74)} = \cos \theta$ $0,9706 \dots = \cos \theta$ $\cos^{-1}(0,9706 \dots) = \theta$ $13,93^\circ = \theta$	$\checkmark F$ A $\checkmark SF$ CA $\checkmark S$ CA $\checkmark$ Answer / Antwoord CA NRP OR/OF $\checkmark F$ A $\checkmark SF$ CA $\checkmark S$ CA $\checkmark$ Answer/Antwoord CA NRP	(4)
6.4	$\text{Area of } \Delta STP = \frac{1}{2} (ST \times SP \times \sin \hat{S})$ $= \frac{1}{2} (18,3 \times 10 \times \sin 140^\circ)$ $= 58,82\text{m}^2$ OR/OF $\text{Area of } \Delta STP = \frac{1}{2} (TP \times ST \times \sin \hat{T})$ $= \frac{1}{2} (26,74 \times 18,3 \times \sin 13,91^\circ)$ $= 58,82\text{m}^2$	$\checkmark F$ A $\checkmark SF$ CA $\checkmark$ Area CA OR/OF $\checkmark F$ A $\checkmark SF$ CA $\checkmark$ Area CA	(3)
			[14]



QUESTION/VRAAG 7

				
7.1	Perpendicular/loodreg or/of 90°	✓ ST	A	(1)
7.2	$\tan 20^\circ = \frac{OT}{35}$ $OT = 35 \tan 20^\circ$ $\therefore OT = 12,74 \text{ units}$ $OT = OD \text{ (radii/radii)}$ $OE = 12,74 - 8$ $OE = 4,74$ $ET = \sqrt{(12,74)^2 - (4,74)^2} \text{ Pythagoras}$ $ET = 11,83$ $\therefore BT = 2 \times ET$ $BT = 23,65$	✓ ST ✓ ST/RE ✓ ST/RE ✓ ST ✓ ST	A A A A A	(5)
7.3	$\hat{O}TA = 90^\circ \quad \tan \perp \text{rad}$ $\hat{T}OA = 180^\circ - (90^\circ + 20^\circ) \text{ sum of / som van } \angle s \text{ in } \Delta$ $\hat{T}OA = 70^\circ$ $\hat{B} + \hat{O}TB = 70^\circ \quad \text{ext } \angle \text{ of } \Delta$ $\hat{B} = \hat{O}TB \quad \angle s \text{ opp} = \text{sides} / \angle \text{ teenoor} = \text{sye}$ $\therefore \hat{B} = 35^\circ$	✓ ST ✓ ST ✓ ST RE ✓ ST RE ✓ ST	A A A A A	(5)
				[11]

