Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 12

SEPTEMBER 2025

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

MARKS/*PUNTE*: 150

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

NOTE:

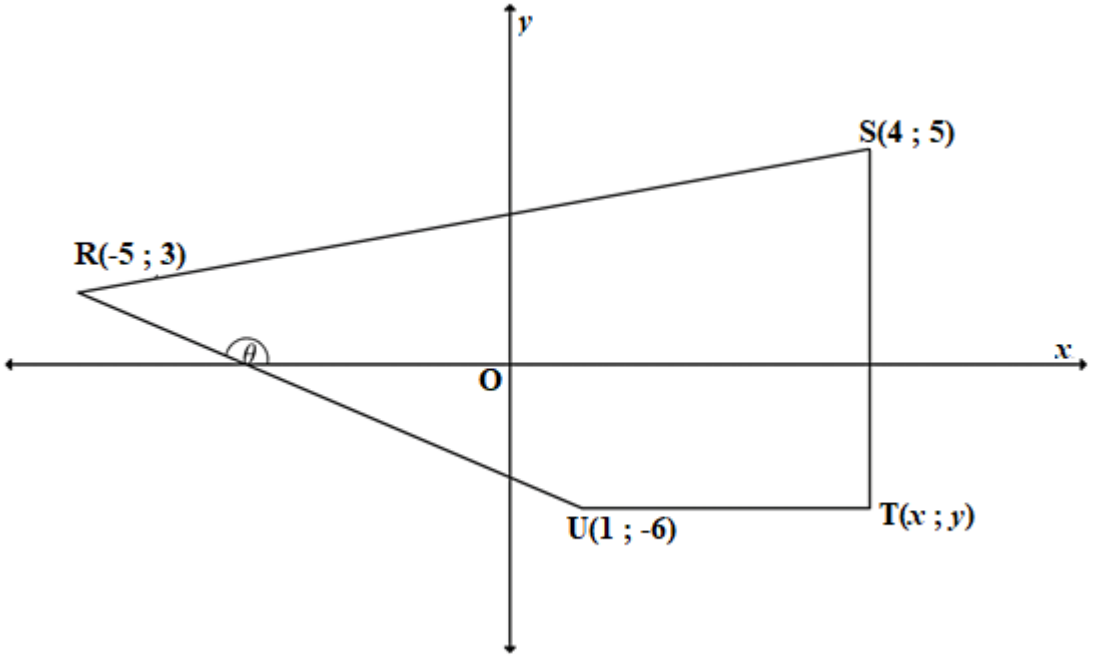
- Continuous accuracy (CA) applies only where indicated in this marking guideline.
- Assuming values/answers in order to solve a problem is unacceptable.

