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**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



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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 probleem op te los, is onaanvaarbaar.*

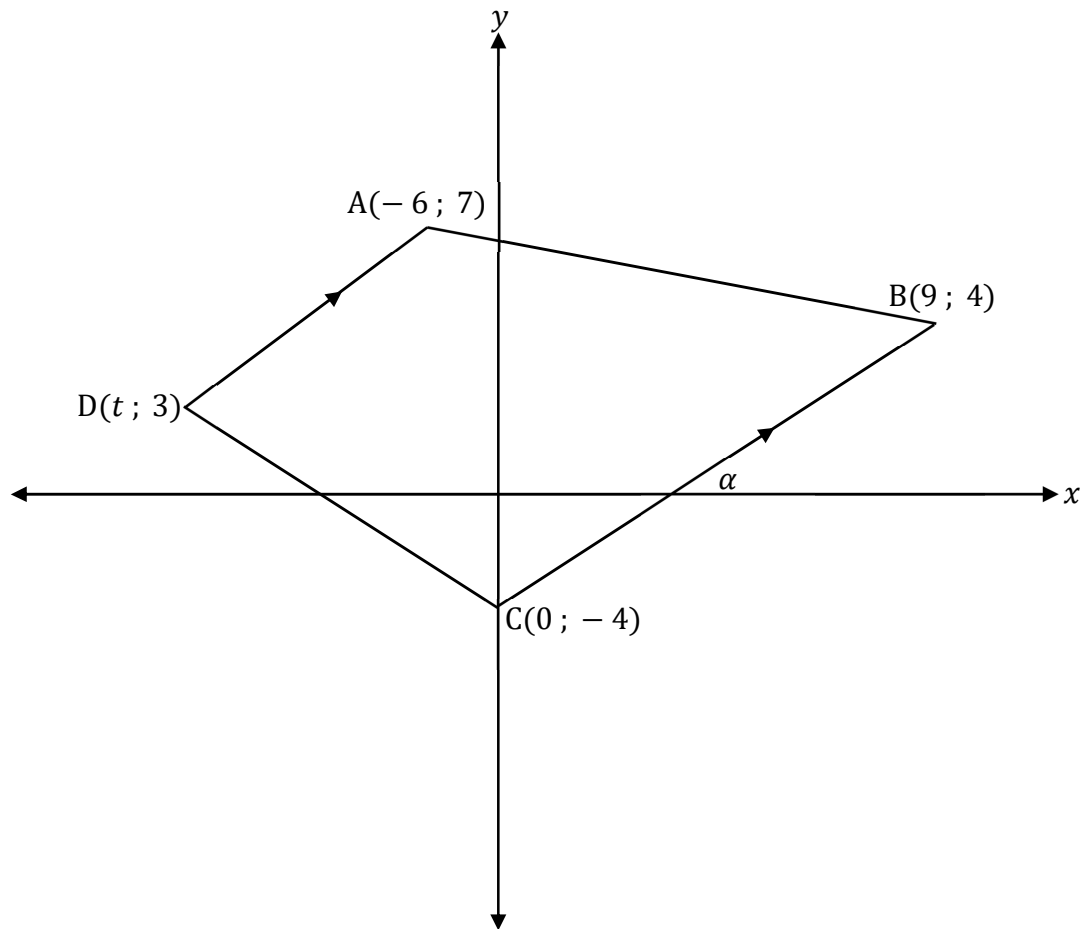
MARKING CODES/NASIENKODES	
M	Method/Metode
A	Accuracy/Akkuraatheid
AO	Answer only/Slegs antwoord
CA	Consistent accuracy/Deurlopende akkuraatheid
F	Formula/Formule
I	Identity/Identiteit
R	Rounding/Afronding
S	Simplification/Vereenvoudiging
ST	Statement/Bewering
RE	Reason/Rede
ST RE	Statement and correct 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

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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)