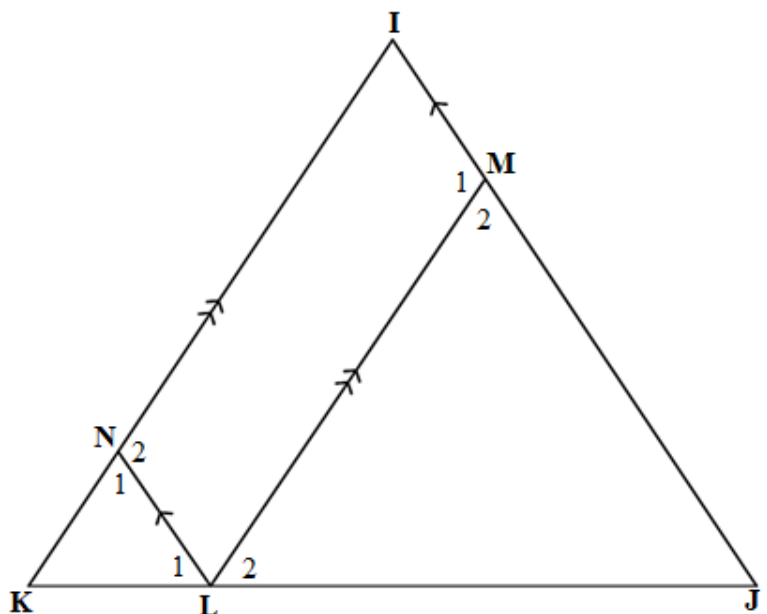


QUESTION/VRAAG 8

8.1	90°	✓ ST	A	(1)
8.2	$\hat{P}_2 = 48^\circ$ $\angle$ s in same seg / dieselfde seg	✓ ST ✓ RE	A	(4)
	$\hat{P}_2 = \hat{S}_1 = 48^\circ$ $\angle$ s opp = sides	✓ ST ✓ RE	A	
8.3.1	$\hat{O}_2 = \hat{P}_2 + \hat{S}_1$ ext $\angle$ of Δ	✓ RE	A	(2)
	$\hat{O}_2 = 48^\circ + 48^\circ = 96^\circ$	✓ $\hat{O}_2 = 96^\circ$	A	
8.3.2	$\hat{S} = 90^\circ$ $\angle$ in semicircle / in halfsirkel	✓ ST ✓ RE	A	(4)
	$\hat{P}_2 + \hat{S} + \hat{R}_2 = 180^\circ$ sum of / som van $\angle$ s in Δ	✓ RE	A	
	$\hat{R}_2 = 180^\circ - (90^\circ + 48^\circ) = 42^\circ$	✓ ST	A	
	OR/OF	OR/OF		
	$Q_2 = 42^\circ$ ($\angle$ in semicircle / in halfsirkel)	✓ ST ✓ RE	A	
	$R_2 = 42^\circ$ ($<$ in same segment / in dieselfde segment)	✓ ST ✓ RE	A	
8.3.3	$\hat{S}_1 + \hat{S}_2 + \hat{S}_3 = 90^\circ$ ($\angle$ in semicircle / in halfsirkel)	✓ ST	A	(2)
	$\hat{S}_3 = 90^\circ - (48^\circ + 21^\circ) = 21^\circ$	✓ ST	CA	
8.3.4	$\hat{P}_1 = \hat{S}_3 = 21^\circ$ ($<$ in same segment / in dieselfde segment)	✓ ST ✓ RE	A	(2)
				[15]



QUESTION/VRAAG 9

9.1	Parallel/eeweredig	✓ ST	A	(1)
9.2				
9.2.1	in $\triangle NKL$ and/en $\triangle NKL$ $\hat{K}$ common / gemeen $\hat{N}_1 = \hat{I}$ <i>corrs $\angle$s</i> $LN \parallel JI$ $\hat{L}_1 = \hat{J}$ <i>third / derde $\angle$</i> $\therefore \triangle NKL \parallel \triangle IJK$ $\angle \angle \angle$	✓ ST ✓ ST ✓ RE ✓ RE	A A A	(4)
9.2.2.(a)	$\frac{NK}{IK} = \frac{NL}{IJ}$ $\triangle NKL \parallel \triangle IJK$ $\therefore \frac{NL}{IJ} = \frac{2}{5}$	✓ ST RE ✓ ST	A A	(2)
9.2.2(b)	$\frac{JM}{JI} = \frac{JL}{JK}$ <i>prop theorem</i> $LM \parallel KI$ $\frac{JL}{JK} = \frac{IN}{IK}$ <i>prop theorem</i> $LN \parallel JI$ $\therefore \frac{JM}{JI} = \frac{3}{5}$	✓ ST ✓ RE ✓ ST	A A	(3)
				[10]



QUESTION/VRAAG 10			
10.1.1	$D = 25 \times 2 = 50 \text{ cm}$	✓ans/antw NPU	A (1)
10.1.2	$\frac{200}{1 \text{ min}} \times \frac{1}{60 \text{ sec}} = \frac{10}{3} \text{ rev/s} \approx 3,33 \text{ rev/s}$	✓conv/herleid ✓ans/antw NPU, NPR	A CA (2)
10.1.3	$v = \pi D n$ $v = \pi \left(\frac{50}{100} \right) (3,33)$ $v = \frac{333}{200} \pi \text{ m/s}$ $v = 5,23 \text{ m/s}$ OR/OF $v = \pi (0,5) \left(\frac{10}{3} \right)$ $v = \frac{5}{3} \pi$ $v = 5,24 \text{ m/s}$	✓F ✓SF ✓ $D = \frac{50}{100}$ ✓Ans/antw OR/OF ✓F ✓SF ✓ $D = 0,5$ ✓Ans/antw	A A A CA A A A CA
10.1.4	$\omega = 2\pi n$ $\omega = 2\pi (3,33)$ $\omega = \frac{333}{50} \pi$ $\omega = 20,92 \text{ rad/s}$ OR/OF $\omega = 2\pi \left(\frac{10}{3} \right)$ $\omega = \frac{20}{3} \pi$ $\omega = 20,94 \text{ rad/sec}$	✓F ✓SF ✓Ans/antw NPU, NPR OR/OF ✓F ✓SF ✓Ans/antw NPU, NPR	A CA CA A CA CA
			(4)
			(3)