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***

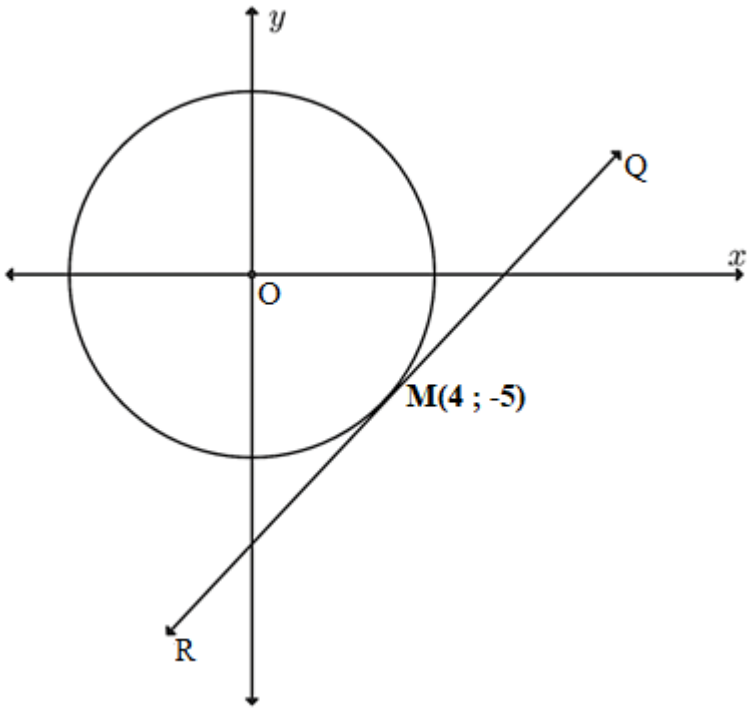
QUESTION/*VRAAG* 1

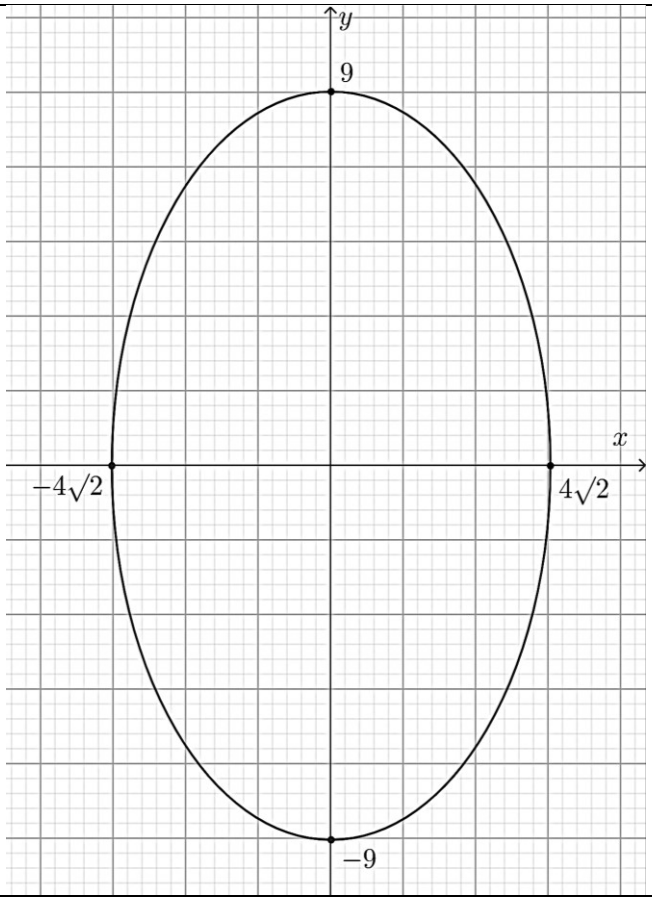


1.1	$T(4;-6)$	✓***x***-value / *waarde* **A** ✓***y***-value / *waarde* **A**	(2)
1.2	$RS = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $RS = \sqrt{(4 - (-5))^2 + (5 - 3)^2}$ $RS = \sqrt{81 + 4}$ $RS = \sqrt{85}$ RS = 9,22 units/*eenhede*	✓**F** **A** ✓Subst. / *Vervang* **A** ✓Ans / *Antw* **CA**	(3)
1.3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

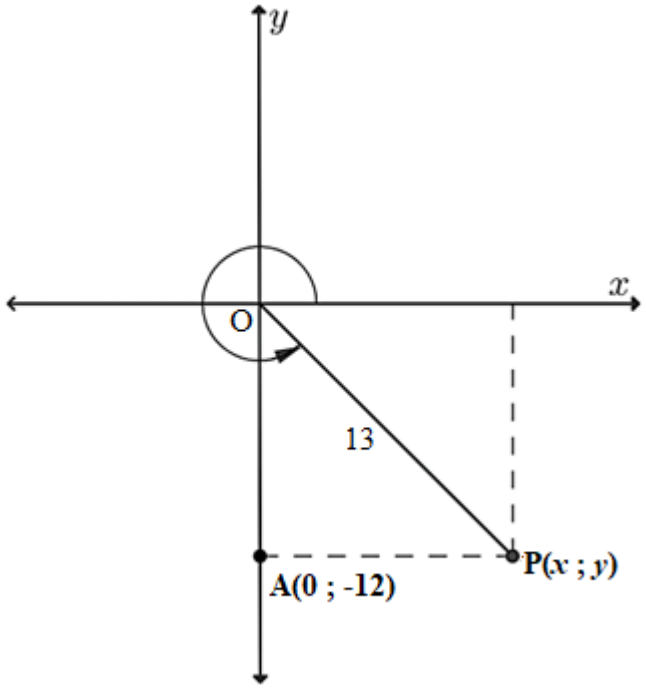
1.5	$m_{RS} = \frac{5-3}{4+5} = \frac{2}{9}$ $m_l = \frac{-1}{2/9} = -\frac{9}{2}$ $y - 4 = -\frac{9}{2}\left(x + \frac{1}{2}\right)$ $y = -\frac{9}{2}x - \frac{9}{4} + 4$ $y = -\frac{9}{2}x + \frac{7}{4}$ **OR/*OF*** $m_{RS} = \frac{5-3}{4+5} = \frac{2}{9}$ $m_l = \frac{-1}{2/9} = -\frac{9}{2}$ $y =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