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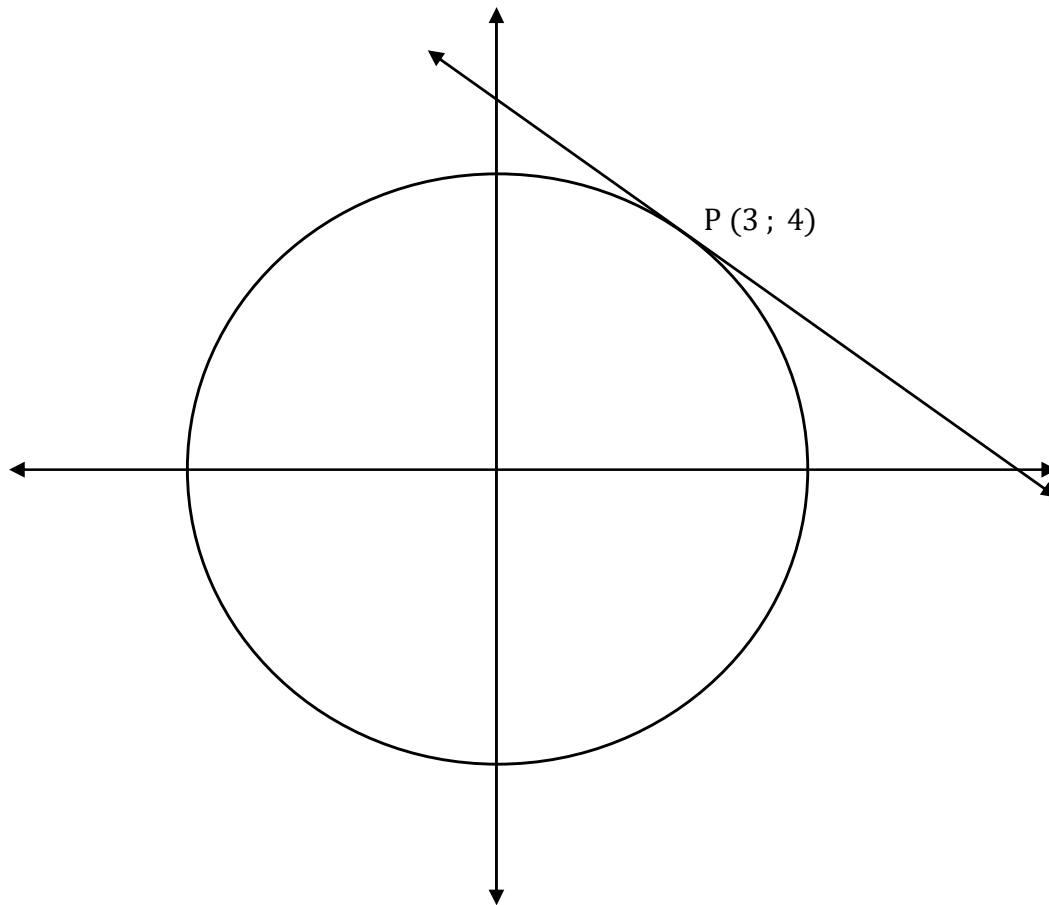
1.4	$m_{BC} = \frac{8}{9}$ $y = mx + c$ $y = \frac{8}{9}x + c$ $(0; -4) : -4 = \frac{8}{9}(0) + c$ $-4 = 0 + c$ $-4 = c$ $\therefore y = \frac{8}{9}x - 4$ OR/OF $m_{BC} = \frac{8}{9}$ $y - y_1 = m(x - x_1)$ $y - y_1 = \frac{8}{9}(x - x_1)$ $(0; -4) : y - (-4) = \frac{8}{9}(x - 0)$ $y + 4 = \frac{8}{9}x + 0$ $\therefore y = \frac{8}{9}x - 4$	✓ Gradient/ <i>Gradiënt</i> CA ✓ Subst./ <i>vervang</i> pt A ✓ Eqn / <i>Vgl</i> CA OR/OF ✓ Gradient/ <i>Gradiënt</i> CA ✓ Subst./ <i>vervang</i> pt A ✓ Eqn / <i>Vgl</i> CA (3)
1.5	$m_{BC} = \frac{8}{9}$ $\tan \alpha = \frac{8}{9}$ $\therefore \alpha = \tan^{-1}\left(\frac{8}{9}\right)$ $\therefore \alpha = 41,63^\circ$	✓ Gradient/ <i>Gradiënt</i> CA ✓ Subst./ <i>vervanging</i> CA ✓ answer/ <i>antwoord</i> CA (3)
1.6	$m_{AD} = m_{BC} = \frac{8}{9}$ $\frac{y_2 - y_1}{x_2 - x_1} = \frac{8}{9}$ $\frac{7 - 3}{-6 - t} = \frac{8}{9}$ $\frac{-6 - t}{4} = \frac{8}{9}$ $\frac{-6 - t}{-6 - t} = \frac{8}{9}$ $4(9) = 8(-6 - t)$ $36 = -48 - 8t$ $84 = -8t$ $-\frac{21}{2} = t$	✓ $m_{AD} = m_{BC}$ 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	$x \cdot x_1 + y \cdot y_1 = r^2$ $(3; 4): x(3) + y(4) = (5)^2$ $3x + 4y = 25$ $y = \frac{-3}{4}x + \frac{25}{4}$ OR/OF $m_{radius} = \frac{4}{3}$ $\therefore m_{tangent/raaklyn} = \frac{-3}{4}$ $y - y_1 = m(x - x_1)$ $(3; 4): y - 4 = \frac{-3}{4}(x - 3)$ $y - 4 = \frac{-3}{4}x + \frac{9}{4}$ $y = \frac{-3}{4}x + \frac{9}{4} + 4$ $y = \frac{-3}{4}x + \frac{25}{4}$	✓ F A ✓ SF A ✓ S CA ✓ equation/vergl CA OR/OF ✓ grad radius A ✓ grad tan/raakl CA ✓ SF A ✓ equation/vergl CA	

