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

JUNE/*JUNIE* 2026

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

MARKS/*PUNTE*: 150

This marking guideline consists of 20 pages./
Hierdie nasienriglyn bestaan uit 20 bladsye.

NOTE:

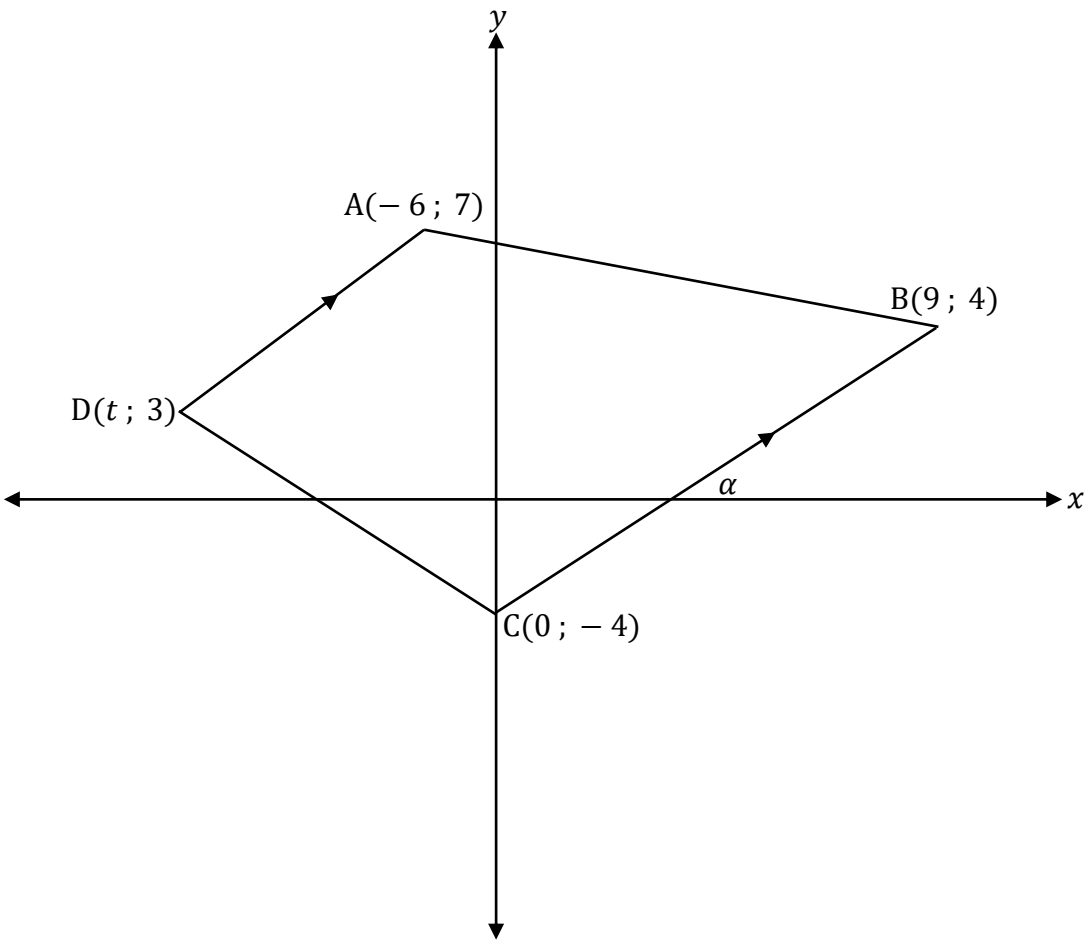
- Continuous accuracy (CA) applies only where indicated in this marking guideline.
- Assuming values/answers in order to solve a problem is unacceptable.

LET WEL:

- *Volgehoue akkuraatheid (CA) is slegs van toepassing soos aangedui in hierdie nasienriglyn.*
- *Aanvaarding van waardes/antwoorde om 'n probleem 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*