QUESTION/*VRAAG* 2

2.1			
2.1.1	Tangent / *Raaklyn*	✓Ans/*Antw* **A**	(1)
2.1.2	$x^2 + y^2 = r^2$ $4^2 + (-5) = r^2$ $16 + 25 = r^2$ $41 = r^2$ $x^2 + y^2 = 41$	✓Subst./Vervang **A** ✓Eqn/Vgl **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** **A** ✓**SF** **A** ✓**S** **CA** ✓Eqn/*Vgl* **CA**	

	$m_{QR} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5-0}{4-0} = -\frac{5}{4}$ $m_{tangent} = -1 \div -\frac{5}{4} = \frac{4}{5}$ $y - y_1 = m(x - x_1)$ $y + 5 = \frac{4}{5}(x - 4)$ $y = \frac{4}{5}x - \frac{16}{5} - 5$ $y = \frac{4}{5}x - \frac{41}{5}$	✓m_{QR} **A** ✓$m_{tangent}$ **CA** ✓**S** **CA** ✓Eqn/*Vgl* **CA**	(4)
2.2.1	$\frac{x^2}{32} + \frac{y^2}{81} = 1$ $\frac{x^2}{\left(\sqrt{32}\right)^2} + \frac{y^2}{9^2} = 1$	✓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

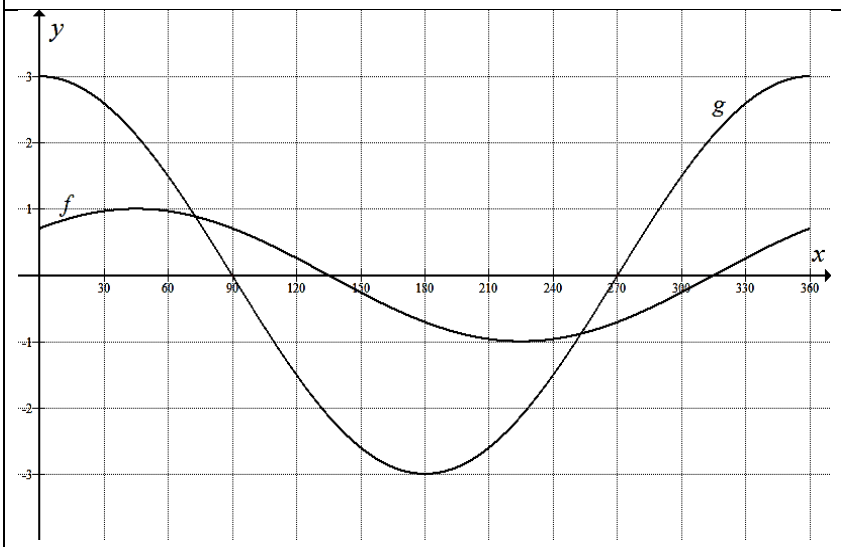
3.1	$x = 1{,}271\ rad$ $cotx + 11 = cot(1{,}271) + 11$ $cotx + 11 = \frac{1}{tan\left(1{,}271 \times \frac{180°}{\pi}\right)} + 11$ $cotx + 11 = 11{,}31$	✓ $\frac{1}{\tan X}$ **A** ✓ $1{,}271 \times \frac{180°}{\pi}$ **A** ✓ Ans / *Antw* **A**	(3)
3.2			
3.2.1	$x^2 + y^2 = r^2$ $x^2 + (-12)^2 = 13^2$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