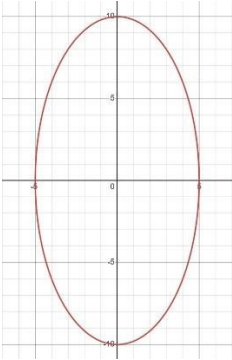


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	$m_{radius} = \frac{4}{3}$ $\therefore m_{tangent/raaklyn} = \frac{-3}{4}$ $y = mx + c$ $(3; 4): 4 = \frac{-3}{4}(3) + c$ $4 = \frac{-9}{4} + c$ $\frac{25}{4} = c$ $y = \frac{-3}{4}x + \frac{25}{4}$	✓ grad radius A ✓ grad tan/raakl CA ✓ SF A ✓ equation/vergl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



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QUESTION/VRAAG 4

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





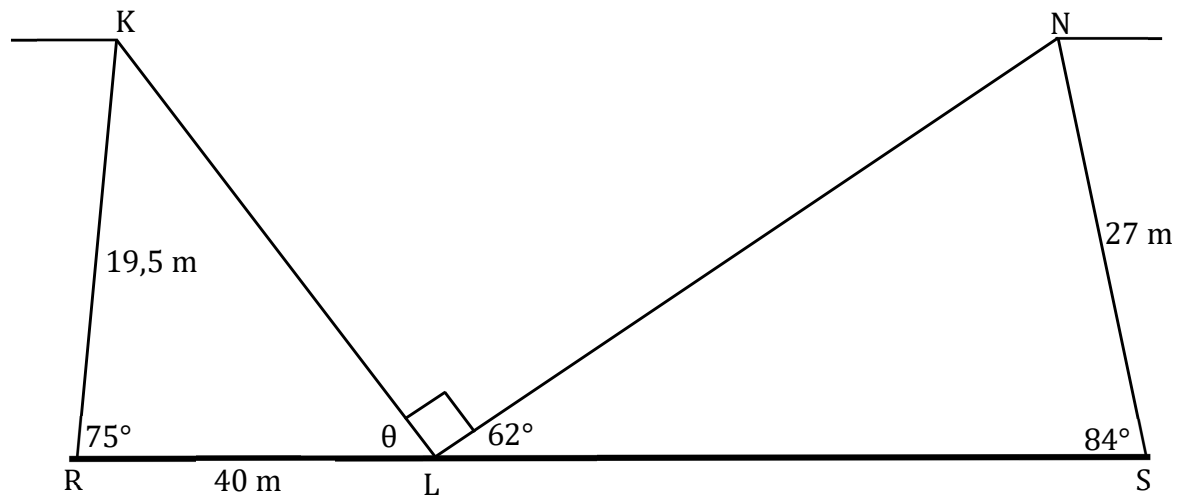
QUESTION/VRAAG 5

	$f(x) = \tan 3x$ and/en $g(x) = \sin 6x$ for/vir $x \in [0^\circ; 90^\circ]$	
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	$Per_f = 180^\circ \div 3 = 60^\circ$ $Per_g = 360^\circ \div 6 = 60^\circ$	✓✓ answer/antwoord A (2)