QUESTION/*VRAAG* 1

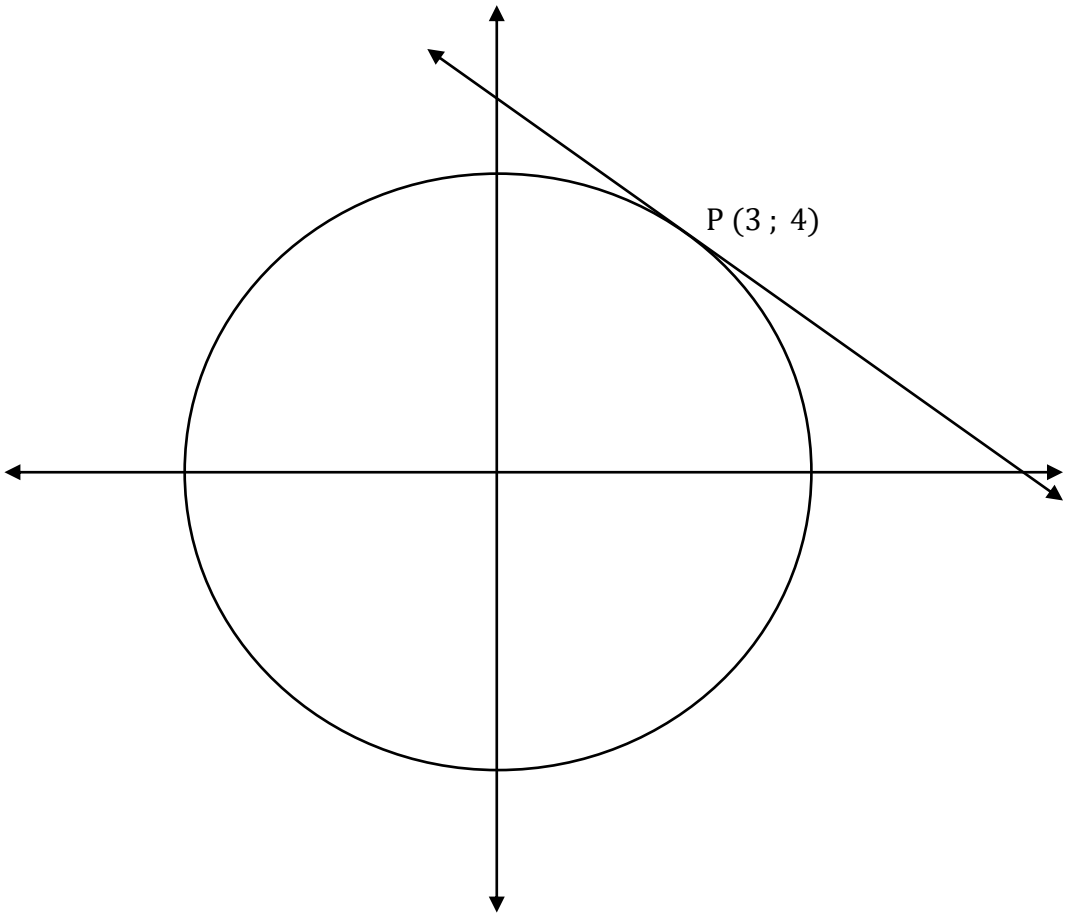


1.1	$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $AB = \sqrt{(-6 - 9)^2 + (7 - 4)^2}$ $AB = 3\sqrt{26}$ $AB = 15{,}30$	✓ **F** **A** ✓ **SF** **CA** ✓ answer/*antwoord* **A** (3)
1.2	$M_{AC} = \left(\frac{x_2+x_1}{2}; \frac{y_2+y_1}{2}\right)$ $M_{AC} = \left(\frac{-6+0}{2}; \frac{7+(-4)}{2}\right)$ $M_{AC} = \left(-3; \frac{3}{2}\right)$	✓ Subst./*vervang* **A** ✓ x **A** ✓ y **A** (3)
1.3	$m_{BC} = \frac{y_2-y_1}{x_2-x_1}$ $m_{BC} = \frac{4-(-4)}{9-0}$ $m_{BC} = \frac{8}{9}$	✓ **S** **CA** ✓ answer/*antwoord* **CA** (2)

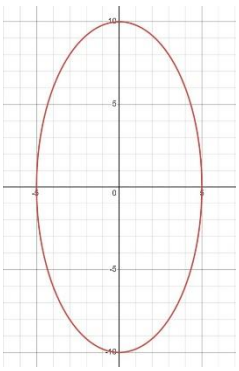
1.4	$m_{BC} = \frac{8}{9}$ $y = mx + c$ $y = \frac{8}{9}x + c$ $(0\,;-4): -4 = \frac{8}{9}(0) + c$ $-4 = 0 + c$ $-4 = c$ $\therefore y = \frac{8}{9}x - 4$ **OR/*OF*** $m_{BC} = \frac{8}{9}$ $y - y_1 = m(x - x_1)$ $y - y_1 = \frac{8}{9}(x - x_1)$ $(0\,;-4): y - (-4) = \frac{8}{9}(x - 0)$ $y + 4 = \frac{8}{9}x + 0$ $\therefore y = \frac{8}{9}x - 4$	✓ Gradient/*Gradiënt* **CA** ✓ Subst./*vervang* pt **A** ✓ Eqn / *Vgl* **CA** **OR/*OF*** ✓ Gradient/*Gradiënt* **CA** ✓ Subst./*vervang* pt **A** ✓ Eqn / *Vgl* **CA** (3)
1.5	$m_{BC} = \frac{8}{9}$ $\tan\alpha = \frac{8}{9}$ $\therefore \alpha = tan^{-1}\left(\frac{8}{9}\right)$ $\therefore \alpha = 41{,}63°$	✓ Gradient/*Gradiënt* **CA** ✓ Subst./*vervanging* **CA** ✓ answer/*antwoord* **CA** (3)
1.6	$m_{AD} = m_{BC} = \frac{8}{9}$ $\frac{y_2 - y_1}{x_2 - x_1} = \frac{8}{9}$ $\frac{7-3}{-6-t} = \frac{8}{9}$ $\frac{4}{-6-t} = \frac{8}{9}$ $4(9) = 8(-6 - t)$ $36 = -48 - 8t$ $84 = -8t$ $-\frac{21}{2} = t$	✓ $m_{AD} = m_{BC}$ **CA** ✓ **S** **CA** ✓ $t = -\frac{21}{2}$ **CA** (3)
		[17]