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

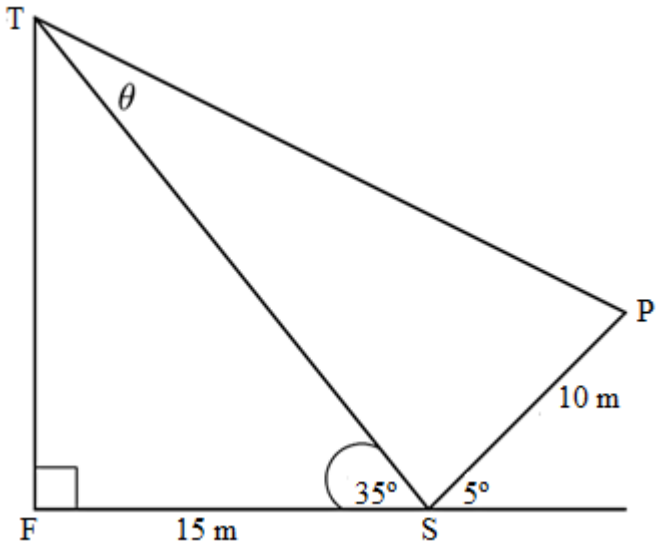
QUESTION/*VRAAG* 4

4.1	$\dfrac{\cos^2(180^\circ+x)+\sin(360^\circ+x).\sin x+\tan^2 x}{\cot(180^\circ+x).\tan x}$	✓ $-\cos x$ **A**	
	$=\dfrac{(-\cos x)^2+\sin x.\sin x+\tan^2 x}{\cot x.\tan x}$	✓ $\sin x$ **A**	
	$=\dfrac{\cos^2 x+\sin^2 x+\tan^2 x}{\dfrac{1}{\tan x}.\tan x}$	✓ $\cot x$ **A**	
	$=\dfrac{1+\tan^2 x}{1}$	✓ $\dfrac{1}{\tan x}$ **A**	
	$=\sec^2 x$	✓ $\cos^2 x+\sin^2 x=1$ **A**	
		✓ $\sec^2 x$ **A**	(6)
4.2	$\cos ec\,\theta-\cot\theta=\dfrac{\sin\theta}{1+\cos\theta}$	✓ $\dfrac{1}{\sin\theta}$ **A**	
	$LHS\ /\ LK=\cos ec\,\theta-\cot\theta$		
	$=\dfrac{1}{\sin\theta}-\dfrac{\cos\theta}{\sin\theta}$	✓ $\dfrac{\cos\theta}{\sin\theta}$ **A**	
	$=\dfrac{1-\cos\theta}{\sin\theta}$	✓ $\dfrac{1+\cos\theta}{1+\cos\theta}$ **A**	
	$=\dfrac{1-\cos\theta}{\sin\theta}\times\dfrac{1+\cos\theta}{1+\cos\theta}$	✓ **S** **CA**	
	$=\dfrac{1-\cos^2\theta}{\sin\theta(1+\cos\theta)}$	✓ $\sin^2\theta$ **A**	
	$=\dfrac{\sin^2\theta}{\sin\theta(1+\cos\theta)}$		
	$=\dfrac{\sin\theta}{1+\cos\theta}$		
	$=RHS\ /\ \text{RK}$		(5)
			[11]

QUESTION/*VRAAG* 5

5.1	$f(x)=\sin(x+45°)$ and / en $g(x)=3\cos x$ for $x\in[0^o\ ;\ 360^o]$.		
		***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^o	✓360^o **A**	(1)
5.2.2	Amplitude = 3	✓Answer/*antwoord* **A**	(1)
5.3	$x = 0°$ *or* $x = 360°$	✓ $x = 0°$ **A** ✓ $x = 360°$ **A**	(2)
5.4	$135° < x < 255°$	✓ $x = 135°$ **A** ✓ $x = 225°$ **A**	(2)
			[12]