5.3	$x = 0^\circ; 15^\circ; 45^\circ; 60^\circ; 75^\circ$	✓✓ answer/antwoord A (2)
		[12]





QUESTION/VRAAG 6



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





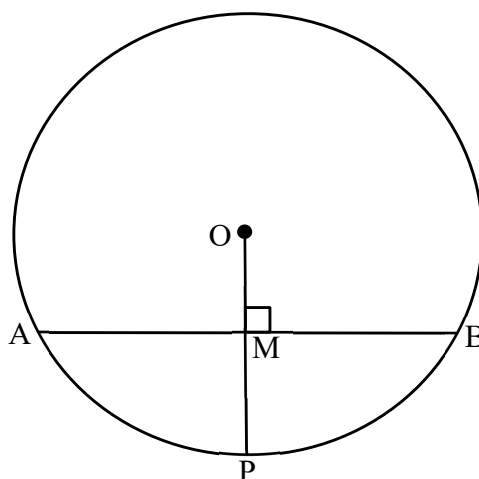
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6.5	$KN^2 = KL^2 + LN^2$ (Pyth) $KN^2 = (40)^2 + (30)^2$ $KN = \pm\sqrt{2500}$ $\therefore KN = 50 \text{ m}$	✓ SF ✓ answer/antwoord	A CA (2)
			[12]

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QUESTION/VRAAG 7



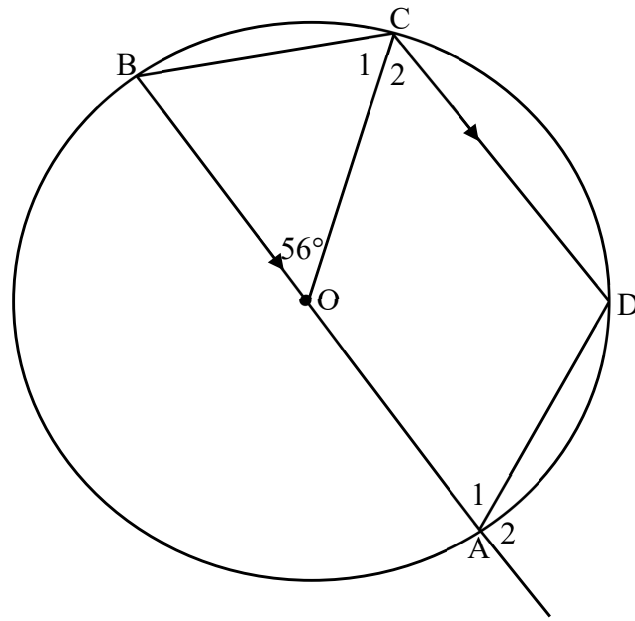
7.1	AM = MB = 7 cm (line from centre $\perp$ to chord)/ (lyn van die midde $\perp$ a koord)	✓ ST ✓ RE	A	(2)
7.2	OP = x + 3	✓ ST	A	(1)
7.3	OP = OA = OB (radii) $OA^2 = OM^2 + AM^2$ $OA^2 = (x)^2 + (7)^2$ $OA^2 = x^2 + 49$ $OA = \sqrt{x^2 + 49}$ $\therefore \sqrt{x^2 + 49} = x + 3$ $x^2 + 49 = (x + 3)^2$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