QUESTION/*VRAAG* 2

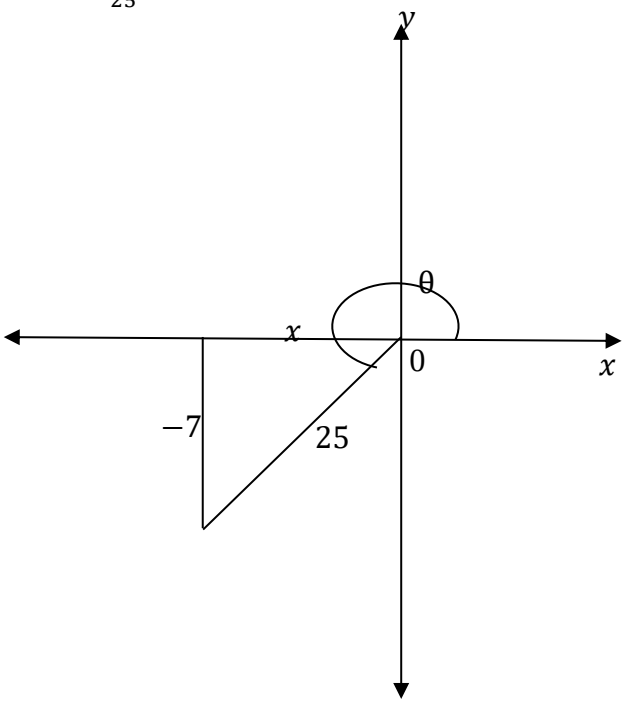
2.1



2.1.1	$r = 5$	✓ **A** (1)
2.1.2	$x.x_1 + y.y_1 = r^2$ $(3;4): x(3) + y(4) = (5)^2$ $3x + 4y = 25$ $y = \frac{-3}{4}x + \frac{25}{4}$ **OR/*OF*** $m_{radius} = \frac{4}{3}$ $\therefore m_{\text{tangent/raaklyn}} = \frac{-3}{4}$ $y - y_1 = m(x - x_1)$ $(3;4): y - 4 = \frac{-3}{4}(x - 3)$ $y - 4 = \frac{-3}{4}x + \frac{9}{4}$ $y = \frac{-3}{4}x + \frac{9}{4} + 4$ $y = \frac{-3}{4}x + \frac{25}{4}$ **OR/*OF***	✓ **F** **A** ✓ **SF** **A** ✓ **S** **CA** ✓ equation/*verg* **CA** **OR/*OF*** ✓ grad radius **A** ✓ grad tan/*raakl* **CA** ✓ **SF** **A** ✓ equation/*vergl* **CA** **OR/*OF***

	$m_{radius} = \frac{4}{3}$ $\therefore m_{tangent/raaklyn} = \frac{-3}{4}$ $y = mx + c$ $(3;4): 4 = \frac{-3}{4}(3) + c$ $4 = \frac{-9}{4} + c$ $\frac{25}{4} = c$ $y = \frac{-3}{4}x + \frac{25}{4}$	✓ grad radius **A** ✓ grad tan/*raakl* **CA** ✓ **SF** **A** ✓ equation/*vergl* **CA** (4)
2.2		✓ elliptical shape/ elliptiese *vorm* **A** ✓ *x*-intercepts/ *afsnitte* **A** ✓ *y*-intercepts/*afsnitte* **A** (3)
		[8]

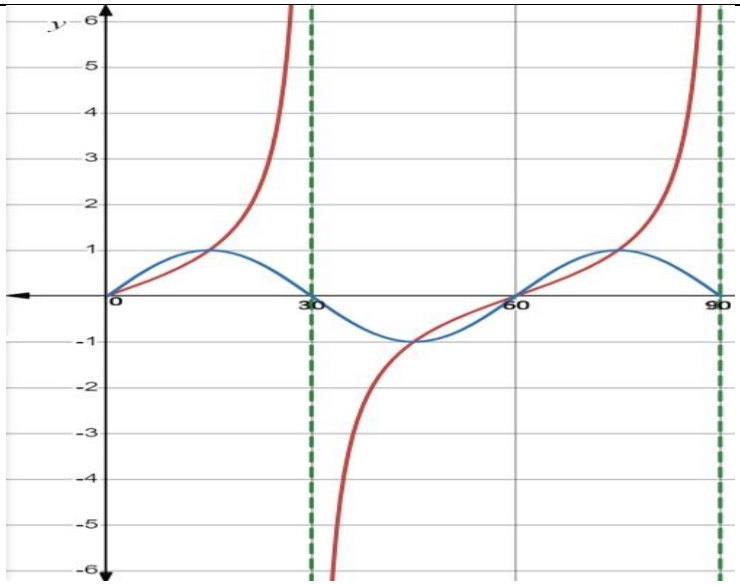
QUESTION/*VRAAG* 3

3.1.1	$25\sin\theta = -7$ $\sin\theta = \frac{-7}{25}$	✓ $\sin\theta = \frac{-7}{25}$ **A**
		✓ Diagram **A**
	$x^2 + y^2 = r^2$ $x^2 + (-7)^2 = (25)^2$ $x^2 + 49 = 625$ $x^2 = 576$ $x = \pm\sqrt{576}$ $\therefore x = -24$	✓ **SF** **A** ✓ **S** **CA** ✓ value of/*waarde van* x **CA** (5)
3.1.2	$\sec(180° - \theta) = -\sec\theta = -\left(\frac{25}{-24}\right) = \frac{24}{24}$	✓✓ answer/*antwoord* **A** (2)
3.2	$\cos(\beta - 60°) = 0{,}25$ Ref. / *verw.* $< = cos^{-1}(0{,}25)$ Ref. / *verw.* $< = 75{,}52°$ $\therefore$ I: $\beta - 60° = 75{,}52°$ $\therefore \quad \beta = 75{,}52° + 60°$ $\therefore \quad \beta = 135{,}52°$ **AND/*EN*** $\therefore$ IV: $\beta - 60° = 360° - 75{,}52°$ $\therefore \quad \beta - 60° = 284{,}48°$ $\therefore \quad \beta = 284{,}48° + 75{,}52°$ $\therefore \quad \beta = 344{,}48°$	✓ **S** **A** ✓ Ref/*Verw* ∠ **CA** ✓✓ values of x/ *waardes van* x **CA** (4)
		[11]