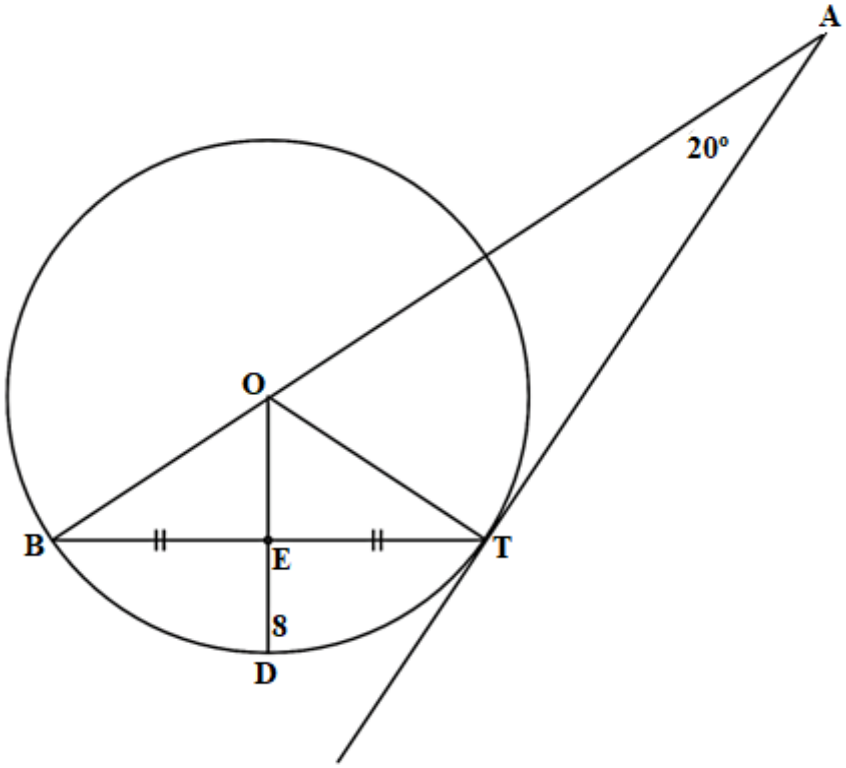
QUESTION/*VRAAG* 6



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

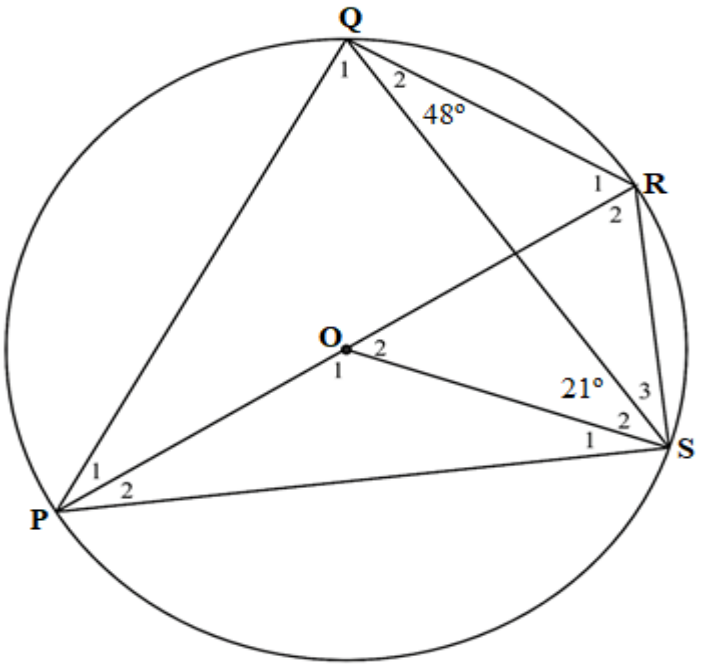
6.3	$\frac{\sin\theta}{SP} = \frac{\sin\hat{S}}{TP}$ $\sin\theta = \frac{10 \times \sin 140°}{26,74}$ $\sin\theta = \frac{10 \times \sin 140°}{26,74}$ $\theta = \sin^{-1}(0,2404)$ $\theta = 13,91°$ **OR/*OF*** $SP^2 = TS^2 + TP^2 - 2.TS.TP.\cos\theta$ $(10)^2 = (18,3)^2 + (26,74)^2 - 2(18,3)(26,74)\cos\theta$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