10.2	$4h^2 - 4dh + x^2 = 0$ $4h^2 - 4(80 \times 2)h + (60)^2 = 0$ $4h^2 - 640h + 3600 = 0$ $h^2 - 140h + 900 = 0$ $h = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $h = \frac{-(-140) \pm \sqrt{(-140)^2 - 4(1)(900)}}{2(1)}$ $h = 133,25$ or/of $h = 6,75$ $\therefore CO = OD - CD$ $\therefore CO = 80 - 6,75$ $\therefore CO = 73,25$	✓F A ✓SF A ✓Std form CA ✓Both Values h A ✓CO CA NPU, NPR	(5)
10.3.1	$s = r\theta$ $s = 13 \left(87^\circ \times \frac{\pi}{180^\circ} \right)$ $s = \frac{377}{60} \pi$ $s = 19,74 \text{ cm}$	✓F A ✓SF CA ✓conv/herleid A ✓Ans/antw CA	(4)
10.3.2	Area of sector / van sektor $= \frac{1}{2} r^2 \theta$ $= \frac{1}{2} \times (13)^2 \times \left(\frac{29\pi}{60} \right) = \frac{4901}{120} \pi$ $= 128,31 \text{ cm}^2$ OR/OF Area of sector / van sektor $= \frac{rs}{2}$ $= \frac{13 \times 19,74}{2}$ $= 128,31 \text{ cm}^2$	✓F A ✓SF CA ✓Area/Oppervl CA NPU, NPR AO Full Marks OR/OF ✓F A ✓SF CA ✓Area/Oppervl CA NPU, NPR AO Full Marks	(3)
			[22]



QUESTION/VRAAG 11

11.1	$A_T = a \left(\frac{o_1 + o_8}{2} + o_2 + o_3 + o_4 + o_5 + o_6 + o_7 \right)$ $= \frac{28}{7} \left(\frac{9 + 6,52}{2} + 8,25 + 7 + 6,25 + 9,1 + 7,5 + 8 \right)$ $= 4 \left(\frac{2693}{50} \right)$ $= 215,44 \text{ m}^2$ OR/OF $A_T = a(m_1 + m_2 + m_3 + m_4 + \dots + m_n)$ $= \frac{28}{7} \left(\frac{9+8,25}{2} + \frac{8,25+7}{2} + \frac{7+6,25}{2} + \frac{6,25+9,1}{2} + \frac{9,1+7,5}{2} + \frac{7,5+8}{2} + \frac{8+6,25}{2} \right)$ $= 4 \left(\frac{2693}{50} \right)$ $= 215,44 \text{ m}^2$	✓F A ✓SF A ✓ $a = \frac{28}{7}$ A ✓S CA ✓Area/Oppervl CA OR/OF ✓F A ✓SF A ✓ $a = \frac{28}{7}$ A ✓S CA ✓Area/Opperv CA	(5)
11.2.1	Total Volume of the three / Totale volume van die drie: $V_T = \frac{4}{3} \pi (13)^3 + \frac{4}{3} \pi \left(\frac{22}{2} \right)^3 + \frac{4}{3} \pi \left(\frac{28}{2} \right)^3$ $= \frac{25088}{3} \pi$ $= 26272,09 \text{ cm}^3$	✓SF A ✓ $r = \frac{22}{2} \dots \dots \dots$ A ✓ $r = \frac{28}{2}$ A ✓S CA ✓Ans/Antw CA	(5)
11.2.2	Surface area of the inflated volleyball / Buite-oppervlakte van die opgeblaasde vlugbal $= 4\pi r^2$ $= 4\pi \left(\frac{22}{2} \right)^2$ $= 484\pi$ $= 1520,53 \text{ cm}^2$	✓SF A ✓value of/waarde van Area CA	(2)
			[12]
		TOTAL/TOTAAL:	150