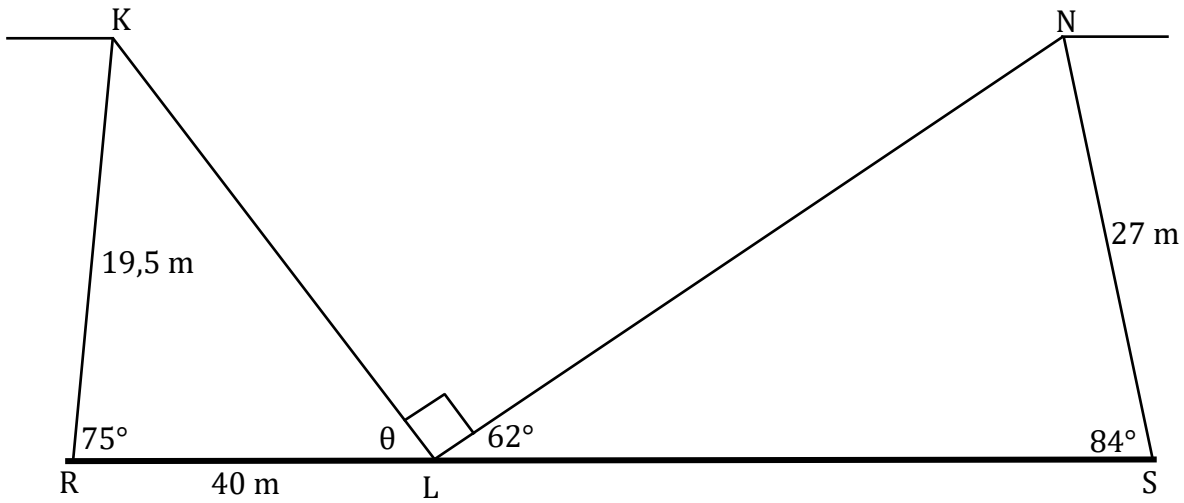
QUESTION/*VRAAG* 4

4.1	$\frac{\cot(180°+\theta).\sec(360°-\theta)}{\sin(360°-\theta).\sin(180°+\theta)+\cos(540°+\theta).\cos(180°-\theta)}$ $= \frac{\cot\theta.\sec\theta}{-\sin\theta.-\sin\theta+(-\cos\theta).-\cos\theta}$ $= \frac{\frac{\cos\theta}{\sin\theta}.\frac{1}{\cos\theta}}{sin^2\theta+cos^2\theta}$ $= \frac{\frac{1}{\sin\theta}}{1}$ $= \frac{1}{\sin\theta}$ $= \text{cosec}\,\theta$	✓ $\sec\theta$ **A** ✓ $\cot\theta$ **A** ✓ $-\sin\theta$ **A** ✓ $-\sin\theta$ **A** ✓ $-\cos\theta$ **A** ✓ $\frac{\cos\theta}{\sin\theta}$ **A** ✓ $\sin^2\theta+\cos^2\theta$ **A** ✓ $\text{cosec}\,\theta$ **A** (8)
4.2	$\frac{1}{1+\cos x}+\frac{1}{1-\cos x}=2\text{cosec}^2x$ $\text{LHS}=\frac{1}{1+\cos x}+\frac{1}{1-\cos x}$ $\text{LHS}=\frac{1-\cos x+1+\cos x}{(1+\cos x)(1-\cos x)}$ $\text{LHS}=\frac{1+1}{(1+\cos x)(1-\cos x)}$ $\text{LHS}=\frac{2}{1-\cos^2x}$ $\text{LHS}=\frac{2}{sin^2x}$ $\text{LHS}=2\text{cosec}^2x$ $\text{LHS}=\text{RHS}$	✓ $(1+\cos x)(1-\cos x)$ **A** ✓ $1-\cos x+1+\cos x$ **A** ✓ 2 **A** ✓ $1-\cos^2x$ **A** ✓ $\sin^2x$ **A** ✓ LHS = RHS **A** (6)
		[14]

QUESTION/*VRAAG* 5

	$f(x) = tan3x$ and/*en* $g(x) = sin6x$ for/*vir* $x \in [0° ; 90°]$	
5.1		*f:* ✓ intercepts/*afsnitte* ✓ shape/*vorm* ✓ start and end point/ *begin- en eindpunt* ✓ Asymptotes/*asymptote* *g:* ✓ intercepts/*afsnitte* ✓ shape/*vorm* ✓ start and end point/ *begin- en eindpunt* ✓ turning points/ *draaipunte* (8)
5.2	$Per_f = 180° \div 3 = 60°$ $Per_g = 360° \div 6 = 60°$	✓✓ answer/*antwoord* **A** (2)
5.3	$x = 0° ; 15° ; 45° ; 60° ; 75°$	✓✓ answer/*antwoord* **A** (2)
		[12]