QUESTION/VRAAG 8

8.1



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

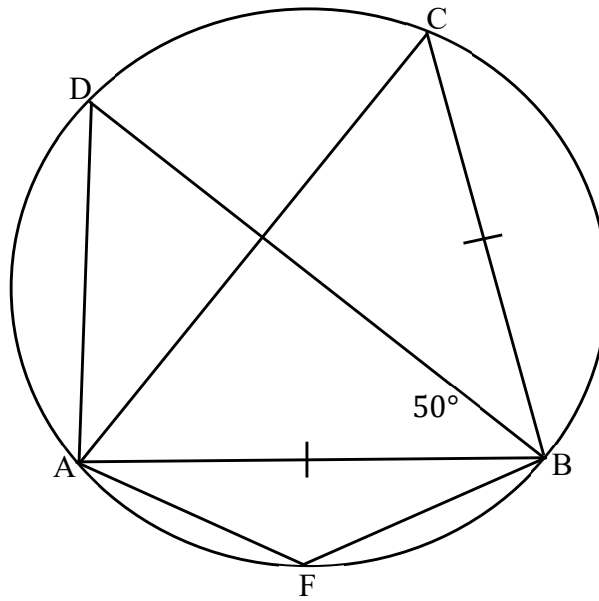


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8.2



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

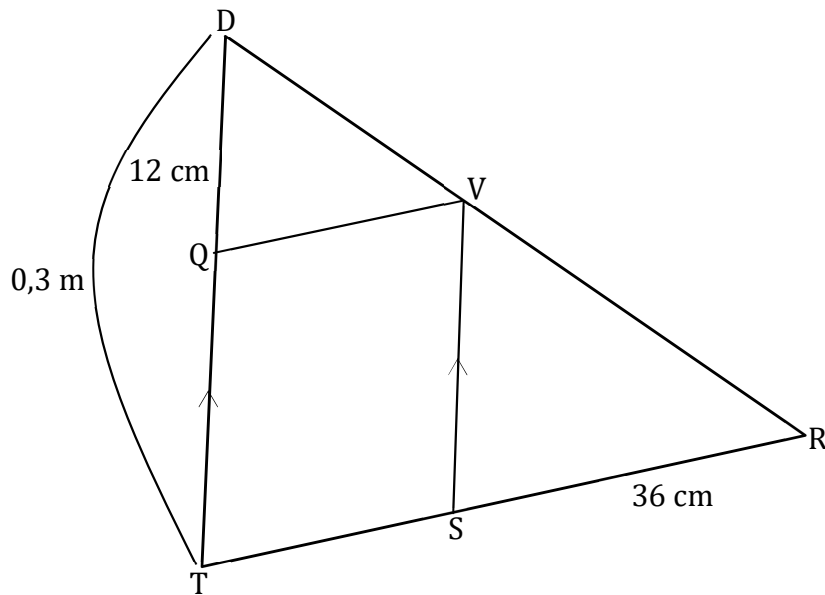


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QUESTION/VRAAG 9

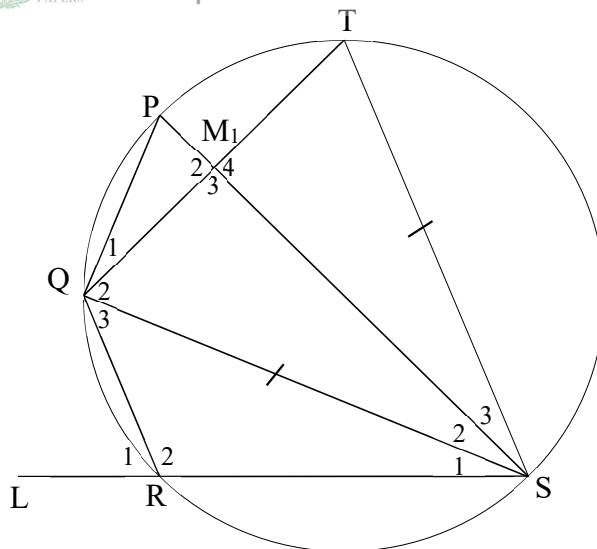


9.1.1	$0,3\text{ m} = 30\text{ cm}$ $QT = 30 - 12$ $QT = 18\text{ cm}$	✓ Conv./Herleid A ✓ answer/antwoord CA	(2)
9.1.2	$VR:VD = 3:2$ $TQ:QD = 18:12$ $TQ:QD = 3:2$ $\frac{VR}{VD} = \frac{TQ}{QD} = \frac{3}{2}$ $\therefore QV \parallel TS$ (converse similarity thm / omgekeerd gelykvormigheid stelling)	✓ 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

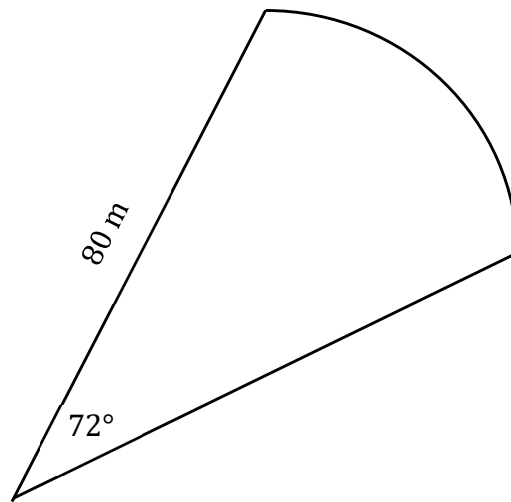


9.2.1	In $\triangle PQM$ & $\triangle TSM$: 1) $\hat{P} = \hat{T}$ ($\angle$'s in same segment / $\angle$'s in <i>dieselfde segment</i>) 2) $\hat{Q}_1 = \hat{S}_3$ ($\angle$'s in same segment / $\angle$'s in <i>dieselfde segment</i>) 3) $\hat{M}_2 = \hat{M}_4$ (Vert opp $\angle$'s = / <i>regoorst</i>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