QUESTION/*VRAAG* 7



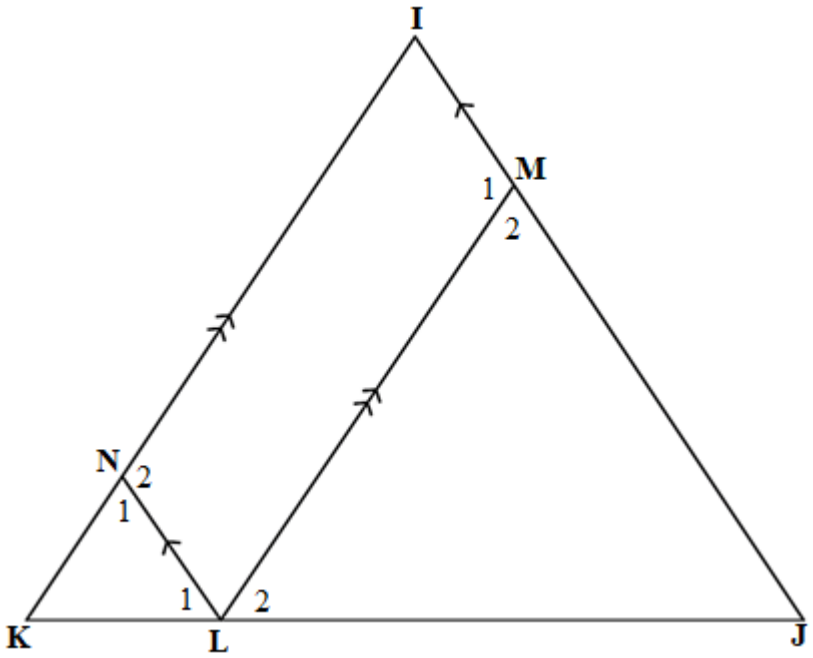
7.1	Perperndicular/*loodreg* **or/*of*** 90°	✓ **ST** **A**	(1)
7.2	$tan20° = \frac{OT}{35}$ $OT = 35tan20°$ $\therefore OT = 12{,}74\ units$ $OT = OD$ (radii/*radii*) $OE = 12{,}74 - 8$ $OE = 4{,}74$ $ET = \sqrt{(12{,}74)^2 - (4{,}74)^2}$ Pythagoras $ET = 11{,}83$ $\therefore BT = 2 \times ET$ $BT = 23{,}65$	✓ **ST** **A** ✓ **ST** **A** ✓ **ST/RE** **A** ✓ **ST/RE** **A** ✓ **ST** **A** ✓ **ST** **A**	(5)
7.3	$O\hat{T}A = 90°$ *tan* ⊥*rad* $T\hat{O}A = 180° - (90° + 20°)$ sum of / som van ∠*s in* Δ $T\hat{O}A = 70°$ $\hat{B} + O\hat{T}B = 70°$ *ext* ∠ *of* Δ $\hat{B} = O\hat{T}B$ ∠*s* opp = sides / ∠*e* teenoor = sye $\therefore \hat{B} = 35°$	✓ **ST** **A** ✓ **ST** **A** ✓**ST RE** **A** ✓**ST RE** **A** ✓**ST** **A**	(5)
			[11]

QUESTION/*VRAAG* 8



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

QUESTION/*VRAAG* 9

9.1	Parallel/*eweredig*	✓ **ST** **A**	(1)
9.2			
9.2.1	in ΔNKL and/*en* ΔNKL $\hat{K}$ common / *gemeen* $\hat{N}_1 = I$ *corrs ∠s* LN ∥ JI $\hat{L}_1 = J$ third / *derde ∠* ∴ ΔNKL ||| ΔIKJ ∠∠∠	✓ **ST** **A** ✓ **ST** ✓ **RE** **A** ✓ **RE** **A**	(4)
9.2.2.(a)	$\frac{NK}{IK} = \frac{NL}{IJ}$ ΔNKL ||| ΔIKJ $\therefore \frac{NL}{IJ} = \frac{2}{5}$	✓ **ST** **RE** **A** ✓ **ST** **A**	(2)
9.2.2(b)	$\frac{JM}{JI} = \frac{JL}{JK}$ *prop theorem* LM ∥ KI $\frac{JL}{JK} = \frac{IN}{IK}$ *prop theorem* LN ∥ JI $\therefore \frac{JM}{JI} = \frac{3}{5}$	✓ **ST** ✓ **RE** **A** ✓ **ST** **A**	(3)
			[10]