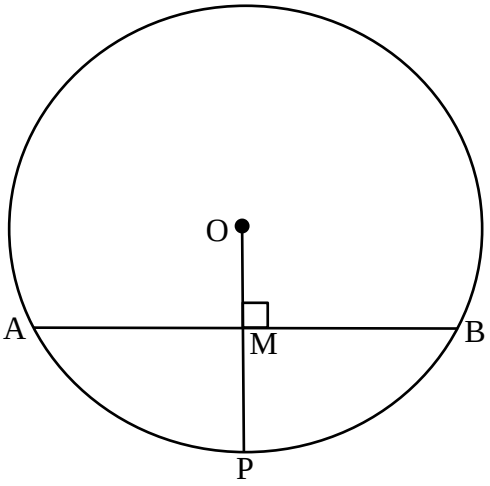
QUESTION/*VRAAG* 6



6.1	In ΔLNS: $\frac{LN}{\sin \hat{S}} = \frac{NS}{\sin N\hat{L}S}$ $\therefore \frac{LN}{\sin 84°} = \frac{27}{\sin 62°}$ $\therefore LN = \frac{27}{\sin 62°} \times \sin 84°$ $\therefore LN = 30{,}41 \ldots$ $\therefore LN = 30 \text{ m}$	✓ **F** **A** ✓ Subst./*vervang* **A** ✓ answer/*antwoord* **CA** (3)
6.2	In ΔKRL: $KL^2 = KR^2 + RL^2 - 2(KR)(RL)\cos \hat{R}$ $KL^2 = (19{,}5)^2 + (40)^2 - 2(20)(40)\cos 75°$ $KL = 39{,}70 \ldots$ $KL = 40 \text{ m}$	✓ **F** **A** ✓ **SF** **A** ✓ answer/*antwoord* **CA** (3)
6.3	$\theta = 28°$(<'s on a str. line / *< 'e op 'n reguit lyn*) **OR/*OF*** $\frac{KR}{\sin K\hat{L}R} = \frac{KL}{\sin \hat{R}}$ $\frac{19{,}5}{\sin \theta} = \frac{40}{\sin 75°}$ $\therefore \sin \theta = \frac{19{,}5 \times \sin 75°}{40}$ $\therefore \theta = \sin^{-1}\left(\frac{19{,}5 \times \sin 75°}{40}\right)$ $\therefore \theta = 28{,}09 \ldots °$ $\therefore \theta = 28°$	✓ answer/*antwoord* **CA** **OR/*OF*** ✓ answer/*antwoord* **CA** (1)
6.4	Area of $\Delta KRL = \frac{1}{2}(KR)(RL)\sin \hat{R}$ Area of $\Delta KRL = \frac{1}{2}(19{,}5)(40)\sin 75°$ Area of $\Delta KRL = 376{,}71 \text{ m}^2$	✓ **F** **A** ✓ **SF** **A** ✓ answer/*antwoord* **CA** (3)

6.5	$KN^2 = KL^2 + LN^2$ (Pyth) $KN^2 = (40)^2 + (30)^2$ $KN = \pm\sqrt{2500}$ $\therefore KN = 50$ m	✓ **SF** **A** ✓ answer/*antwoord* **CA** (2)
		[12]

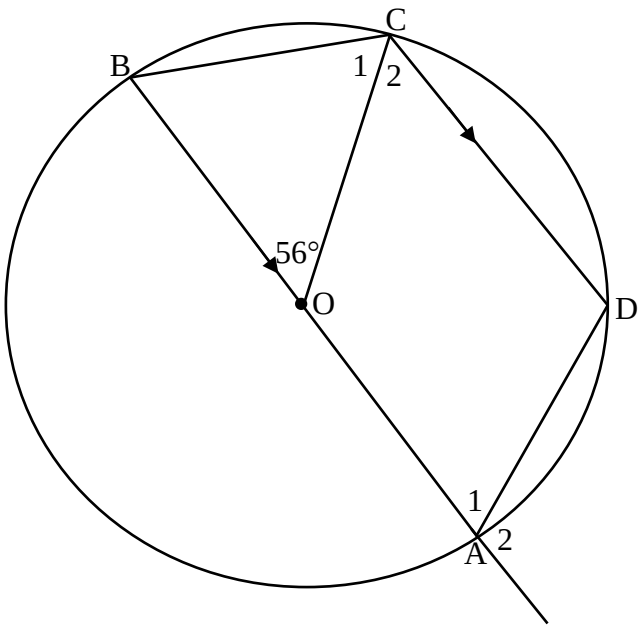
QUESTION/*VRAAG* 7



7.1	AM = MB = 7 cm *(line from centre ⊥ to chord)/ (lyn van die midde ⊥ a koord)*	✓ **ST** ✓ **RE** **A** (2)
7.2	OP = $x + 3$	✓ **ST** **A** (1)
7.3	OP = OA = OB (radii) $OA^2 = OM^2 + AM^2$ $OA^2 = (x)^2 + (7)^2$ $OA^2 = x^2 + 49$ $OA = \sqrt{x^2 + 49}$ $\therefore \sqrt{x^2 + 49} = x + 3$ $x^2 + 49 = (x + 3)^2$ $x^2 + 49 = x^2 + 6x + 9$ $40 = 6x$ $6{,}66 \ldots = x$ $\therefore x = 7$ cm	✓ **ST** **A** ✓ Subst./*vervang* **A** ✓ **S** **CA** ✓ answer/*antwoord* **CA** (4)
		[7]