QUESTION/VRAAG 10



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





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



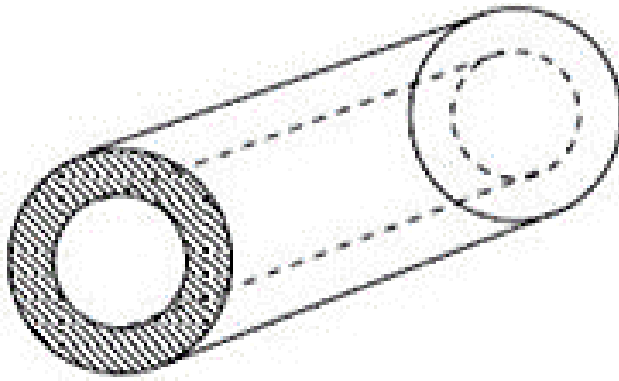
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QUESTION/VRAAG 11

11.1



11.1	$r_{\text{inner/binneste}} = 13 \text{ cm}$ $r_{\text{outer/buitenste}} = 15 \text{ cm}$ Vol of concrete / Vol van beton = $V_{\text{outer/buitenste}} - V_{\text{inner/binneste}}$ Vol of concrete / Vol van beton = $\pi r_{\text{(outer/buitenste)}}^2 h - \pi r_{\text{(inner/binneste)}}^2 h$ $20600 = \pi(15)^2 h - \pi(13)^2 h$ $20600 = \pi h((15)^2 - (13)^2)$ $\frac{20600}{56\pi} = h$ $117,10 \text{ cm} = h$	✓ $V_{\text{inner/binneste}}$ 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 $\therefore$ Total cost / Totale koste = $990 \times R45$ $\therefore$ Total cost – Totale koste = R44 550	✓ F A ✓ SF CA ✓ SA / BO CA ✓ answer/antwoord CA (4)



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