QUESTION/*VRAAG* 10			
10.1.1	$D = 25\times 2 = 50\,\text{cm}$	✓ans/*antw* **A** ***NPU***	(1)
10.1.2	$\frac{200}{1\,\text{min}}\times\frac{1}{60\,\text{sec}}=\frac{10}{3}\,rev/s\approx 3{,}33\,rev/s$	✓conv/*herleid* **A** ✓ans/*antw* **CA** ***NPU, NPR***	(2)
10.1.3	$v=\pi Dn$ $v=\pi\left(\frac{50}{100}\right)(3{,}33)$ $v=\frac{333}{200}\pi\ m/s$ $v=5{,}23\ m/s$ **OR/*OF*** $v=\pi(0{,}5)\left(\frac{10}{3}\right)$ $v=\frac{5}{3}\pi$ $v=5{,}24\ m/s$	✓**F** **A** ✓**SF** **A** ✓ $D=\frac{50}{100}$ **A** ✓Ans/*antw* **CA** **OR/*OF*** ✓**F** **A** ✓**SF** **A** ✓ D = 0,5 **A** ✓Ans/*antw* **CA**	(4)
10.1.4	$\omega=2\pi n$ $\omega=2\pi(3.33)$ $\omega=\frac{333}{50}\pi$ $\omega=20{,}92 rad/s$ **OR/*OF*** $\omega=2\pi\left(\frac{10}{3}\right)$ $\omega=\frac{20}{3}\pi$ $\omega=20{,}94 rad/sec$	✓**F** **A** ✓**SF** **CA** ✓Ans/*antw* **CA** ***NPU, NPR*** **OR/*OF*** ✓**F** **A** ✓**SF** **CA** ✓Ans/*antw* **CA** ***NPU, NPR***	(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	$s = r\theta$ $s = 13\left(87° \times \frac{\pi}{180°}\right)$ $s = \frac{377}{60}\pi$ $s = 19{,}74cm$	✓**F** **A** ✓**SF** **CA** ✓conv/*herleid* **A** ✓Ans/*antw* **CA**	(4)
10.3.2	Area of sector / *van sektor* $= \frac{1}{2}r^2\theta$ $= \frac{1}{2} \times (13)^2 \times \left(\frac{29\pi}{60}\right) = \frac{4901}{120}\pi$ $= 128{,}31\,cm^2$ **OR/*OF*** Area of sector / *van sektor* $= \frac{rs}{2}$ $= \frac{13 \times 19{,}74}{2}$ $= 128{,}31\,cm^2$	✓**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	$A_T = a\left(\frac{o_1+o_8}{2} + o_2 + o_3 + o_4 + o_5 + o_6 + o_7\right)$ $= \frac{28}{7}\left(\frac{9+6,52}{2} + 8,25 + 7 + 6,25 + 9,1 + 7,5 + 8\right)$ $= 4\left(\frac{2693}{50}\right)$ $= 215,44\ m^2$ **OR/*OF*** $A_T = a(m_1 + m_2 + m_3 + m_4 + ... + m_n)$ $= \frac{28}{7}\left(\frac{9+8,25}{2} + \frac{8,25+7}{2} + \frac{7+6,25}{2} + \frac{6,25+9,1}{2} + \frac{9,1+7,5}{2} + \frac{7,5+8}{2} + \frac{8+6,25}{2}\right)$ $= 4\left(\frac{2693}{50}\right)$ $= 215,44\ m^2$	✓**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*: $V_T = \frac{4}{3}\pi(13)^3 + \frac{4}{3}\pi\left(\frac{22}{2}\right)^3 + \frac{4}{3}\pi\left(\frac{28}{2}\right)^3$ $= \frac{25088}{3}\pi$ $= 26272,09\ cm^3$	✓**SF** **A** ✓ $r = \frac{22}{2}$ … ….. **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* $= 4\pi r^2$ $= 4\pi\left(\frac{22}{2}\right)^2$ $= 484\pi$ $= 1520,53\ cm^3$	✓**SF** **A** ✓value of/*waarde van Area* **CA**	(2)
			[12]
		TOTAL/*TOTAAL*:	**150**