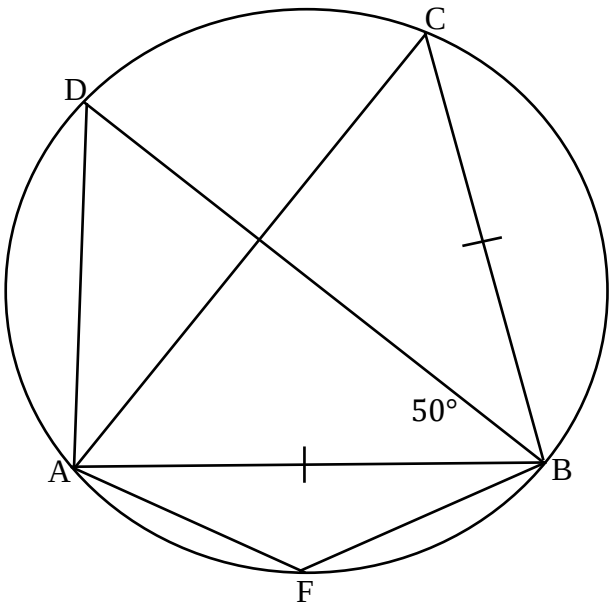
QUESTION/*VRAAG* 8

8.1



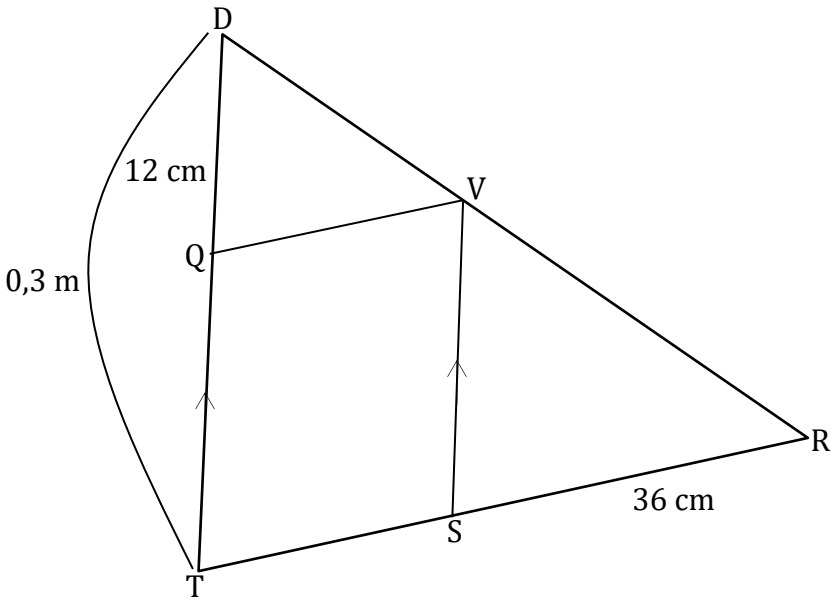
8.1.1	$\hat{C}_1 = B$ (<'s opp = sides ; OB = OC / *<'e teenoor gelyke sye ;* OB = OC) $\hat{C}_1 = \frac{180°-56°}{2}$ $\hat{C}_1 = 62°$ (Int. <'s of Δ / *Binne <'e van* Δ)	✓ **ST**✓ **RE** **A** ✓ **ST** **CA** (3)
8.1.2	$\hat{D} = 118°$ (opp <'s of cq / *teenoorst. <'e van kvh*)	✓ **ST**✓ **RE** **A** (2)
8.1.3	$\hat{C}_2 = 56°$ (alt. <'s = ; AB ∥ CD / *verw. <'e =;* AB ∥ CD)	✓ **ST**✓ **RE** **A** (2)
8.1.4	$\hat{A}_2 = 118°$ (ext < of cq / *buite < van kvh)* or / *of* (alt. <'s = ; AB ∥ CD / *verw. <'e =;* AB ∥ CD)	✓ **ST**✓ **RE** **A** (2)

8.2



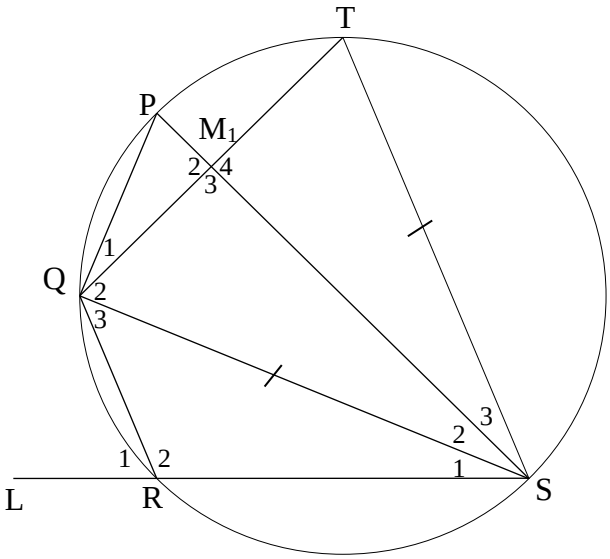
8.2.1	$\hat{C} = C\hat{A}B$ (<'s opp = sides / *< 'e teenoor gelyke sye*) $\hat{C} = \frac{180° - 50°}{2} = 65°$ (Int <'s of Δ / *binne < 'e van* Δ)	✓ **ST**✓ **RE** **A** ✓ **ST** **CA** (3)
8.2.2	$\hat{F} = 115°$ (opp <'s of cq / *teenoorst. < 'e van kvh*)	✓ **ST**✓ **RE** **A** (2)
8.2.3	$\hat{D} = 65°$ (<'s in same segment / *< 'e in dieselfde segment*)	✓ **ST**✓ **RE** **A** (2)
		[16]

QUESTION/*VRAAG* 9



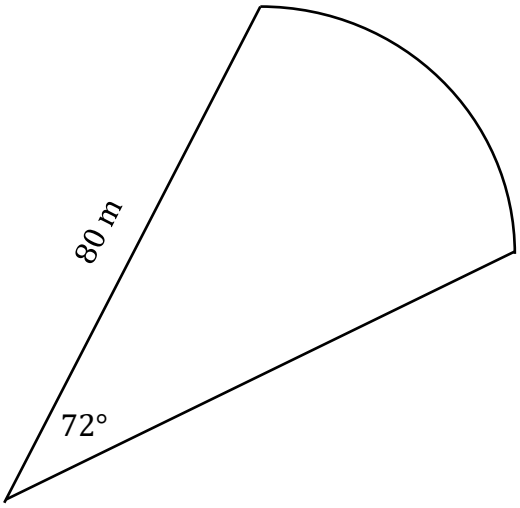
9.1.1	$0{,}3\ m = 30$ cm $QT = 30 - 12$ $QT = 18$ cm	✓ Conv./*Herleid* **A** ✓ answer/*antwoord* **CA** (2)
9.1.2	$VR : VD = 3 : 2$ $TQ : QD = 18 : 12$ $TQ : QD = 3 : 2$ $\frac{VR}{VD} = \frac{TQ}{QD} = \frac{3}{2}$ $\therefore QV \parallel TS$ (converse similarity thm / *omgekeerd gelykvormigheid stelling*)	✓ Ratio/*Verhang* **A** ✓ Substitution/*vervang* **CA** ✓ answer/*antwoord* **CA** (3)
9.1.3	$QV = TS$ (proven / *bewys*) $\frac{TS}{SR} = \frac{DV}{VR}$ (line $\parallel$ one side of Δ / *lyn* $\parallel$ *een sy van* Δ) $\frac{TS}{36} = \frac{2}{3}$ $TS = 24 = QV$	✓QV = TS **A** ✓ **ST**✓ **RE** **A** ✓ answer/*antwoord* **CA** (4)

9.2



9.2.1	In ΔPQM & ΔTSM: 1) $\hat{P} = \hat{T}$ (<'s in same segment / *<é in dieselfde segment*) 2) $\hat{Q}_1 = \hat{S}_3$ (<'s in same segment / *<é in dieselfde segment*) 3) $\hat{M}_2 = \hat{M}_4$ (Vert opp <'s = / *regoorst <é* =) ∴ ΔPQM///ΔTSM (<<< or / *of* AAA)	✓ **ST** **A** ✓ **ST** ✓ **RE** **A** ✓ answer/*antwoord* **CA** (4)
9.2.2	$\frac{PQ}{TS} = \frac{QM}{SM}$ $(\Delta PQM///\Delta TSM)$ BUT / *MAAR* TS = QS ∴ $\frac{PQ}{QS} = \frac{QM}{SM}$ ∴ $PQ = \frac{QM.QS}{SM}$	✓ **ST** ✓ **RE** **A** ✓ answer/*antwoord* **CA** (3)
		[16]

QUESTION/*VRAAG* 10

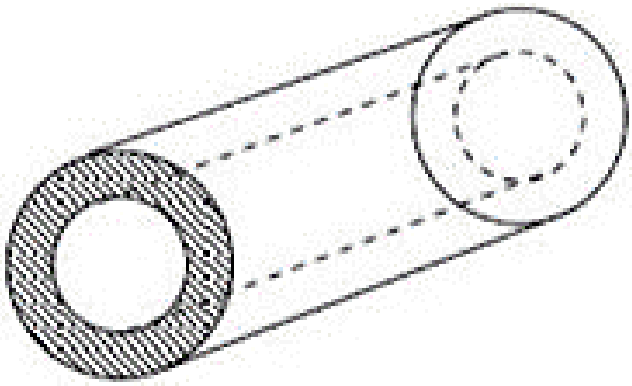


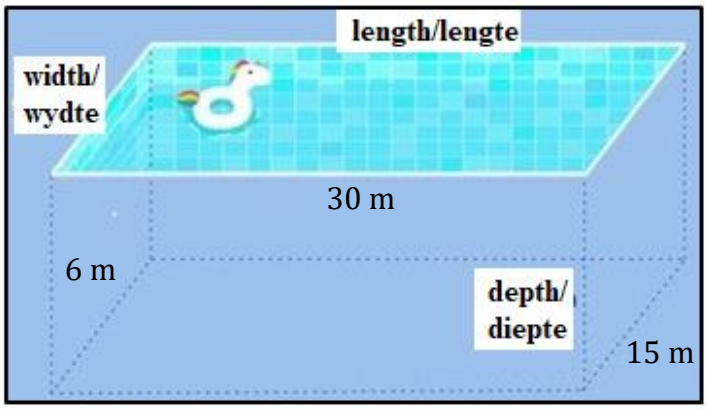
10.1	$\theta = 72° \times \frac{\pi}{180°} = \frac{2}{5}\pi$ $s = r\theta$ $s = (80)\left(\frac{2}{5}\pi\right)$ $\therefore s = 32\pi$ $\therefore$ Total fencing / *Totale omheining* $= 80 + 80 + 32\pi$ $\therefore$ Total fencing / *Totale omheining* $= 160 + 32\pi \approx 260{,}53 \ldots$ $\therefore$ Total cost / *Totale koste* $= 260{,}53 \ldots \times R360$ $\therefore$ Total cost / *Totale koste* $= R93791{,}15$	✓ $\theta = \frac{2}{5}\pi$ **A** ✓ **F** **A** ✓ **SF** **CA** ✓260,53 **CA** ✓ **S** **CA** ✓ answer/*antwoord* **CA** (6)
10.2.1	$s = r\theta$ $3{,}1 = r(1{,}9)$ $\therefore 1{,}63 \text{ m} = r$	✓ **SF** **CA** ✓ answer/*antwoord* **CA** (2)
10.2.2	Area / *Oppervlakte* $= \frac{rs}{2}$ Area / *Oppervlakte* $= \frac{(1{,}63)(3{,}1)}{2}$ Area / *Oppervlakte* $= 2{,}53 \text{ m}^2$ **OR/*OF*** Area / *Oppervlakte* $= \frac{r^2\theta}{2}$ Area / *Oppervlakte* $= \frac{(1{,}63)^2(1{,}9)}{2}$ Area / *Oppervlakte* $= 2{,}52 \text{ m}^2$	✓ **F** **A** ✓ **SF** **CA** ✓ answer/*antwoord* **CA** **OR/*OF*** ✓ **F** **A** ✓ **SF** **CA** ✓ answer/*antwoord* **CA** (3)

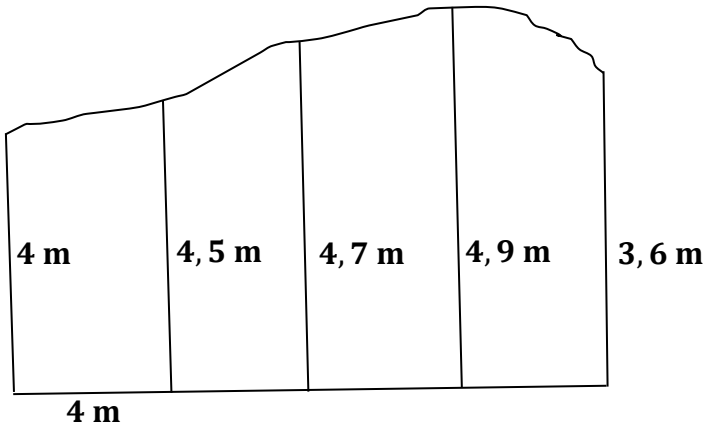
10.3	$l = 250 \div 10 = 25$ cm $4\text{h}^2 - 4d\text{h} + x^2 = 0$ $4\text{h}^2 - 4(38)\text{h} + (25)^2 = 0$ $4\text{h}^2 - 152\text{h} + 625 = 0$ $\text{h} = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $\text{h} = \frac{-(-152) \pm \sqrt{(-152)^2-4(4)(625)}}{2(4)}$ $\therefore \text{h} = 33{,}31$ cm or/*of* $\text{h} = 4{,}69$ cm	✓ Conve ✓ **F** ✓ **SF** ✓ **S** ✓ Both/*albei*	**A** **A** **CA** **CA** **CA** (5)
10.4.1	$\omega = 2\pi n$ $\omega = 2\pi\left(\frac{1500}{\pi}\right)$ $\omega = 3000$ rad/min	✓ **F** ✓ **SF** ✓ answer/*antwoord*	**A** **CA** **CA** (3)
10.4.2	$v = \pi Dn$ $v = \pi(540 \div 1000)(\frac{1500}{\pi} \div 60)$ $v = 13{,}5$ m/sec	✓ **F** ✓ Convesn ✓ **SF** ✓ answer/*antwoord* **NPR / NPU**	**A** **A** **CA** **CA** (4)
			[23]

QUESTION/*VRAAG* 11

11.1



11.1	$r_{\text{inner}/binneste} = 13$ cm $r_{\text{outer}/buitenste} = 15$ cm Vol of concrete / Vol van beton $= V_{\text{outer}/buitenste} - V_{\text{inner}/binneste}$ Vol of concrete / Vol van beton $= \pi r_{(\text{outer}/buitenste)}{}^2 h - \pi r_{(\text{inner}/binneste)}{}^2 h$ $20600 = \pi(15)^2 h - \pi(13)^2 h$ $20600 = \pi h((15)^2 - (13)^2)$ $\frac{20600}{56\pi} = \text{h}$ 117,10 cm = h	✓ $V_{\text{inner}/binneste}$ **A** ✓ $V_{\text{outer}/buitenste}$ **A** ✓ **S** **CA** ✓ answer/*antwoord* **CA** (4)
11.2.1	Vol $= l \times b \times h$ Vol $= 30 \times 15 \times 6$ Vol $= 2700$ m^3	✓ **F** **A** ✓ **SF** **CA** ✓ answer/*antwoord* **CA** (3)
11.2.2		
	SA / BO $= (l \times w) + 2(l \times h) + 2(w \times h)$ SA / BO $= (30 \times 15) + 2(30 \times 6) + 2(15 \times 6)$ SA / BO $= 990\ m^2$ ∴ Total cost / *Totale koste* $= 990 \times R45$ ∴ Total cost – *Totale koste* $= R44\ 550$	✓ **F** **A** ✓ **SF** **CA** ✓ SA / BO **CA** ✓ answer/*antwoord* **CA** (4)

11.3		
	$A_T = a\left(\frac{o_1+o_n}{2} + o_2 + o_3 + o_4 + \ldots + o_{n-1}\right)$ $A_T = (4)\left(\frac{4+3,6}{2} + 4,5 + 4,7 + 4,9\right)$ $A_T = 71,6\ m^2$ **OR/*OF*** $A_T = a(m_1 + m_2 + m_3 + \ldots + m_{n-1})$ $A_T = (4)(4,25 + 4,6 + 4,8 + 4,25)$ $A_T = 71,6\ m^2$	✓ **F** **A** ✓ **SF** **CA** ✓ answer/*antwoord* **CA** **OR/*OF*** ✓**F** **A** ✓ **SF** **CA** ✓ answer/*antwoord* **CA** (3)
		[14]
		TOTAL/*TOTAAL*: 150